Gippsland Lakes Ocean Access

2022 - 2032

REPORT

Long term management and monitoring plan

Document revision

Version	Date	Prepared by	Approved by	Comments
0.6	13/4/22	D. Snell	D. Holding	Distributed to TACC for comment
0.7	20/6/22	D. Snell	D. Holding	Distributed to TACC for comment
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1.0	12/10/23	D. Snell	D. Holding	Minor updates
1.1	29/01/24	D Holding	D Holding	Minor updates

Contents

1 Introduction

Gippsland Ports Committee of Management Incorporated (Gippsland Ports) has been delegated the responsibilities to manage five local ports and four waterways (Figure 1) on behalf of the Victorian Government (Australia). The waterways under management total approximately 1,430 square kilometres of some of the largest and most beautiful waterways in Australia, and stretch over 720 kilometres from Anderson Inlet to Mallacoota on the south-eastern coastline of Victoria.

- Port of Mallacoota
- Port of Snowy River
- Port of Gippsland Lakes
- Port of Corner Inlet and Port Albert
- Port of Anderson Inlet
- Shallow Inlet Waterway
- Lake Tyers Waterway
- Sydenham Inlet
- Tamboon Inlet

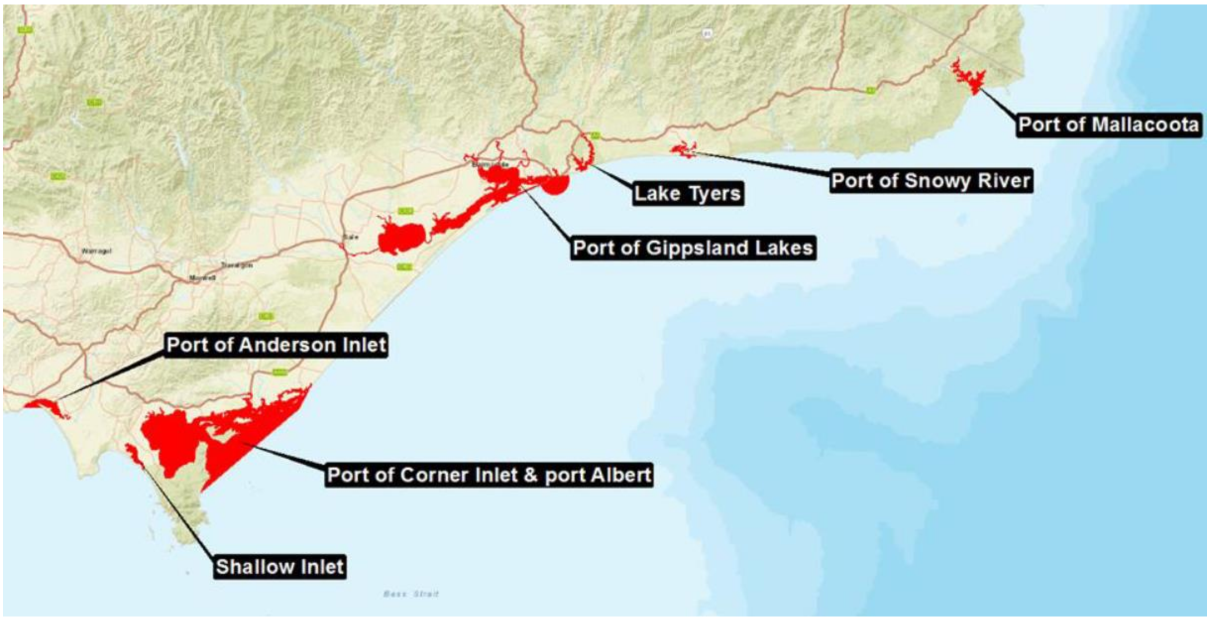


Figure 1: Gippsland Ports designated ports and waterways

1.1 The Port of Gippsland Lakes

The Port of Gippsland Lakes is one of Australia's biggest and most beautiful inland waterways. The Port waters cover 420 square kilometres from Sale in the west to Lakes Entrance in the east, and include Lake Wellington, Lake Victoria and Lake King. The port waters also include the lower reaches of the Latrobe, Nicholson, Mitchell and Tambo rivers.

A man-made ocean access at Lakes Entrance has provided reliable passage to Bass Strait since it was opened permanently in 1889 and has contributed significantly to the region's history.

The Port of Gippsland Lakes has its main node at the township of Lakes Entrance which is home to Victoria's largest commercial fishing fleet. Lakes Entrance and the Gippsland Lakes in general are also popular recreational fishing, boating, holiday and tourist destinations.

In addition to supporting a significant commercial fishing fleet, increasingly the Port of Gippsland Lakes (Lake Entrance) is being used:

a) as a safe refuge by cruising vessels (it is the only safe refuge between the Port of Eden (NSW) and Port Welshpool, a stretch of coastline exceeding 450 km)

b) by large numbers of small recreational vessels each week during the summer season (up to 500 vessel transits per day through the entrance).

The Econosearch report - Economic Value of Commercial Fishing Operating out of Lakes Entrance (Port of Gippsland Lakes) commissioned by Gippsland Ports in 2014, places the value of direct and flow-on economic activity from commercial fishing at **$50 million per annum.**

The Boating Industry Association commissioned report - Economic Value of Boating and Marine Industries on the Gippsland Lakes 2014 places the value of direct and flow-on economic activity associated with recreational boating at **$163 million per annum**

It is anticipated that boating traffic, particularly that of recreational vessels, will continue to increase in the Lakes Entrance precinct in association with growth in tourism and the expected growth in residential population of the area. Gippsland Ports has found that boating registrations increase at approximately twice the rate of population increase.

The operational constraints of the Port including Port access (navigable channel depth and width) and available land preclude any substantial change in the type of maritime activity through the Port. There is no plan or justification for changing the character of maritime activity other than adequately plan for the increasing numbers of vessel traffic.

Figure 2: Port of Gippsland Lakes

1.2 Purpose and objectives

The purpose of this Long-Term Monitoring and Management Plan (LTMMP) is to document the strategy for managing natural sediment (sand) accumulation on the Bar and Inner Channels at the entrance to the Port of Gippsland Lakes, in a way that ensures the reliable and efficient operation of the Port and the ongoing protection of local environmental, social and cultural values.

Left unmanaged, clean oceanic sand fills up navigational infrastructure, impacting the depth necessary for safe and reliable manoeuvring of commercial and recreational vessels. In 2007, the entrance channel was severely restricted in navigable depths and widths due to sand accumulation as a result of continuous south-east weather patterns and lack of river inflows (Figure 3)

The objectives of the LTMMP are to:

1. Provide a framework for maintaining reliable and navigable ocean access over the next 10-years.
2. Establish a robust, transparent long-term planning approach to managing port sediment.
3. Outline operational, planning, consultation and monitoring arrangements.
4. Maintain local environmental, social and cultural values.
5. Apply continual improvement practices in the management of sediment and dredging actions.

Figure 3: Entrance Channel severe sand accumulation in May 2007 (Lakes Entrance)

1.3 Review of LTMMP

Gippsland Ports has had a LTMMP in place since 2013 which has been used to monitor and manage dredging operations over the last decade. The LTMMP is typically reviewed annually in consultation with the Technical Advisory and Consultative Committee (TACC) (refer Section 4.1) and updated versions are subsequently forwarded to the TACC, including State and Commonwealth regulators.

The existing LTMMP (2013-23) had a major review in 2019 following early operation and monitoring of the Gippsland Ports procured Trailing Suction Hopper Dredging (TSHD) *Tommy Norton*.

This new LTMMP (2022-32) has been prepared based on the continuous monitoring, management, learnings and operational improvements over the last decade of TSHD dredging as part of the Gippsland Lakes Ocean Access (GLOA) program.

In general, the current LTMMP will be:

- reviewed annually by the Executive Manager Maritime Services.
- Reviewed by Victorian DoT as the GLOA funding agency.
- forwarded to TACC members prior to annual (typ.) meetings and feedback sought during and post TACC meeting.
- updated annually (if required) following TACC consultation
- revised and submitted to DCCEEW and DEECA prior to being implemented.
- available on Gippsland Ports' website at www.gippslandports.vic.gov.au.

1.4 Policy context

This plan will ensure that sand management activities align with the principles, elements and objectives described in the following guidelines, though subordinate to legislation outlined below:

- National Assessment Guidelines for Dredging (NAGD, 2009)
- Best Practice Environmental Management – Guidelines for Dredging (Publication 691, EPA Vic, 2001)

The Victorian Government, with guidance of the Victorian Marine and Coastal Council, has developed a new state-wide Marine and Coastal Policy (the Policy). The Policy guides decision makers in the planning, management and sustainable use of our coastal and marine environment. It provides direction to decision makers including local councils and land managers on a range of issues such as dealing with the impacts of climate change, population growth and ageing coastal structures.

The Victorian Government is committed to implementing the Policy through the development of a Marine and Coastal Strategy.

The Strategy will give effect to the policy by detailing priority actions over a 5-year period and will be the key mechanism for addressing new and challenging issues.

1.5 Governance

Maintenance and capital dredging programs are subject to a number of Commonwealth and Victorian government laws and policies. This section describes the key environmental, cultural and planning legislation and policies that apply to dredging and dredge material placement projects undertaken at Lakes Entrance, Port of Gippsland Lakes. Commonwealth legislation

1.5.1 Commonwealth legislation

1.5.1.1 Environment Protection (Sea Dumping) Act 1981

Dumping (placement) of waste and other material (including clean oceanic sand) from any vessel, aircraft or platform in Australian waters is prohibited under the *Environment Protection (Sea Dumping) Act 1981*, unless a permit has been issued. Permits are most commonly issued for dredging operations and the creation of artificial reefs. The Act fulfils Australia's international obligations under the London Protocol (to prevent marine pollution by controlling dumping of wastes and other matter). The Act is administered by the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW).

1.5.1.2 Environment Protection and Biodiversity Conservation (EPBC) Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central environmental legislation. The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, wetlands and heritage places which are defined in the EPBC Act as matters of national environmental significance (MNES).

The EPBC Act is triggered when a development proposal has the potential to have a significant impact on MNES. Approval under this Act is not required if significant impact to MNES will not result.

1.5.2 State legislation

1.5.2.1 Marine and Coastal Act 2018

The *Marine and Coastal Act 2018* (MACA 2018) provides a simpler, more integrated and coordinated approach to planning and managing the marine and coastal environment by:

- enabling protection of the coastline and the ability to address the long-term challenges of climate change, population growth and ageing coastal structures
- ensuring that partners work together to achieve the best outcomes for Victoria's marine and coastal environment.

1.5.2.2 Environmental Effects Act 1978

In Victoria, environment assessment of the potential environmental impacts or effects of a proposed development may be required under the Environment Effects Act 1978.

The process under this Act is not an approval process itself, rather it enables statutory decision-makers (Ministers, local government and statutory authorities) to make decisions about whether a project with potentially significant environmental effects should proceed.

If the Minister for Planning decides that an Environment Effects Statement (EES) is required, the project proponent is responsible for preparing the EES and undertaking the necessary investigations. Another possible decision following referral of a project under the Act is for conditions to be set in lieu of an EES. These conditions may provide a practical alternative to an EES or provide additional safeguards or management measures.

If a project requires assessment under both the Environment Effects Act and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999, the relevant process can be accredited under the new Assessment Bilateral Agreement between the Commonwealth and Victoria. This means that proponents will not have to undertake two separate assessment processes, minimising duplication and saving them time and resources.

1.5.2.3 Environment Protection Act 2017 (Vic)

The *Environment Protection Act 2017*, as significantly amended by the *Environment Protection Amendment Act 2018* and other Acts, came into effect on 1 July 2021.

It includes environmental obligations and protections for all Victorians and changes Victoria's focus for environment protection and human health to a prevention-based approach. It includes the general environmental duty (GED).

1.5.2.4 Flora and Fauna Guarantee Act 1988 (Vic)

Victoria's biodiversity target is a net improvement in the outlook for all species by 2037. The Flora and Fauna Guarantee Act 1988 (the FFG Act) is a key tool in achieving this target. It is the key piece of Victorian legislation for the conservation of threatened species and communities and for the management of potentially threatening processes.

The FFG Act places importance on prevention to ensure that more species do not become threatened in the future. The Act emphasises the importance of cooperative approaches to biodiversity conservation and recognises that all government agencies and the community need to participate in the conservation effort. The Act's objectives aim to conserve all of Victoria's native plants and animals

1.5.2.5 National Parks Act 1975 (Vic) (section 27)

Parks Victoria is responsible for management of National Parks under the *National Parks Act 1975 (Vic)*. This includes the Gippsland Lakes Coastal Park which stretches along the narrow expanse of Ninety Mile Beach from Seaspray to Lakes Entrance. Approval may be required from time to time for installation or maintenance of any onshore sand management infrastructure associated with the western discharge outfall on the western side of the Entrance Channel.

1.5.2.6 Wildlife Act 1975 (Vic)

The Wildlife Act sets the rules around how we protect, conserve, sustainably manage and use wildlife in Victoria.

1.5.3 Approvals

A summary of Gippsland Ports' historical sea dumping permits is provided in Table 1 below. These permits are required where dredging and loading of material is required for relocation and placement in Australian waters.

Table 1: Gippsland Ports historical sea dumping permits

Permit	Date issued	Period	Dredge	Volume
SD2005/0024	30/9/2005	5 years	Side-casting	< 350,000 m^3 / yr
SD2007/0562	18/6/2007	9 months	Trailing suction hopper	< 450,000 m^3
SD2007/0663	13/2/2008	7.5 months	Trailing suction hopper	< 760,000 m^3
SD2009/1162	29/5/2009	14 months	Trailing suction hopper	< 750,000 m^3 / yr
SD2011/2002	16/9/2011	2 years	Trailing suction hopper	< 750,000 m^3 / yr
SD2013/2442,	15/10/2013	10 years	Trailing suction hopper	< 7,500,000 m^3
SD2022-4039	24/10/2023	10 years	Trailing suction hopper	< 500,000 m^3 / yr on average

A summary of Gippsland Ports' current GLOA approvals is provided in Table 2 below.

Table 2: Gippsland Ports current GLOA approvals

Consent	Agency	Reference	Issued	Expiry
Sea Dumping Act 1981	DCCEEW	SD2022/4039	24 Oct 23	24 Oct 33
EPBC Act 1999 referral	DAWE	2011/5932	08 Sep 11	Ongoing
Marine and Coastal Act 2018 (CMA Act 1995)	DEECA	SP481563	11 May 23	11 May 33
Environmental Effects Act 1978	DEECA	2007R00017	10 Jan 08	N/A

1.6 Roles and responsibilities

An overview of Gippsland Ports' roles and responsibilities is provided in Figure 4.

The Executive Manager Maritime Services is responsible for:

- Ensuring compliance with management actions, strategies and other commitments within this LTMMP
- Reporting to State and Commonwealth determining authorities
- Induction and training of staff within organisation to ensure understanding of and compliance with LTMMP

Gippsland Ports' dredging crew is responsible for complying with the relevant management actions within the LTMMP and reporting any incidents to the Executive Manager Maritime Services.

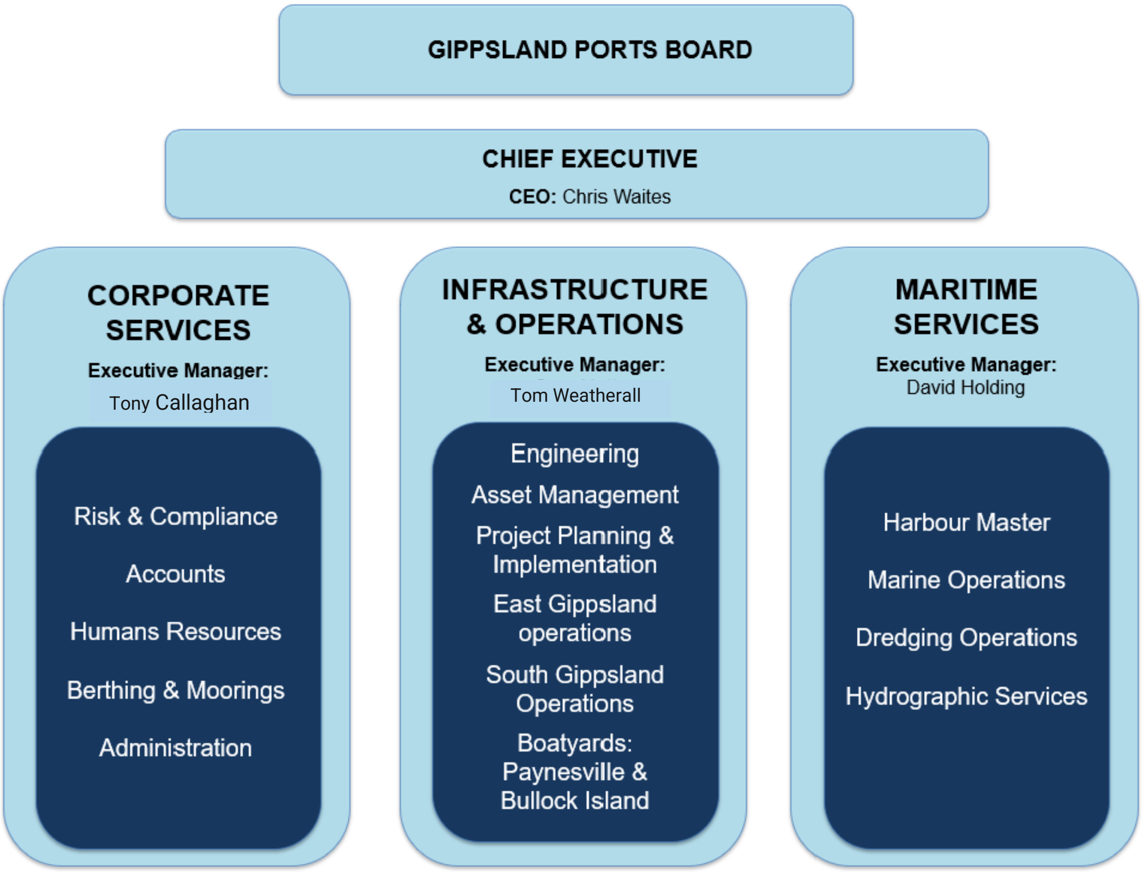


Figure 4: Gippsland Ports' roles and responsibilities

1.7 Stakeholder consultation

Details of Gippsland Ports stakeholder consultation with respect to Gippsland Lakes Ocean Access Program are provided in **Section 4** of this LTMMP.

2 Port Locality, Setting and Navigation

2.1 Locality and setting

The Port of Gippsland Lakes has its main node at the township of Lakes Entrance (320 kms east of Melbourne, Victoria, Australia) which is home to Victoria's largest commercial fishing fleet. Lakes Entrance, and the Gippsland Lakes in general, are also popular recreational fishing, boating, holiday and tourist destinations.

Extending from Sale to Lakes Entrance, the port covers all waters of the Gippsland Lakes including Lake Wellington, Lake Victoria, Lake King, numerous 'arms' and the lower reaches of the Latrobe River (to the Port of Sale), Avon River, Perry River, Mitchell River (to Lind and Eastwood Bridges), Nicholson River, and Tambo River (to Battens Landing). Waters of Bass Strait up to three nautical miles offshore from Lakes Entrance are included.

2.2 Lakes Entrance marine precinct

Cunninghame Arm is located between Ninety Mile beach and the Township of Lakes Entrance. This marine precinct consists of a number of harbours, jetties and marine infrastructure to service commercial fishing vessels, offshore and sheltered waters charter vessels, small coastal and offshore support vessels and all types of recreational vessels.

On the northern side of the entrance to Cunninghame Arm is **Bullock Island** which is home to Gippsland Ports' Bullock Island Boat Yard and Depot, as well as the Lakes Entrance Fisherman's Co-Operative.

The **North Arm** marine precinct services smaller shallow draft recreational and hire-and-drive vessels. North Arm has three separate boat launching ramps and boat trailer parking facilities. There is a refuelling and sewage pump out facility on Bullock Island for recreational vessels. The entrance to North Arm is air draft height restricted due to the Princes Highway Road bridge.

Figure 5: Lakes Entrance marine precinct

2.3 Navigational areas

A permanent artificial entrance (the Entrance) to the Gippsland Lakes from Bass Strait was completed at Lakes Entrance in 1889. Since its construction, there has been ingress of ocean sand into the Inner Channels. In addition, an offshore bar (the Bar) has formed outside the Entrance (Figure 6).

Accumulation of sand on the Bar and in the inner channels has created navigation hazards requiring regular maintenance dredging to ensure reliable navigable access to and from the ocean to the Port of Gippsland Lakes.

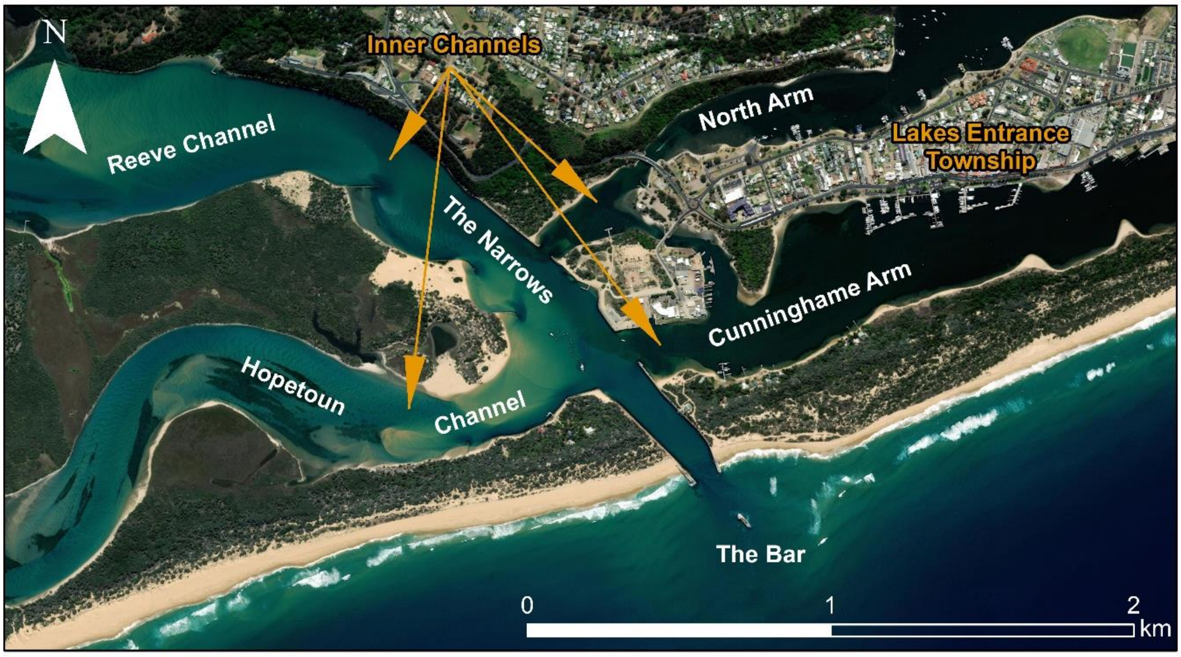


Figure 6: GLOA navigable areas sand management infrastructure locations

2.4 Navigational dimensions

In order to maintain the reliable navigation depths of -3.5m and -3.0m Chart Datum (CD), *maximum* dredging target depths stated in Table 3 are required to allow for sand infilling in between dredging and an insurance buffer against emergency shoaling events.

Table 3: GLOA navigational area dimensions

Navigational area	Dimensions of navigation reliability (metres)		Maximum design target (metres)	
	Width	Depth	Width	Depth
Bar	80 to 450	3.5	80 (min)	4.5-5.5
Entrance channel	50	3.5	50	4.5
Swing basin	100 (dia.)	3.5	100 (dia.)	4.5
Cunninghame Arm	50	3.5	50	4.5

Reeves Channel to The Narrows	50	3.0	50	4.0
Hopetoun Channel	50	3.0	50	4.0
North Arm	50	3.0	50	4.0

Notes:

- All depths are measured from 'Chart Datum' (0.757m below Australia Height Datum).
- 80m width just beyond the seaward end of the training wall and 450m is the maximum width at the outer boundary of the wedge.
- Design target depths allows for ongoing monthly accretion of sand
- Over-dredging tolerances (includes survey tolerance) are up to -1.0m vertical and +/- 5.0m horizontal to allow for slumping and settlement immediately after dredging
- The Swing basin and western end of Cunninghame Arm design is to allow safe navigation to unloading facilities for trawlers at Bullock Island; and for safe operation and berthing of TSHD *Tommy Norton*.
- Two sand traps up to 220m length and 35m width can be dredged if required on both western and eastern boundary of wedge. The exact locations are dependent on location of Bar formation.

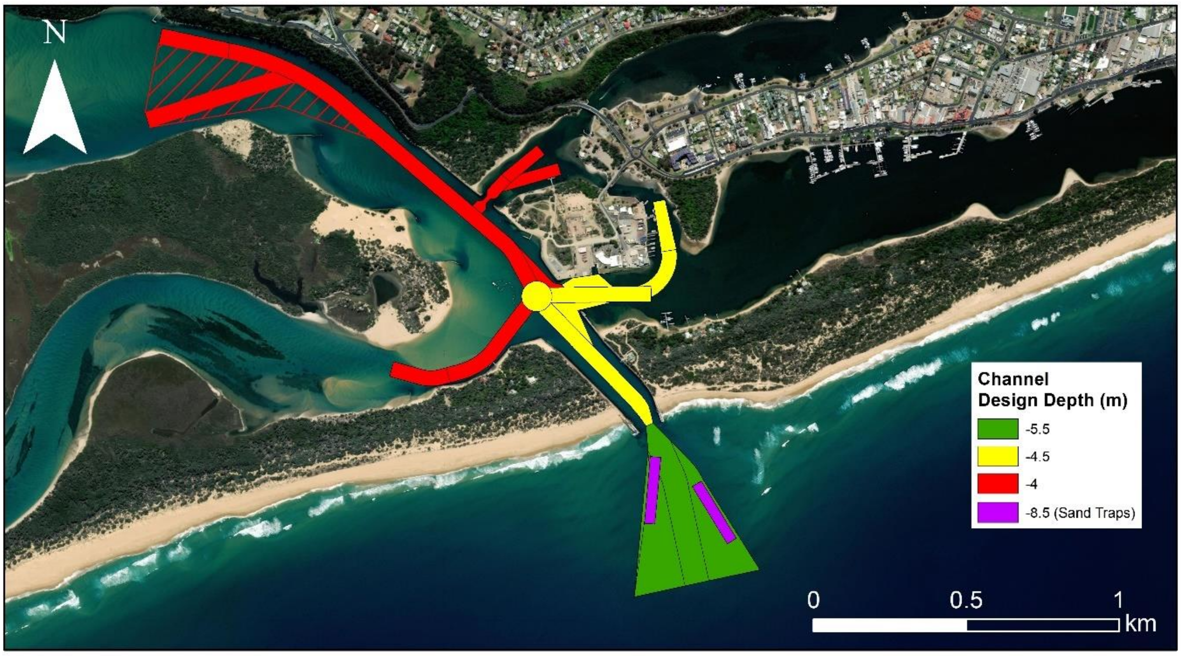
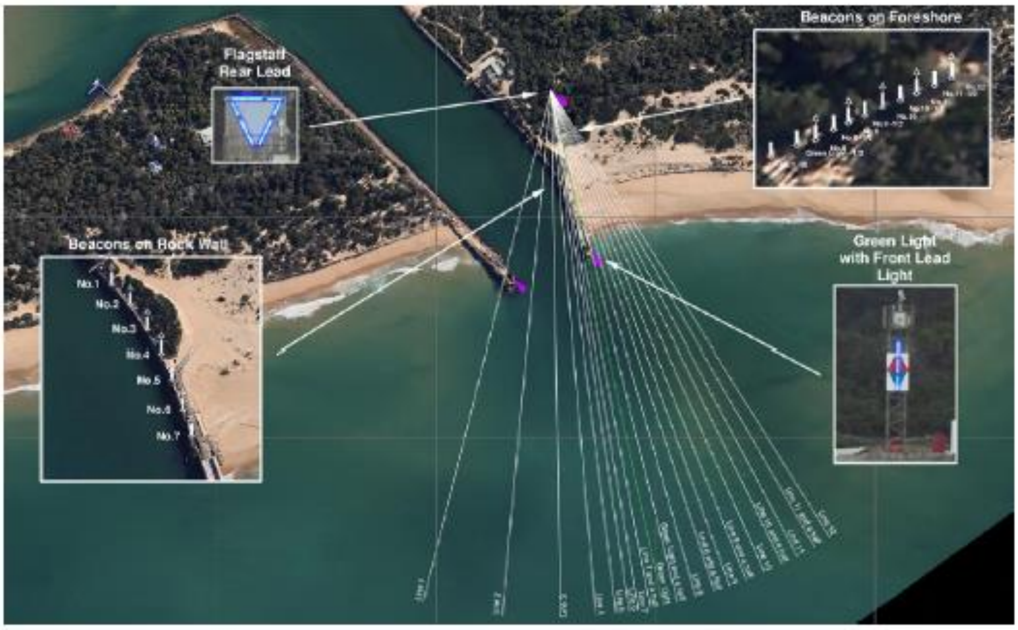


Figure 7: GLOA navigational channels and design depths

2.5 Lead Lines

Gippsland Ports has established "Leads in Line" for the purpose of assisting safe navigation. At any given time when a transit line joining the “rear lead” and the “front lead” is extended seawards it will coincide with the deepest fairway line to enter and exit the Port. The “front lead” will be moved from time to time whenever the fairway position or alignment has changed, as a consequence of the naturally occurring sand movement, determined following bathymetric survey results. Further details are contained within Gippsland Ports’ *Harbour Master Directions – Port of Gippsland Lakes.*

The photo above is taken from seaward of the Entrance and illustrates the “Leads in Line” when the “front Lead” is located on the “Green Light”



The photo above illustrates the characteristics of the “Flagstaff Rear Lead” triangular blue LED light apex down, and the “Green Light Front Lead” vertical bar LED light. The Green Line indicates the line of approach with the “Leads in Line”. The Leading lights are available day and night.

Figure 8: Lakes Entrance description of Lead Lines

2.6 Waves, Tides and Weather

A Directional Waverider Buoy is installed at a location offshore from Lakes Entrance to measure wave height, period, direction, and surface water temperature. Mariners should note that this buoy is located at an approximate position of S 37° 54.9075' E 147° 57.9379' (WGS 84).

Tide measuring equipment is installed to provide near-real time tide data. Tide gauges at Lakes Entrance are located in the Entrance Channel midway along the training walls, and at the Gippsland Ports depot jetty on Bullock Island.

An Automatic Weather Station is installed to provide measurements of air pressure, air temperature, wind speed and direction, relative humidity and rainfall.

Current, wave, tide and weather information is available on Gippsland Ports website here.

Further details on current, wave, tide and weather information are provided in Section 3.2.

2.7 Vessel Operating Limits

The maximum length, beam and draft limits outlined in Table 4 below must not enter the Port of Gippsland Lakes waters without written authority and direction from the Harbour Master.

Further details are contained in the Harbour Masters Directions – Port of Gippsland Lakes.

Table 4: Port of Gippsland Lakes vessel operating limits

Destination	Maximum Length	Maximum Beam	Maximum Draft
Bar and Entrance channel	60 m	13 m	3.0 m
Bullock Island Wharf	60 m	13 m	3.0 m
Bullock Island Boat Yard	60 m	13 m	3.0 m
Eastern Wharf (Cunninghame Arm)	35 m	12 m	2.5 m
Paynesville Boat Yard	35 m	12 m	2.5 m

3 Port Environmental Values

In maintaining the Gippsland Lakes Ocean Access program, it is essential to understand the environmental, social, cultural and heritage values, as well as the recreational and commercial activities that take place within the Port of Gippsland Lakes, but particularly at Lakes Entrance.

The focus is on values that are considered important or notable at a national, regional or local level. The aim is to provide a useful level of detail and relevance to management of the GLOA program. Values are described with respect to the GLOA dredging and placement areas, their adjacent areas and the Port of Gippsland Lakes.

3.1 Matters of National Environmental Significance

The MNES Significant Impact Guidelines (DoE, 2013) states that *'Dredging to maintain existing navigational channels would not normally be expected to have a significant impact on the environment where the activity is undertaken as part of normal operations and the disposal of spoil (sediment) does not have a significant impact'*.

The Commonwealth's EPBC (2011/5932) referral decision (8 September 2011) determined that the proposed GLOA program activities were *'Not a controlled action if undertaken in a particular manner'*.

The 'manner' included three conditions around cetacean monitoring zones; water quality during the Australian grayling fish migration period; and migratory shorebird disturbance at Rigby Island.

To ensure currency, Gippsland Ports sought an updated EPBC Act Protected Matters Report on 27 January 2022. Despite additional species identified on the MNES list (i.e., Protected Matters Search) report, there has been no change to the original findings and the existing perpetual EPBC referral decision is deemed valid. This EPBC self-assessment has determined that the Gippsland Ports' GLOA program will not have a significant impact on any EPBC listed species, vegetation community or wetland of international importance based on the significant impact criteria provided by the *"Matters of National Environmental Significance: Significant Impact Guidelines 1.1"* (DoE, 2013)

Table 5: MNES Protected Matters Report (GLOA 2022)

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	6
Listed Threatened Species:	67
Listed Migratory Species:	48

In summary the 2022 Protected Matters Report identified:

- 57 birds – listed as EPBC threatened species, EPBC migratory species, and EPBC marine species;
- 30 marine, estuarine and syngnathid fish (i.e. pipefish, pipehorses, seahorses and sea dragons) – EPBC threatened species and EPBC marine species;
- 3 frogs – listed as EPBC threatened species;
- 18 mammals (including marine mammals) – listed as EPBC threatened species, EPBC migratory species, EPBC marine species, and EPBC Cetaceans.

- 10 flora species – all terrestrial species that were considered nil residual risk from any potential impact. There was no marine flora listed.
- 3 reptiles – listed as EPBC threatened species, EPBC migratory species, and EPBC marine species; and
- 5 sharks – listed as EPBC threatened species and EPBC migratory species.

3.1.1 Ramsar wetland

The Gippsland Lakes Ramsar site is located approximately 300 km east of Melbourne on the low-lying South East Coastal Plain bioregion. Covering a vast area, the lakes are a series of large, shallow, coastal lagoons approximately 70 km in length and 10 km wide, separated from the sea by sand dunes.

The surface area of the lakes is approximately 364 km2 and the three main water bodies are Lakes Wellington, Victoria, and King. The Gippsland Lakes together form the largest navigable inland waterway in Australia, and create a distinctive regional landscape of wetlands and flat coastal plains of considerable environmental significance.

The Mitchell Delta of the Ramsar site is a classic form of digitate delta and ranks as one of the finest examples of this type of landform in the world. The silt jetties of the delta extend almost eight kms into the lake as low, narrow tongues of sediment that were formerly bordered by a wide zone of reed swamp.

The Ramsar site contains 11 Ramsar wetland habitat types including most notably, coastal lagoons, subtidal seagrass and algal beds, and a range of saline, brackish and freshwater marsh environments. The site supports a broad range of ecosystem services including nationally and internationally threatened wetland species, waterbird breeding and fish spawning sites. Cultural and socio-economic values are equally diverse, noting the particular importance of the site in a regional context in terms of recreational activities such as boating, recreational fishing and holiday tourism

The Gippsland Lakes support three nationally vulnerable and endangered wetland-associated flora species (dwarf kerrawang, swamp everlasting and metallic sun-orchid), and the nationally threatened growling grass frog and green and golden bell frog. The bird diversity of the Ramsar wetland is high with 86 species of waterbirds being recorded including large numbers of the red-necked stint, black swan, sharp-tailed sandpiper, chestnut teal, musk duck, fairy tern and little tern.

Currently, parts of the Lakes system are heavily used for commercial and recreational fisheries and boating activities, while the immediate hinterland has been developed for agricultural use, and limited residential and tourism purposes *(source: Australian Wetlands Database, DCCEEW)*.

Prior to the opening of the permanent artificial entrance in 1889, the Gippsland Lakes was naturally an intermittently closed and open lagoon system, separated from the ocean by a series of low sand dunes. Fresh water would accumulate in the lagoons and wetlands until they breached the dune system, resulting in saline intrusion into the lakes system. Sand transport down the Ninety Mile Beach would eventually close the breach and freshwater conditions slowly re-established. The permanent entrance has allowed for continuous saline intrusion into the system, now showing a salinity gradient from east to west, and replacing the freshwater system with marine, estuarine and brackish habitats regularly influenced by coastal tides, currents and storm surges (BMT WBM, 2011).

The permanent entrance was established in 1889, some 93 years prior to the Gippsland Lakes being declared a Ramsar wetland in 1982. Dredging has occurred at Lakes Entrance since 1889, and before, as summarised in Gippsland Ports' 'History of Dredging the Entrance to Gippsland Lakes'.

Figure 9: Gippsland Lakes Ramsar site boundary (Lakes Entrance)

Figure 10: Rigby Island buffer zone

3.1.2 Wetland and Shorebirds

Wetland species (including migratory species) are considered unlikely to be affected as there is no important habitat located adjacent to GLOA activities. GLOA dredging activities are unlikely to have a significant effect on the hydrodynamic or salinity regime (refer Section 3.3.1), suggesting little to no impact on wetland species or their habitat throughout the Gippsland Lakes system. Therefore, these species are not likely to be at risk of significant impact.

Shorebird species such as terns and plovers that are known to utilize habitat adjacent to GLOA actions (i.e. Rigby Island) may be affected. To minimize disturbance from airborne noise, the Rigby Island buffer zone (Figure 10) has been established during the shorebird breeding season (October – March inclusive) within which GLOA actions are prohibited. Annual audits of the GLOA Environmental Management Plan between 2011 and 2021 (excluding 2017 when there was no audit conducted) confirm that the Rigby Island buffer zone has not been breached by GLOA actions during the breeding season. Therefore, these species are considered to be at low residual risk of significant impact to EPBC-listed shorebird species.

3.1.3 Australian Grayling

The Australian Grayling is a diadromous species that migrates between fresh and marine waters. Most of its life is spent in freshwater, but at least part of the larval and/or juvenile stages are spent in coastal seas. Spawning appears to be initiated by an increase in river flows from seasonal rains, and likely linked to a decrease in water temperature. In eastern Victoria (Tambo River), spawning occurs in autumn (April-May). Eggs hatch after 10-20 days and larvae are swept downstream to estuaries and move into marine waters where they remain for approx. 6 months before returning to fresh water (Backhouse, Jackson, & O'Connor, 2008b).

Key threats to the Australian Grayling include river regulation and barriers to movement for migration (such as dams, weirs, culverts, levee banks, areas of unsuitable habitat, etc), poor water quality, siltation, impact of introduced fish, climate change, disease and fishing (Backhouse, Jackson, & O'Connor, 2008a).

3.1.4 Burrunan dolphins

The Burrunan dolphin is one of three recognized species of Bottlenose dolphins. They are approximately 2.5m in length and have a distinct tri-colouration pattern, from dark grey above, a paler grey midline and cream underside. There are only two known resident populations in Victoria: one in Port Phillip Bay (approx. 120 individuals) and the other in the Gippsland Lakes (approx. 60 individuals).

Key threats to the Burrunan dolphin include pollution (chemicals and heavy metals), litter and marine debris such as plastics, disturbance from vessels interrupting core biological activities such as foraging and resting, underwater noise disturbance, entanglement with fishing ropes, global climate change and environmental change impacting salinity and water quality.

Fresh water skin disease has affected the population in the Gippsland Lakes, when weather conditions caused excessive influx of fresh water into the normally brackish-to-salty lake system. Complex environmental changes to the Gippsland Lakes, such as increased sedimentation, dramatic salinity declines, algal blooms, temperature changes and anoxic conditions may also contribute to the health decline of the dolphins. Increased incidence of these weather events could threaten the small population in the lakes. Other possible threats are low population sizes and low genetic diversity (Parks Victoria, 2021).

3.1.5 Marine habitat

The Lakes Entrance Inner Channels were found to comprise mainly bare sediment habitat with small areas of seagrass and artificial (constructed) rocky intertidal habitats (Figure 11). The Bar and near shore coastal areas comprised bare sediment habitats, both intertidal and subtidal. No subtidal reef was found in any of the areas. Surveys of marine communities and habitats in the Inner Channels have not revealed any unique, or particularly vulnerable or diverse entities.

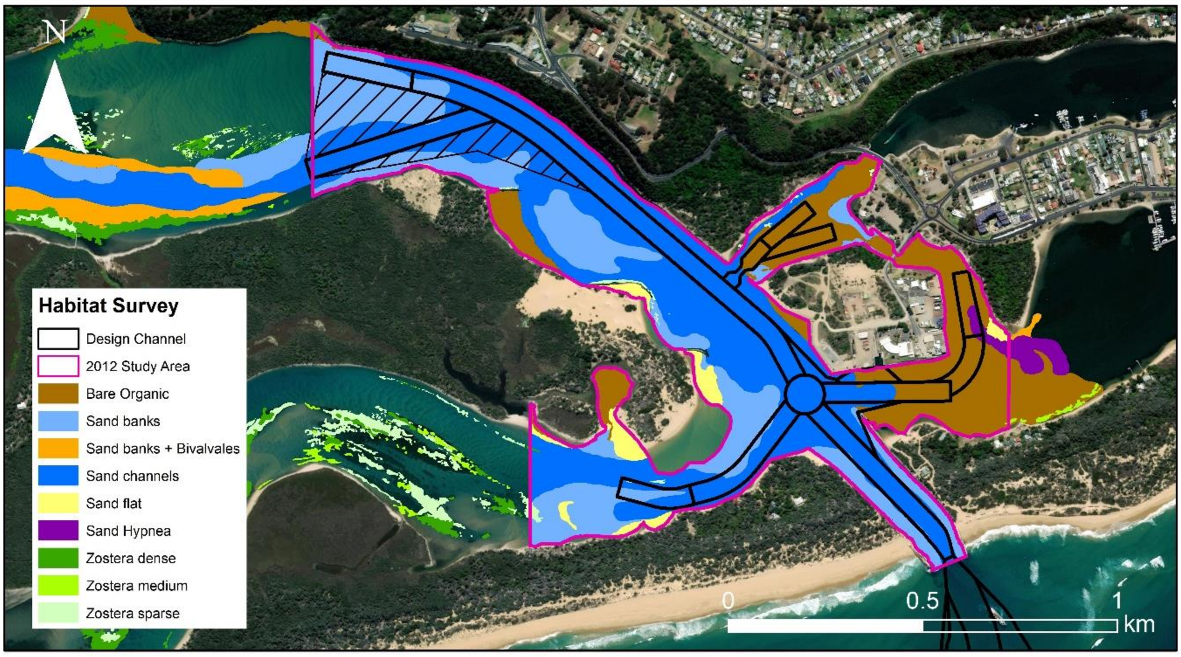


Figure 11: Lakes Entrance marine habitat

3.1.6 Seagrass

Although the distribution of seagrass displays high annual variability, mapping of seagrass beds in the Narrows, Hopetoun Channel, North and Cunningham Arms, adjacent to GLOA actions, have shown little change between mapping periods 2007 – 2012 (AME, 2007) and 2017 – 2021 (EGCMA, 2021).

Seagrass mapping (Hale, Brooks, 2021) was undertaken for the Gippsland Lakes Ramsar site using Sentinel-2 satellite imagery which provided 10m high resolution for the entire Ramsar site. While total seagrass extent (refer Table 6) did not vary substantially over the four time periods, there are distributional differences with 2017 having more seagrass in Jones Bay and less in the western end of Lake Victoria in comparison to the other years.

Table 6: Gippsland Lakes seagrass extents 2017-2021 (Hale, Brooks 2021)

	2017	2019	2020	2021
Dense Seagrass	896	920	892	838
Sparse Seagrass	1866	1934	1724	1396
total (ha)	**2762**	**2854**	**2616**	**2235**

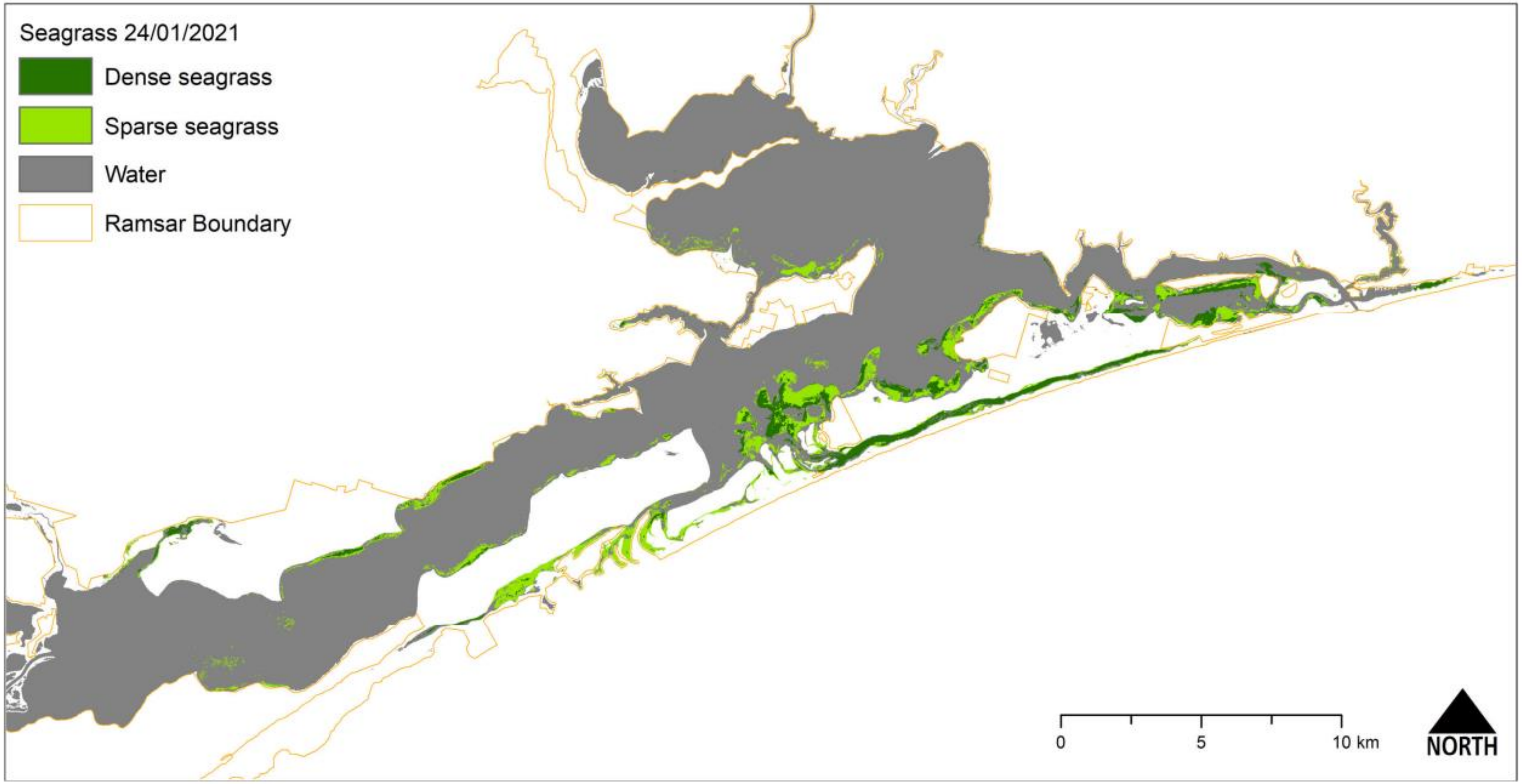


Figure 12: Extent of seagrass in the Gippsland Lakes Ramsar site mapped from Sentinel-2 image 24/01/2021 (Hale, Brooks, 2021)

3.1.7 Water quality

Aerial and onboard visual observation of the sediment plume generated by the TSHD during both dredging and placement activities has indicated that it is short-lived and restricted in area (Figure 13). This is consistent with expectations given that the material is almost entirely clean sand of oceanic origin.

Gippsland Ports' long-term turbidity monitoring program carried out since 2011 indicates that the turbidity generated by the TSHD is well below the conditioned trigger point of 25 NTU above natural conditions (Figure 14). On this basis it is concluded that the current operations are unlikely to have an adverse impact upon the migratory behaviour of the Australian Grayling. It is also noted that natural river discharges and flood events (Figure 15) cause comparatively greater turbidity and visual impacts.

Refer also to Section 3.3.1 Hydrodynamic modelling.

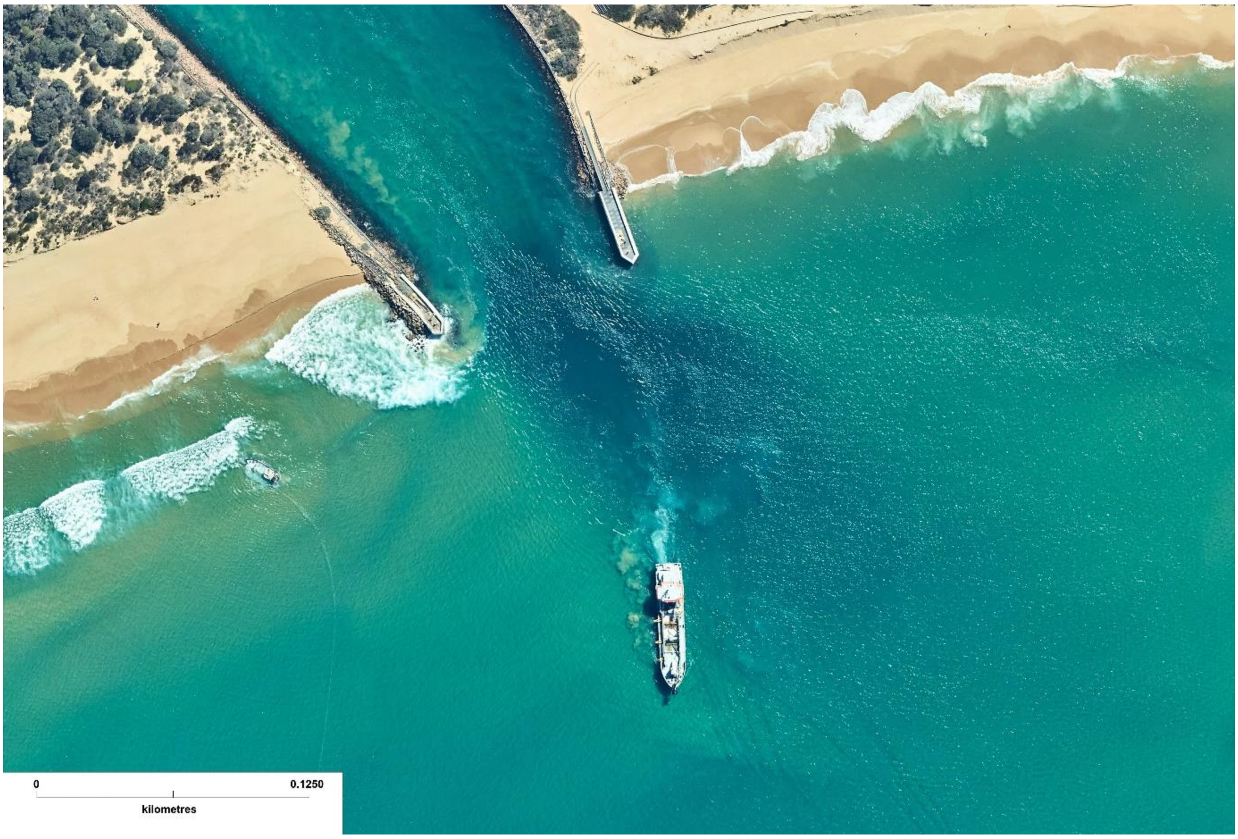
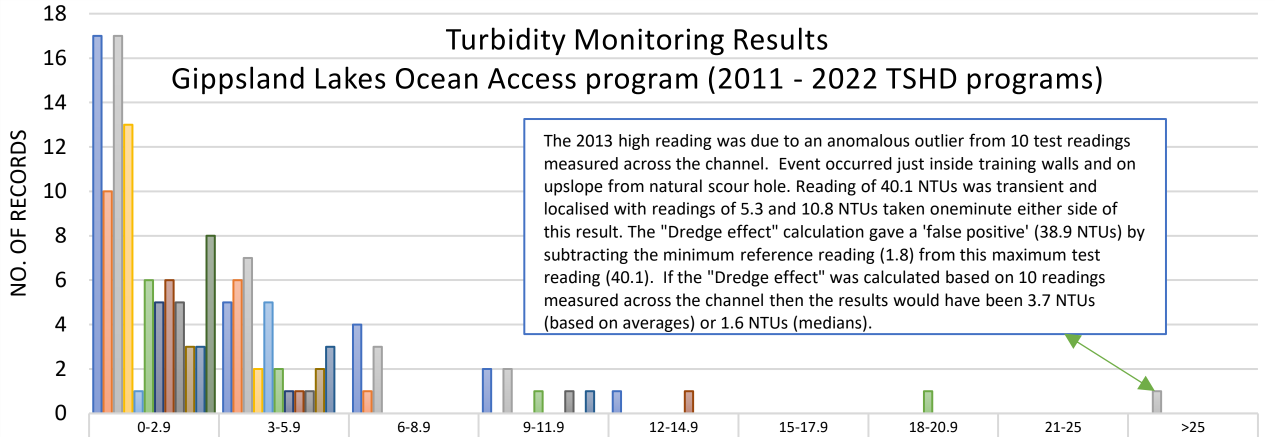


Figure 13: TSHD Tommy Norton operating on the Bar



	0-2.9	3-5.9	6-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-25	>25
2011	17	5	4	2	1	0	0	0	0
2012	10	6	1	0	0	0	0	0	0
2013	17	7	3	2	0	0	0	0	1
2014	13	2	0	0	0	0	0	0	0
2015	1	5	0	0	0	0	0	0	0
2016	6	2	0	1	0	0	1	0	0
2017	5	1	0	0	0	0	0	0	0
2018	6	1	0	0	1	0	0	0	0
2019	5	1	0	1	0	0	0	0	0
2020	3	2	0	0	0	0	0	0	0
2021	3	3	0	1	0	0	0	0	0
2022	8	0	0	0	0	0	0	0	0

Note: The Independent Auditor concluded that despite the single anomalous turbidity reading (40.1 NTUs, 2013) the available evidence and subsequent analysis adequately demonstrated Full Compliance with the Audit Criteria. DEPI (now DEECA) did not believe the trigger level of 25 NTUs was reached across the channel. (March 2014, Ethos NRM)

Figure 14: GLOA turbidity monitoring results 2011 – 2021 (units are Nephelometric Turbidity Unit (or NTUs))

Figure 15: Turbid water during a flood event in July 2007

3.2 Current, tides, wind and waves

3.2.1 Water levels

- Semi-diurnal tidal signal (two tides/day).
- Diurnal inequality which results in one larger and one smaller range tide each day.
- Tidal forcing is relatively weak with a 0.95m range between Mean Higher High Water and Mean Lower Low Water, indicating a micro-tidal system.
- Water levels at Bullock Island exhibit a smaller tidal range (~75%) compared to the range in Entrance Channel. This is mainly a result of the low water levels being elevated.
- Low pressure weather systems can result in elevated water levels in Bass Strait and variations within the lakes of +/- 0.2m about mean sea leve.
- Large ocean surge events in Bass Strait can results in as much as 1.0m change in mean water level within the lakes.

3.2.2 Currents

- Flows have been measured in the Entrance Channel.
- Flows are relatively fast due to the large tidal prism (volume) of the Lakes.
- Flows are less than 4 knots (~2m/s) approximately 98% of the time (Figure 18).
- Peaks in flow occur close to the time of high and low water.
- Current directions are aligned with the channel.

3.2.3 Waves

- Largely sheltered from highly energetic wave climate of the Southern Ocean.
- Larger waves predominantly generated in the eastern Bass Strait by south westerly to southerly winds and in the South Tasman Sea by east to south easterly winds.
- Wave heights are relatively small with 95% of waves having Hs < 2m.
- Dominant wave direction from east south-east to south.
- Consistent dominance of waves from south-east except in 2004 and 2019 when waves from south-west were dominant.
- The 1 in 10-year ARI was only exceeded in 2007, 2012 and 2018.
- The largest number of wave events exceeded the 10 in 1 year ARI in 2011, this was when the largest annual volume was dredged from the Bar (355,579 m^3, Table 14).

3.2.4 Rainfall and river discharge

- Relatively uniform spread of rainfall throughout the year, highest in June.
- Significant variability in seasonal rainfall patterns can occur between the years
- Previous studies found that in the Lakes Entrance area the overall contribution of freshwater flow from rivers is small compared to the flow from the astronomical tide.

Table 7: Tidal Planes at Lakes Entrance

Tidal Plane	Elevation (m CD)	Elevation (m AHD)
Highest Astronomical Tide (HAT)	1.51	0.75
Mean Higher High Water (MHHW)	1.24	0.48
Mean Lower High Water (MLLW)	0.79	0.03
Australian Height Datum (AHD)	0.76	0.00
Mean Higher Low Water (MHLW)	0.73	-0.03
Mean Lower Low Water (MLLW)	0.29	-0.47
Lowest Astronomical Tide (LAT)	0.00	-0.76

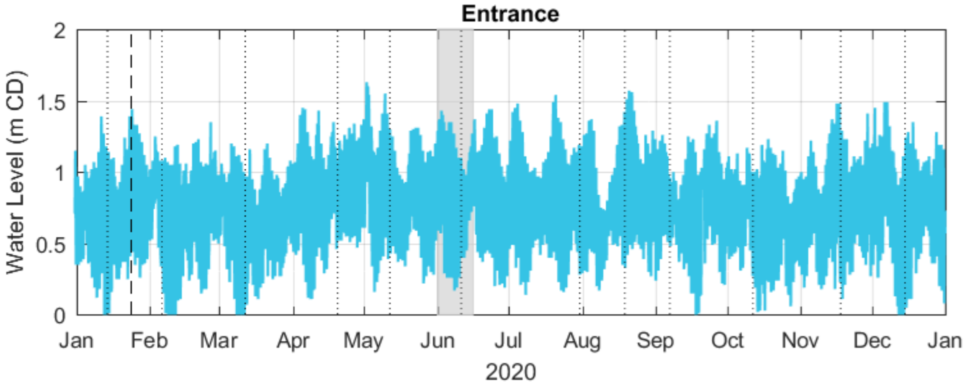


Figure 16: Water levels at Lakes Entrance in 2020 (PCS, 2021)

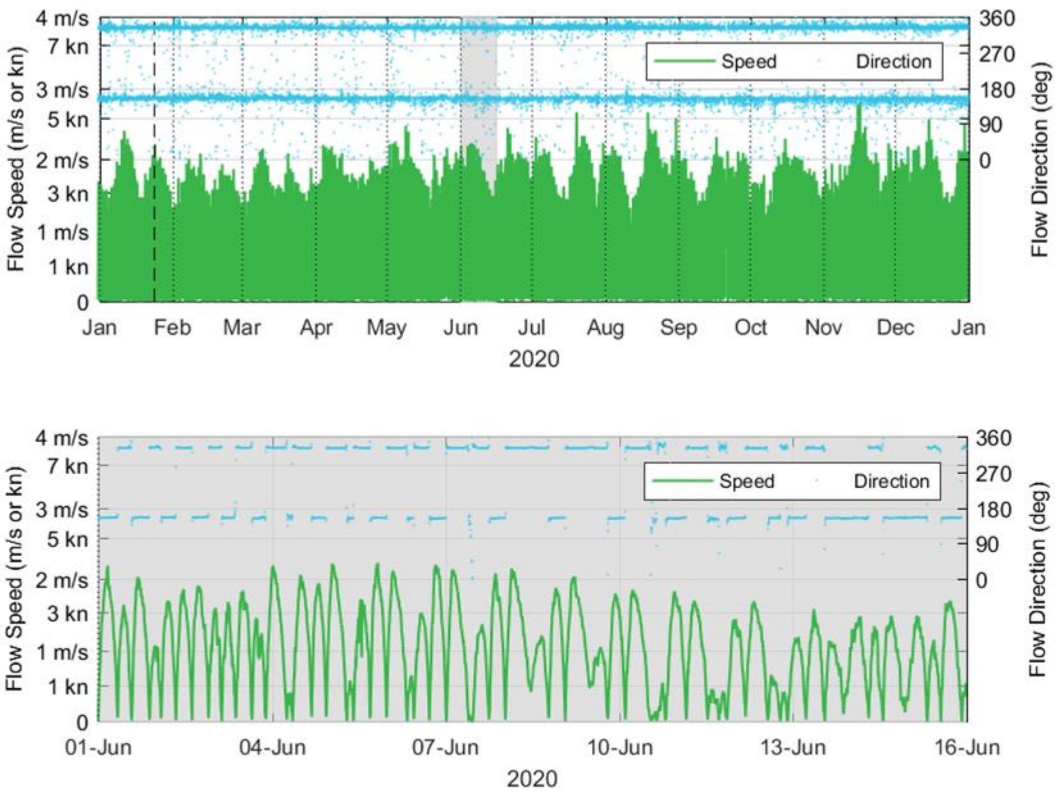


Figure 17: Currents at Lakes Entrance in 2020

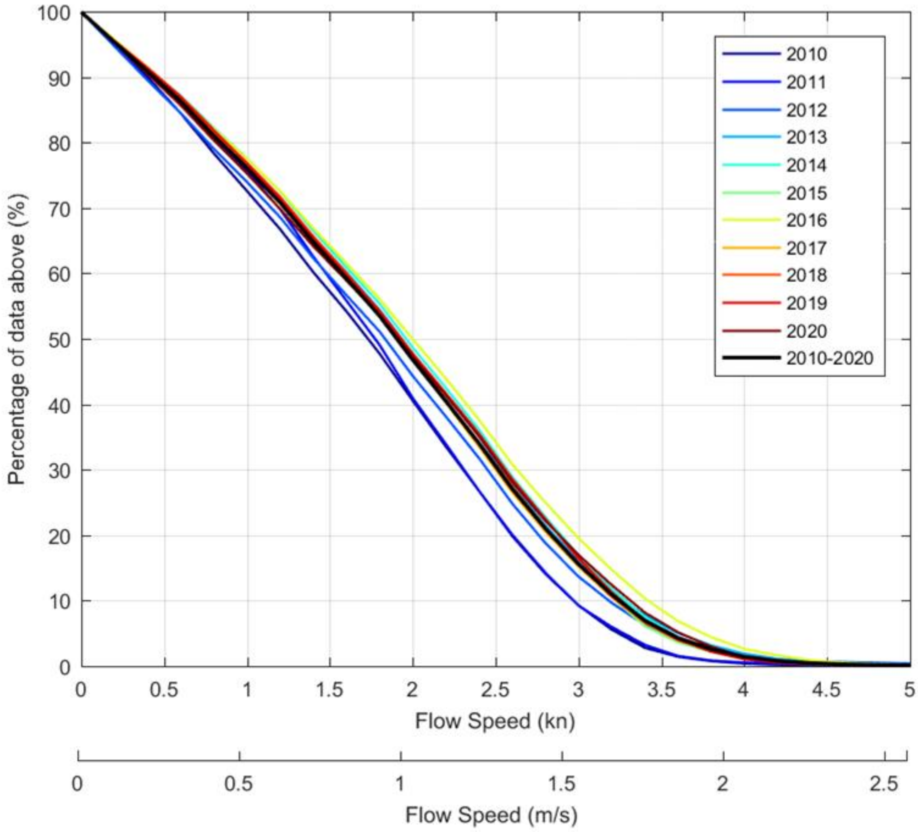


Figure 18: Annual Lakes Entrance flows 2010 to 2020 (PCS, 2021)

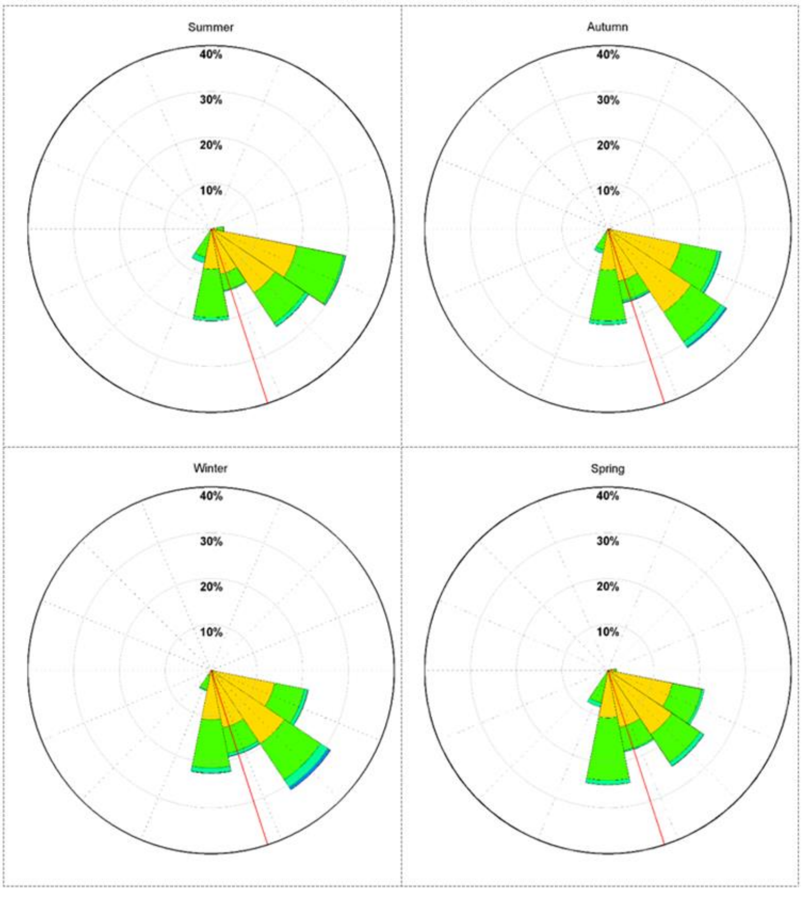


Figure 19: Seasonal wave roses 2010 to 2020 (PCS, 2021)

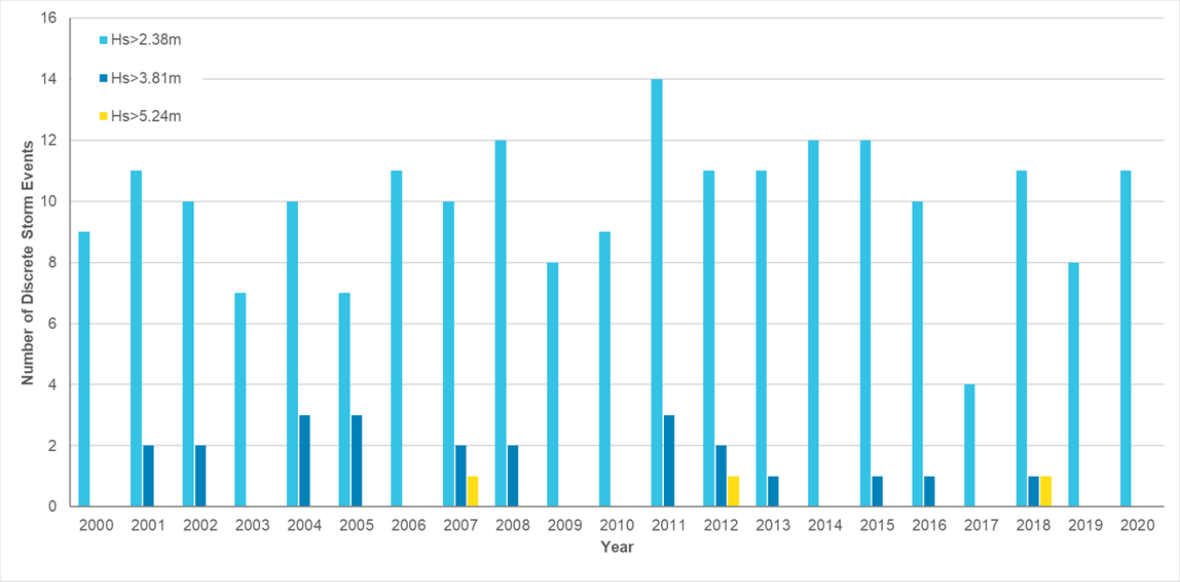
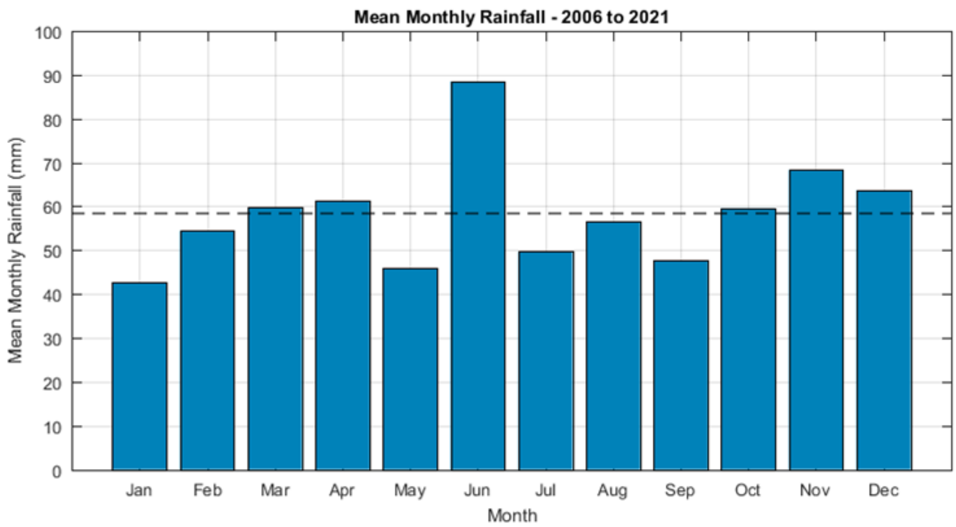


Figure 20: Number of discrete storm events per year to exceed the 10 in 1, 1 in 1 and 1 in 10-year ARIs (PCS, 2021)



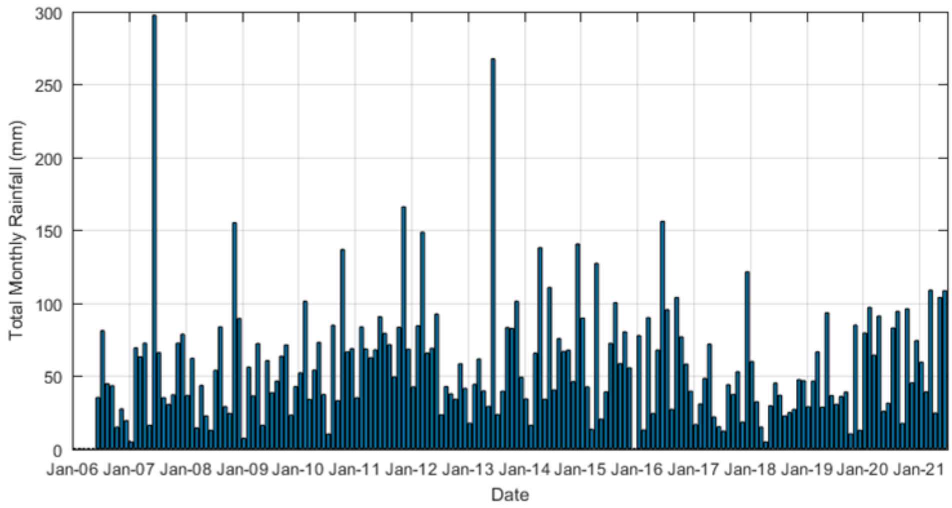


Figure 21: Monthly rainfall data from BoM 2006 to 2021 (PCS, 2021)

3.3 Coastal Processes

A conceptual sediment transport understanding for Lakes Entrance is provided in Figure 39.

This understanding is based on analysis of metocean data (water level, current, wind, wave, rainfall and river discharge data) and analysis of hydrographic survey data of the Bar, Entrance Channel, Swing Basin, Inner Channels and DMGs between 2008 to 2021.

3.3.1 Hydrodynamic modelling

Reviews by Water Technology (2022, 2013) have sought to collate the existing literature on the hydrodynamic and salinity regimes (Figure 22) within the Gippsland Lakes and assess the degree of sensitivity the system had on the dredging at the entrance. The documents reviewed included numerous reports, studies and models dating between 1980 and 2022; data sets provided by Gippsland Ports; and the EPA and publicly available data sourced online.

The **key findings** are as follows:

- The key hydraulic control for the lakes is the trained entrance cross-section. This is naturally scoured by the tidal flow and only requires minor dredging at certain sections in response to specific weather conditions.
- A secondary control exists through the shallowing extent of Reeves Channel, behind Flanagan Island and towards Metung. This area is unaffected by GLOA dredging works.
- The volume of the inner channels has a small influence on the tidal prism. Dredging can alter this slightly, as can scouring and infilling associated with catchment flow changes.
- Changes in the tidal prism have little influence on the mixing and salinity regime. The **larger influences** are:
    - **Longer ocean level changes**, such as due to storm effects over several days.
    - **Catchment flows**, which during floods can push the salt water out of the system, or during droughts can experience salt-water intrusion far deeper into the lakes and estuaries.

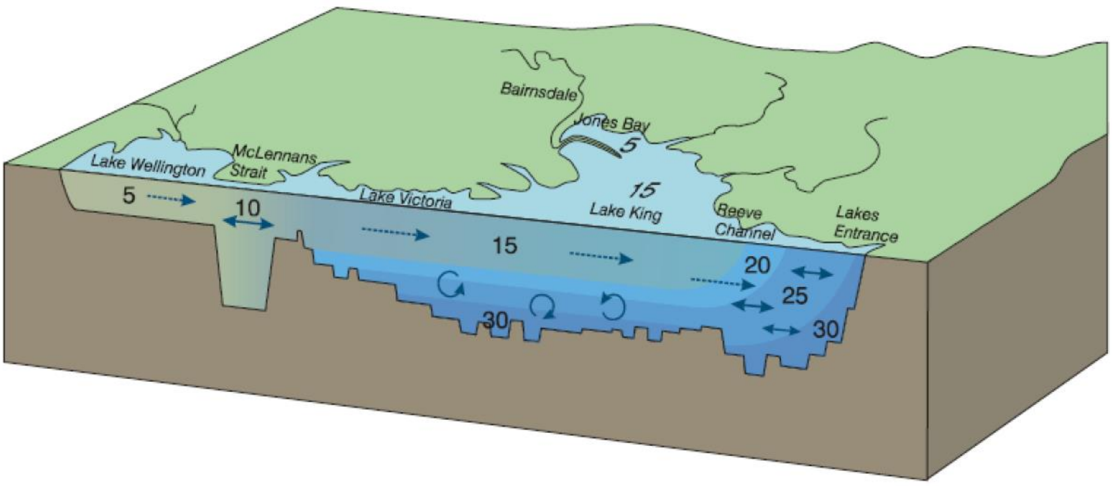


Figure 22: Conceptual model of salinity within the Gippsland Lakes (Webster et al, 2001). The numbers denote typical salinity concentration (ppt) and the colours show the salinity variation.

3.3.2 Water level and salinity modelling and analysis (2023)

In 2023, as requested by DCCEEW, Gippsland Ports commissioned updated data analysis and numerical modelling. The aims of this study were:

- to analyse available historical tidal records throughout Gippsland Lakes to ascertain whether the harmonic constituents of the tide may have changed significantly in response to dredging practises; and
- to undertake 3-Dimensional (3D) numerical modelling of the Gippsland Lakes for existing conditions and the future proposed dredging. The modelling will be used to show the potential impacts of the proposed dredging on the astronomical tide, water levels and salinity within the Gippsland Lakes.

The detailed report is provided in **Appendix A** to this LTMMP, with the executive summary provided below.

Water Level Analysis: The analysis of historical measured water level showed an increasing tidal range in Gippsland Lakes over the last 30 years (1994 to 2023), with the rate of increase reducing since 2008. The available data indicated that the change in tidal range which occurred from 2003 to 2008 was due to a gradual ongoing increase in tidal range over this period as opposed to a large jump which occurred over a single year. This suggests that the change was not due to the change from using a side-cast dredge in 2007 to using a TSHD in 2008. The results from the analysis could not identify any drivers responsible for the gradual increase in tidal range which occurred from 1994 to 2002 and again from 2003 to 2008. It was therefore considered most likely that the gradual increase was a result of multiple factors, which could include natural processes and dredging.

Model Setup: A detailed 3-Dimensional hydrodynamic model was setup for the Gippsland Lakes. The model was calibrated and validated using measured water level and salinity data from multiple locations within the Gippsland Lakes over two 12 month periods. The calibration and validation periods covered different conditions and have shown that the model is able to represent the changes in water level and salinity in the Gippsland Lakes resulting from astronomical tides, offshore storm surge, freshwater inputs and evaporation processes.

The 3D hydrodynamic model was setup to represent the existing bathymetry and the future dredged bathymetry. The model was then used to simulate the water level and salinity over two 12 month periods for the following cases:

- offshore forcing due to just astronomical tide, with no offshore storm surge, and with low freshwater inputs; and
- offshore forcing due to the astronomical tide and offshore storm surges along with high freshwater inputs.

Model Results: The results from the numerical modelling predicted similar changes due to the future dredging for both simulations, with the largest changes to both water levels and salinity predicted to occur in the channels around Lakes Entrance and directly offshore of the Entrance Channel. The modelling also predicted some localised areas with very low magnitude changes in lake King and Lake Reeve, but these changes would be too small in extent and magnitude to be measurable. The predicted changes around the Lakes Entrance region are summarised below:

- Hopetoun Channel: the largest predicted change in water level occurred at the western end of Hopetoun Channel, with predicted increases in high water levels and reductions in low water levels resulting in an increase in the maximum water level range of up to 0.025 m. This is the location of the largest depth change due to the future channel extension. The changes in water level in this area were not predicted to result in a change in salinity;
- West of Hopetoun Channel to Metung: this area was predicted to have a small increase in maximum water level range of up to 0.002 m, this increase was predominantly due to a predicted increase in maximum water level. The changes in water level in this area were not predicted to result in a change in salinity;
- Reeve Channel, North Arm, Cunninghame Arm and Entrance Channel: there was predicted to be a reduction in maximum water level range in these channels of typically around 0.002 m, but up to 0.01 m. This reduction in range was due to a combined reduction in maximum water level and an increase in minimum water levels. Within the North Arm and Cunninghame Arm there was also predicted to be an increase in minimum salinity, which resulted in a reduction in the maximum salinity range; and
- Offshore: changes to water levels and salinity offshore of the Entrance Channel was variable between the two simulations, with the changes significantly larger during the surge and freshwater forcing simulation. An offshore area of 10 km by 5 km located approximately 5 km to the south of the Entrance Channel was predicted to have an increase in maximum water level of up to 0.002 m. The offshore areas with predicted changes to salinity were located closer to the Entrance Channel, with areas adjacent to the shoreline up to 3 km to the west and east of the Entrance Channel predicted to have an increase in salinity range of up to 1 practical salinity unit (psu) (the majority is less than 0.1 psu), while an area adjacent to the Entrance Channel extending 2 km to the south was predicted to have a reduction in salinity range of up to 1 psu (the majority is less than 0.1 psu).

Most of these changes occur due to the extension of the western navigable section of Hopetoun Channel as part of the future dredging acting to increase the tidal prism which flows through Hopetoun Channel (both on the flood and ebb flows). This, in turn results in a small reduction in the tidal prism which flows through Reeve Channel and also the channels to the east of Reeve Channel (North Arm and Cunninghame Arm). This small change in the balance of how the tidal prism flows into and out of Gippsland Lakes results in a localised increase in water level range in Hopetoun Channel, and a small increase between Hopetoun Channel and Metung. In contrast, the change results in a reduction in water level range in the channels to the east of Hopetoun Channel. The change in portion of the tidal prism which flows through Hopetoun Channel also means that slightly less of the lower salinity water from the upstream lakes is transported through Reeve Channel during the ebb stage of the tide (or during downstream flows in large flood events), which results in a slight increase in the minimum salinity in the North Arm and Cunninghame Arm. The predicted offshore changes in water level and salinity due to the future dredging are expected to be a result of minor changes in how the ebb tide flows out of the Entrance Channel during periods of high freshwater discharge, which results in localised changes to both water level and salinity.

The predicted changes in water level resulting from the proposed future dredging being relatively localised to the GLOA dredge areas and of small magnitudes (maximum water level range increases of up to 0.025 m) provides further evidence that the historic changes in tidal range experienced in the Gippsland Lakes is unlikely to be a result of changes in dredging approach.

3.4 Bathymetry

The 1892-95 and 2022 bathymetry show similar depths for the Lakes Entrance Bar and Inner Channels as shown in Figure 23 and Figure 29. Depths can reduce to less than two metres below chart datum on the Bar and Inner Channels if no maintenance dredging occurs.

The Entrance Channel predominantly maintains natural depths of greater than four metres, though depths can increase during large rainfall and flood events. A scour hole exists at the end of the narrowed training walls which can have depths up to 19-metres below chart datum.

Gippsland Ports provides updated monthly surveys of the Bar and Inner Channels on its website here or through its Waterways Online mapping tool.

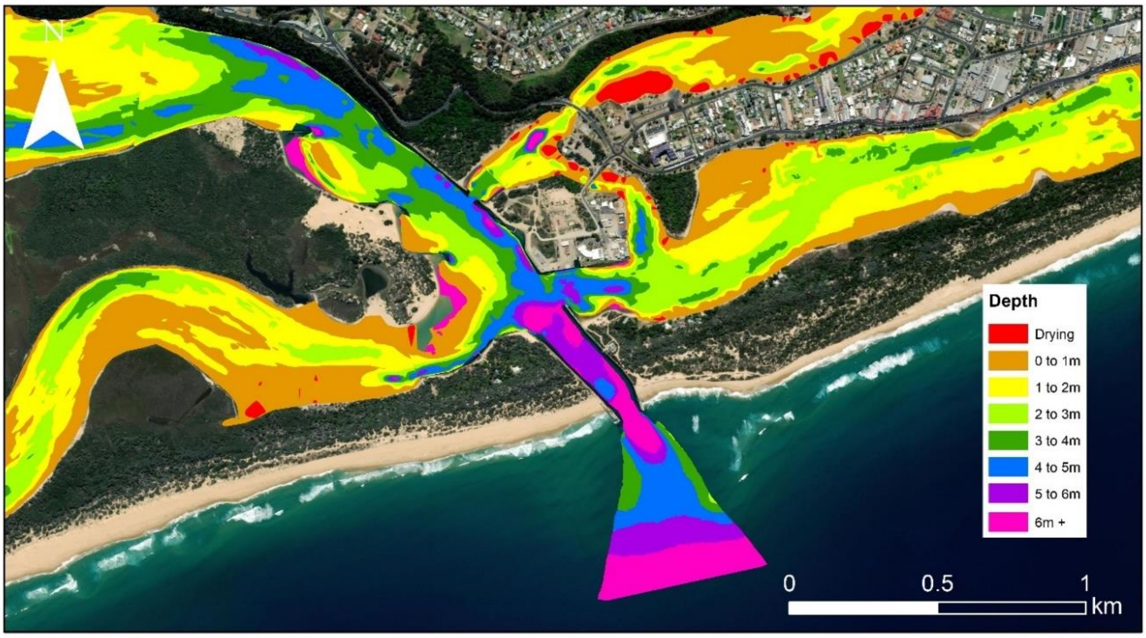


Figure 23: Lakes Entrance bathymetry January 2022 (Gippsland Ports)

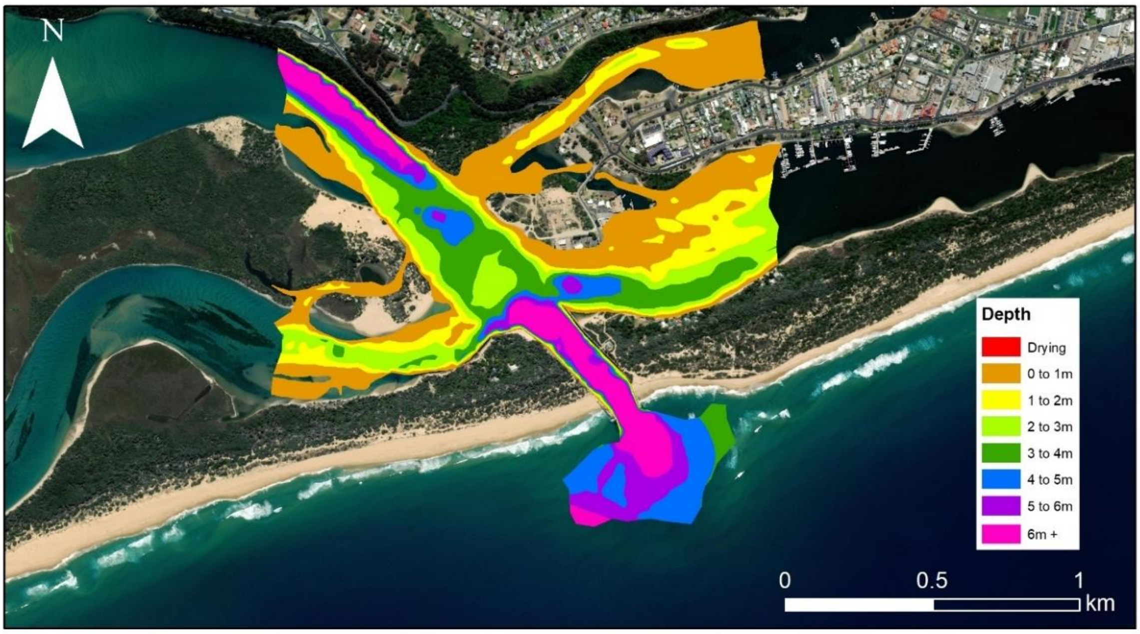


Figure 24: Lakes Entrance bathymetry ***1892 - 1895*** *(Gippsland Ports)*

3.5 Aboriginal heritage places and values

The land around the Gippsland Lakes has been occupied by the Gunaikurnai peoples for thousands of years. Fishing, camping, hunting and gathering remain key traditional practices across the landscape, and the area holds significant physical and intangible cultural heritage values across many sites. The Lakes National Park and Gippsland Lakes Coastal Park are two of the ten parks and reserves within Gippsland jointly managed by Gunaikurnai Traditional Owners and Parks Victoria (GLaWAC, 2021).

Gippsland Ports undertook an archaeological heritage (aboriginal values) impact assessment for sand redistribution works as part of the Lakes Entrance Sand Management Program (Volume 1, Perspectives Heritage Solutions, 2007). Three sensitive area/zones were identified as per Table 8.

Table 8: Aboriginal sensitive areas (Perspectives Heritage Solutions, 2007)

Sensitive Area/Zone	Sensitivity	Potential sites	Potential impact
Site AAV 8422-0083 (Lakes Entrance Cranium)	High	Further human remains	Low to undisturbed if 50m buffer and observer present.
Older sands	High	Shell midden sites, artefacts, scatters, human remains	Low to undisturbed; observer to be present.
New sands area	Very low	n/a	Very low

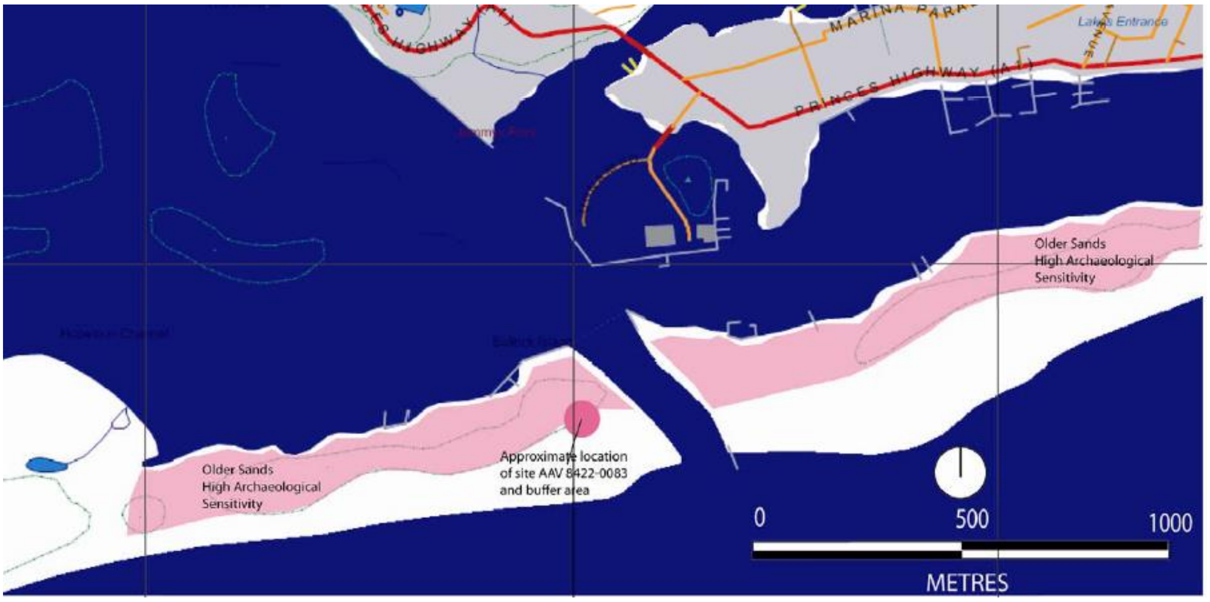


Figure 25: Areas of potential archaeological sensitivity for Aboriginal sites (Perspectives Heritage Solutions, 2007)

3.6 European heritage

3.6.1 Onshore

Gippsland Ports undertook an archaeological heritage (post-contact European) impact assessment for sand redistribution works as part of the Lakes Entrance Sand Management Program (Volume 2, David Helms, 2007).

The above-ground assessment looked at historic features on Boole Poole Peninsula and Long Island, which are located west and east of the Entrance Channel respectively.

The 'New Works complex' is included on the Victoria Heritage Register (H1532) and essentially consists of the extensive settlement (cottages, buildings, construction machinery relics) in these areas during initial construction and ongoing works on the Lakes Entrance training walls between 1870 and the 1920s.

These above ground historic features were addressed as part of Gippsland Ports Sand Transfer Station upgrade and Sand bypass system trials works between 2008 to 2012.

3.6.2 Foreshore and channels

A maritime cultural heritage desk top study was also undertaken as part of the LESMP (ERM, 2007)

One site of State Heritage Significance was listed on the Victorian Heritage Register (New Works Site) and 23 areas were identified containing maritime infrastructure heritage sites which might be considered for inclusion on the Victorian Heritage Inventory (Figure 26
Figure 27). One historic vessel was identified in the area. Three areas of archaeological sensitivity associated with aircraft and ship wrecks were identified, with the area around the Entrance being of particularly high sensitivity.

Material discovered during the 2009 TSHD program on the Bar was confirmed to be the shipwreck "Shark". Heritage Victoria was notified in September 2009. Gippsland Ports was advised there were no significant heritage issues surrounding this shipwreck.

The "SS Despatch" has also been discovered in the scour hole at the end of the training wall at depths of around 17 metres below chart datum.

Figure 26: Position of object believed to be from the trawler vessel 'Shark'

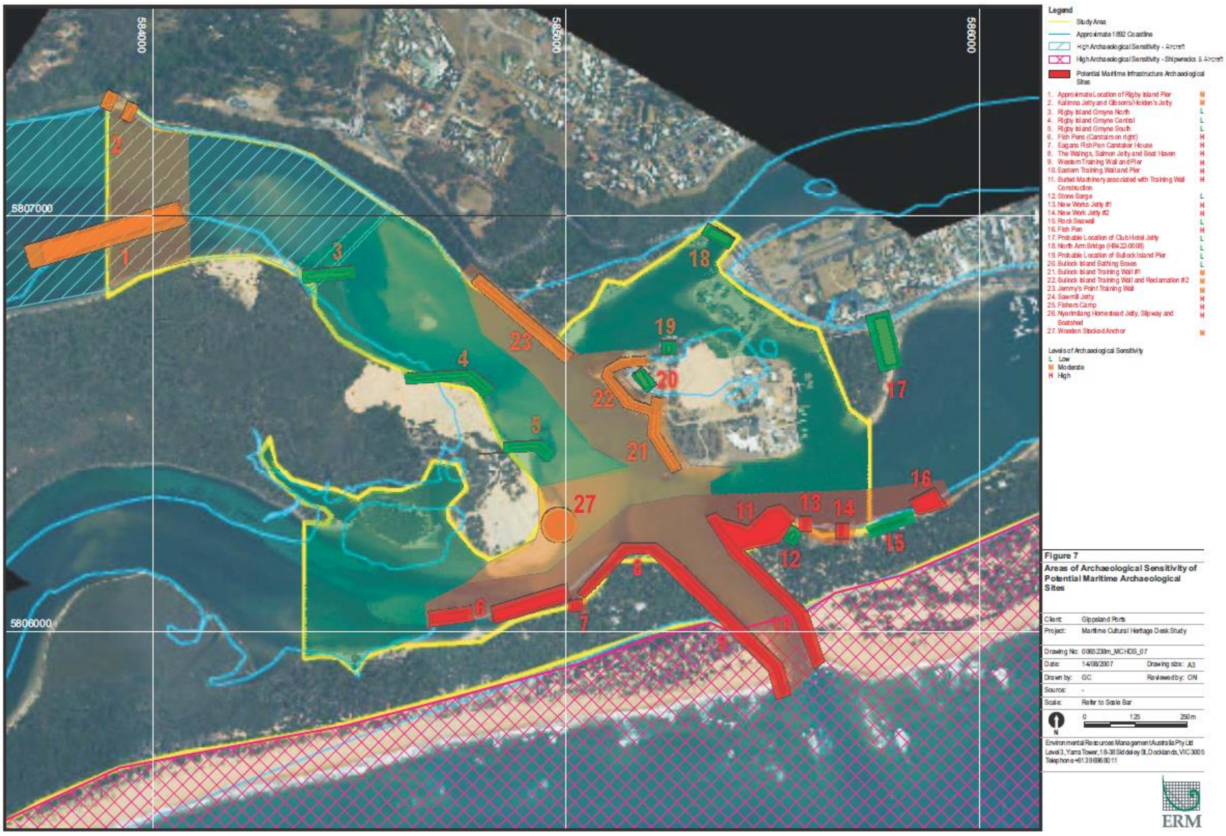


Figure 27: Potential maritime archaeological sites (ERM, 2007)

3.7 Social values and recreational activities

The Boating Industry Association commissioned report *Economic Value of Boating and Marine Industries on the Gippsland Lakes* (AECOM, 2014) places the value of direct and flow-on economic activity associated with recreational boating and fishing at **$163 million per annum**.

In 2013, there were 12,658 boats registered in the Gippsland Lakes region. Registrations in Gippsland for the period 2009 to 2012 increased by approximately 790 vessels, an average annual increase of 1.6% which is slightly below the state average of 1.7% per annum. Future boat registrations have been estimated for the period to 2040 based on trend analysis.

In terms of frequency of boats, there were three user groups:

- Local boat users – these averaged 16 days of boating per annum
- Day trippers (non-locals) – these averaged 7 days of boating per annum
- Multi-day visitors (non-locals) – these averaged 6 days of boating per annum.

For tourists, the most popular activity reason for visiting the Gippsland Lakes was fishing (54%) followed those holidaying in the Gippsland region (23%). This illustrates the significance of the Lakes to local tourism. The majority of the tourists were from elsewhere in Victoria, with a small number from interstate.

3.8 Commercial activities

The Econosearch report *Economic Value of Commercial Fishing Operating out of Lakes Entrance (Port of Gippsland Lakes)* commissioned by Gippsland Ports in 2014, estimates the commercial fishing activity out of Lakes Entrance is estimated to generate direct and flow-on gross state product of around **$50 million per annum.**

The Port of Gippsland Lakes also supports a range of other industries including offshore oil and gas in Bass Strait, the tourism sector and charter fishing operations.

Figure 28: Commercial fishing fleet in Cunninghame Arm, Lakes Entrance

4 Consultation

Gippsland Ports engages regularly with the community and stakeholders on its ongoing GLOA dredging and sand management activities. Consultation processes are detailed in Gippsland Ports' approved GLOA Stakeholder Engagement Plan. Gippsland Ports holds Open Days and dredger tours to stakeholders, interest groups and the community on its dredges (Figure 29).

Figure 29: Community Open Day onboard the previous TSHD Pelican

4.1 TACC

In 2005 Gippsland Ports established the Lakes Entrance Technical Advisory and Consultative Committee (TACC) as recommended by the National Assessment Guidelines for Dredging (NAGD 2009) for proponents seeking long-term dredging permits.

The objective of the TACC is to assist Gippsland Ports and the determining authority in protecting the local environment and in reconciling various stakeholder interests.

The Lakes Entrance TACC was first convened in March 2005 as part of the process to obtain a five-year Sea Dumping Permit for side-cast dredging of the Bar; and in February 2006 at a Stakeholder Workshop to be briefed about the Lakes Entrance Sand Management Program (LESMP). The LESMP was a five-year initiative designed to investigate and develop options for the future management of sand ingression onto the Bar channel and inner channels at Lakes Entrance, and the TACC has continued through the GLOA program.

The TACC meeting agenda is circulated to TACC members with the previous meeting notes and a link to the latest LTMMP approximately one month prior to the meeting.

In addition to the TACC meetings (Table 9), Gippsland Ports has undertaken a number of specific public information and consultative processes as the need has arisen including numerous presentations and public meetings, electronic newsletters and a dedicated Sand Management webpage on Gippsland Ports' website at https://www.gippslandports.vic.gov.au/ports-and-waterways/sand-management/ which provides dredging program information, updates and bathymetric surveys.

Gippsland Ports also has an online Feedback facility which allows the public to provide Gippsland Ports with feedback, to register complaints or appreciation or to seek information.

Table 9: TACC meetings

Meeting no.	Date
1	Mar 2005
(informal)	Feb 2006
2	Dec 2006
3	May 2008
4	Apr 2009
5	Oct 2009
6	Oct 2010
7	Nov 2011
8	Oct 2012
9	Nov 2013
10	Dec 2014
11	Feb 2016
12	Dec 2016
13	Dec 2017
14	Nov 2019
15	May 2022

4.2 Stakeholder Engagement Plan

Gippsland Ports initially prepared a Stakeholder Engagement Plan in 2011 as a requirement of GLOA State and Commonwealth approvals.

Amongst other initiatives, this Stakeholder Engagement Plan identifies TACC meetings as an opportunity for key stakeholders and interested parties to review the Gippsland Lakes Ocean access program information, to raise queries and to seek feedback from key Gippsland Ports staff.

The TACC Terms of reference is circulated to TACC members and also included within the GLOA Stakeholder Engagement Plan.

5 Sustainable Sediment Management Assessment

In 2021, Gippsland Ports undertook a number of reviews and assessments to consolidate the learnings from the last 10-years of the GLOA program. These studies included sediment characterisation, bathymetric analysis, beneficial reuse assessments and review of dredge design; which are summarised briefly below.

5.1 Sediment Characteristics

5.1.1 Sediment Sampling and Analysis Plan

In accordance with the NAGD, Gippsland Ports prepared a Sediment Sampling and Analysis Plan (SAP) which was approved by DAWE (now DCCEEW) on 9 August 2021. This SAP has been prepared following industry best practice, the NAGD and Victorian EPA Best Practice Environmental Management Guidelines for Dredging (BPEMGD; publication no. 691). The SAP documents the recommended numbers and locations of samples, the analytes to assess at each location, detail of proposed sampling method and QA/QC procedures to ensure confidence in the results.

The 2021 approved SAP will be the reference document for any future comprehensive sediment sampling. Any amendments to this SAP will need to be approved by the Determining Authority (DCCEEW) prior to future sampling.

5.1.2 Sampling locations

In 2021, 34 core sampling locations were adopted including 16 in the inner channels (Figure 30), 4 in the DMGs, 8 in the proposed Cunninghame Arm extension (Bullock Island east) and 6 additional field triplicates.

Sampling of the Bar and Entrance Channel was exempt from further sediment analysis due to the following reasons:

- The bar is in a very high-energy area with limited potential for fine sediments to accumulate.
- The material is regularly infilled by marine sands from the adjacent longshore areas consisting of marine sands.
- The adjacent areas will be subject to sampling regardless (at the DMGs)
- The material is regularly dredged and cycled to the DMGs and is therefore recently placed with limited scope for dredging to uncover stratified remnant contaminants.

5.1.3 Physical properties

The particle size distribution analysis shows that the sediments consist of majority medium sand fractions (92-100%) (Figure 31) in the Inner Channels and Dredge Material Grounds (DMGs).

The proposed extension of Cunninghame Arm channel on the east side of Bullock Island also contained predominantly medium sand (79 – 94%) with some increases of silts and clay on eastern side of northern end of channel extension at two sampling locations CA02 and CA05.

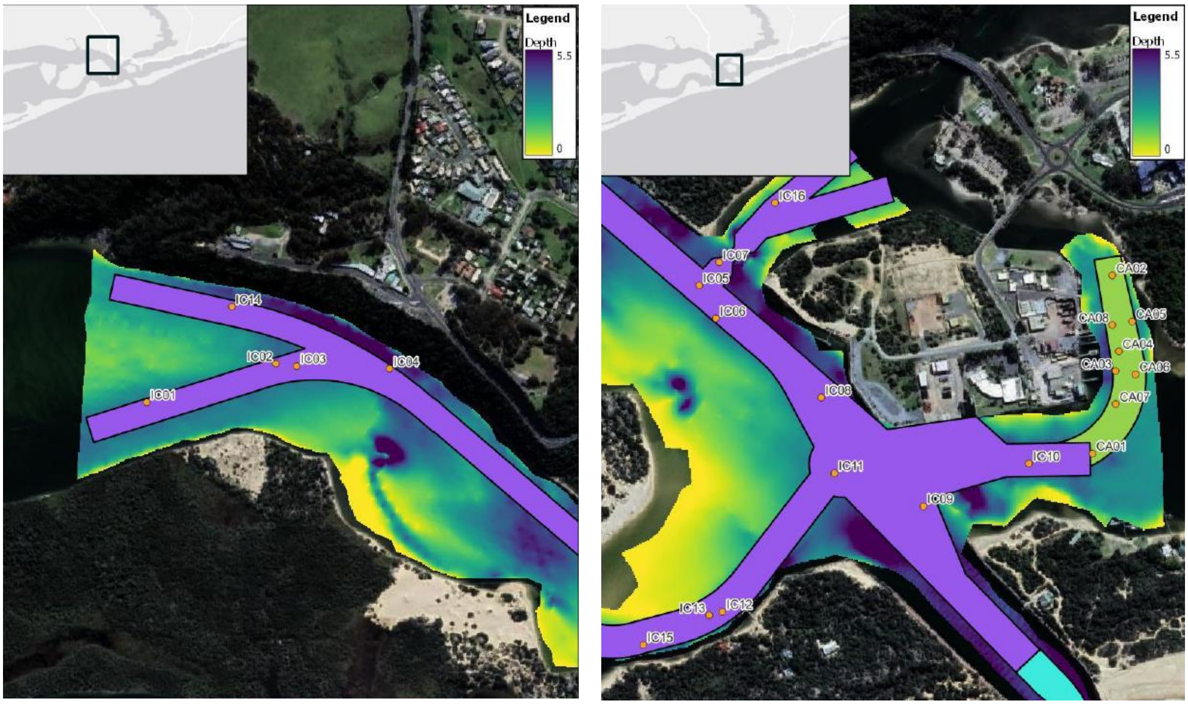


Figure 30: 2021 GLOA inner channel sediment sampling locations

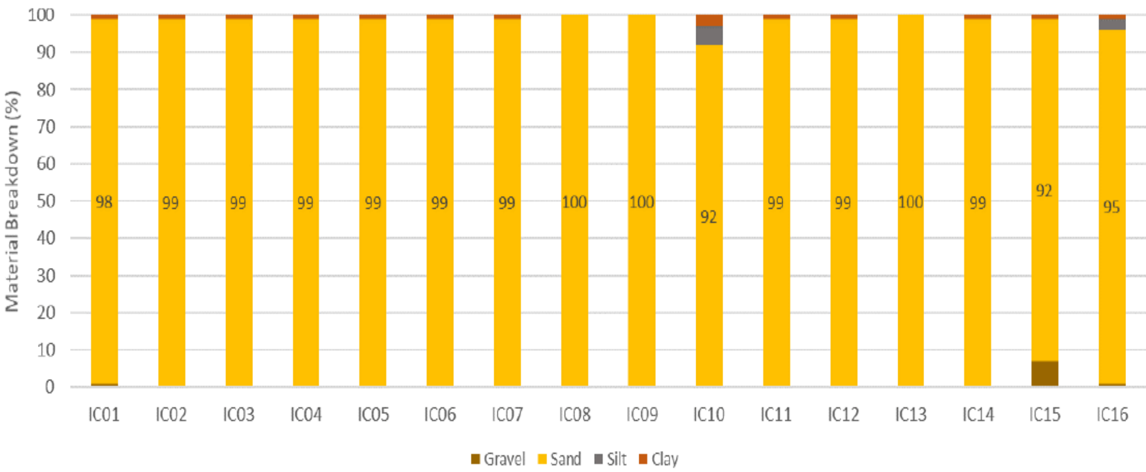


Figure 31: GLOA Inner Channels – Particle Size Distribution (2021)

5.1.4 Contaminants

The results of the contaminants testing in 2021 were similar to that of historical sediment testing undertaken at the Inner Channels and DMGs. It showed that the dredge material in the Inner Channels is comprised of **clean oceanic sand** that is **devoid of any contaminants at notable levels**.

5.1.4.1 Cunninghame Arm extension

Tributyltin (TBT) was measured above the screening level for 6 of 13 samples within the proposed Cunninghame Arm extension on the east side of Bullock Island. It is understood that the nature of TBT contamination in marine sediments (typically from legacy, and now banned, antifoulant paint) can result in heterogeneity where paint 'flecks' may be present. Samples including these paint flecks may be outliers and not typical of the wider sediment contamination levels. In accordance with the NAGD and DAWE approved SAP, further phase III testing of bioavailability by elutriate testing was taken. The results confirmed that TBT is tightly bound to the sediments, not likely to be mobilised within the water column during dredging and hence suitable for unconfined ocean placement.

5.1.5 Coastal Acid Sulphate Soils (CASS)

Five of the collected samples were analysed for the presence of coastal acid sulphate soils (CASS). The Victorian EPA Acid sulphate soil and rock bulletin (document 655.1, EPA 2009) provides guidance for assessing the acidity and acid potential of soil samples. This is based on first assessing the field pH and the field oxidised pH of the soil for acidity and potential acidity. Further analytical testing of the soil can determine a net acidity by acid/base accounting.

The primary field indicator tests show that the in-situ pH of all samples was high (>8.2) and therefore not acidic. The oxidised field pH test showed a drop in pH with the lowest samples having a pH of 5.9 (low CASS risk).

The analytical net acidity tests show that minimal existing acidity but a weak potential acidity. However, acid neutralising capacity results in a low net acidity. For sandy material, the highest (most acidic) net acidity value should be compared to the threshold value of 0.03 %S to assess acid sulphate risk. As all collected samples recorded net acidity below the limit of reporting (of 0.02%S) the analytical tests confirm the risk to be negligible.

Analysis	Sample				
	CA03_CASS	CA08_CASS	IC01_CASS	IC05_CASS	IC10_CASS
Field pH (F)	8.5	8.7	8.6	8.2	8.8
Field oxidised pH (Fox)	6.3	6.3	6	5.9	6.6
Actual Acidity (%S)	<0.02	<0.02	<0.02	<0.02	<0.02
Potential Acidity (%S)	0.065	0.111	0.032	0.019	0.147
Acid Neutralising Capacity (ANC) (%S)	1.21	1.78	0.89	0.63	4.14
Net Acidity (%S)	<0.02	<0.02	<0.02	<0.02	<0.02
Liming Rate (kg $CaCO_3$ / t)	<1	<1	<1	<1	<1
CASS Risk Level	Negligible	Negligible	Negligible	Negligible	Negligible

5.1.6 Sediment currency

The dredged sediment is almost 100% clean medium sand derived from oceanic rather than fluvial sources. Fine-grained particulate material is continually remobilised by waves, tide and flood currents to areas beyond the proposed dredged areas. Consequently, future contamination in the dredge areas is remote.

Gippsland Ports' sediment testing contingency is to undertake further testing immediately following any significant change or incident in the catchment or port areas that could give rise to sediment contamination. Such events will be detected by Gippsland Ports' monitoring of local and State media, by liaison with EPA Victoria (a member of the TACC), and by its own reporting process of marine incidents.

Gippsland Ports will also commit to undertaking periodic (every three years) analysis of sediment collected in the hopper of the TSHD Tommy Norton. This will contribute to any long-term trends over the next 10-years (2023 to 2033).

5.2 Bathymetric Analysis

A bathymetric analysis of the GLOA dredging and placement (DMGs) areas was undertaken to define the natural processes which drive bathymetric changes. The approach was to:

1. analyse the available metocean data to get an understanding of the natural local conditions and to provide context for the bathymetric changes. This included water level, current, wind, wave, rainfall and river discharge data.
2. process and analyse the hydrographic data of the Bar, Entrance Channel, Swing Basin, Inner Channels and DMGs. Monthly surveys for the dredged areas of the Port were available from 2015 to 2020 and around 23 surveys for the DMGs from 2008 to 2021.
3. Develop a conceptual understanding of the processes which influence sediment transport at the Port based on the available bathymetric and metocean data.

A conceptual sediment transport understanding of the GLOA dredging and placement areas in Lakes Entrance is provided in Figure 39 with further details provided in the following sections.

5.2.1 Bar, Entrance channel and Swing basin

Bathymetric surveys were reviewed between December 2014 and December 2020. Annual sedimentation was also calculated over three years (2015 – 2017) (Figure 32 and Figure 33) indicating that maintenance dredging requirements are in the order of:

- Bar Channel: **20,000 to 80,000 m^3 / year**
- Bar Wedge: **70,000 to 160,000 m^3 / year**
- (Bar Total): 90,000 to 240,000 m^3 / year)
- Entrance Channel: **3,000 to 7,000 m^3 / year**
- Swing Basin: **20,000 to 30,000 m^3 / year**

The conceptual understanding of natural conditions is:

- Waves are the dominant driver for sedimentation on the Bar.
- There is no clear correlation between annual wave conditions and sedimentation in the Bar except lower sedimentation occurs during calm years (e.g., 2017).
- Suggests that typical wave conditions are sufficient for regular ongoing sediment transport and sedimentation to occur and that other factors (local morphology, currents through entrance channel etc) also influence sedimentation.

5.2.2 Inner channels

An example of the Inner channels' bathymetry and depths relative to design depths is shown for the month of November 2020 in Figure 34 and Figure 35.

Annual sedimentation was calculated for various sub-areas of the Inner Channels for the four-year period between 2017 and 2020 inclusive.

Sedimentation above design depths for GLOA inner channels is in the order of **140,000 to 170,000 m^3/year.** Of this, **50,000 to 90,000 m^3 / year** accumulates in the southern channels (Hopetoun Channel, Cunninghame Arm and southern half of the Narrows).

The conceptual understanding of natural conditions is:

- No correlation between annual rainfall and sedimentation in Inner Channels.
- Rainfall can influence Inner Channel sedimentation over monthly timescale (e.g., Jan-Feb 2017, Feb-Mar 2020)
- Ongoing sedimentation due to tidal currents means fluctuations due to high monthly rainfall do not significantly contribute to annual sedimentation rates.
- Important to note no major flood events over this period, these events could have a larger influence on sedimentation in the Inner Channels.

5.2.3 Dredge Material Grounds (DMGs)

Each Dredge Material Ground (Figure 39) is:

- 2,000 metres long by 400 metres wide
- separated into four 100-metre-wide rows (A, B, C, D)
- each row has 40 cells
- depths range from 5 to 14 metres (Figure 36)

23 surveys of both the East and West DMGs were analysed as part of the bathymetric analysis assessment (PCS, 2021). The analysis revealed that a storm bar, with sedimentation more than one metre, formed in Row A (nearshore) of the DMGs in June 2012. This was due to very large waves, which were the largest recorded since at least 1979. This storm bar has been gradually eroding since 2012 (Figure 37).

For the period of October 2012 to January 2021, and excluding the natural ongoing net erosion of 2012 storm bar in Row A, it was determined that the:

- **East DMG is 45% retentive** (Figure 38)
- **West DMG is only 20% retentive** (Figure 38)

The conceptual understanding of DMGs is:

- Typical annual wave conditions result in sufficient potential for transport of sediment placed at the DMGs so that transport of sediment out of the DMGs is relatively consistent between years.
- Sediment placed shallower than 9m below CD (Rows A and B) at the DMGs is most likely to be mobilized and have the potential to be transported away from the DMGs.
- Rows C and D are deeper than 9m below CD at both DMGs and so there has been little transport of sediment placed in these areas. The analysis has shown that sediment placed in these deeper rows can still be transported during large wave events.
- The West DMG has an average loss of sediment of **11,000 m^3/month** during regular annual placement or relatively constant loss of **3,100 m^3/month** when no sediment is placed there.
- The East DMG has an average loss of sediment of **6,700 m^3/month** during regular ongoing placement.

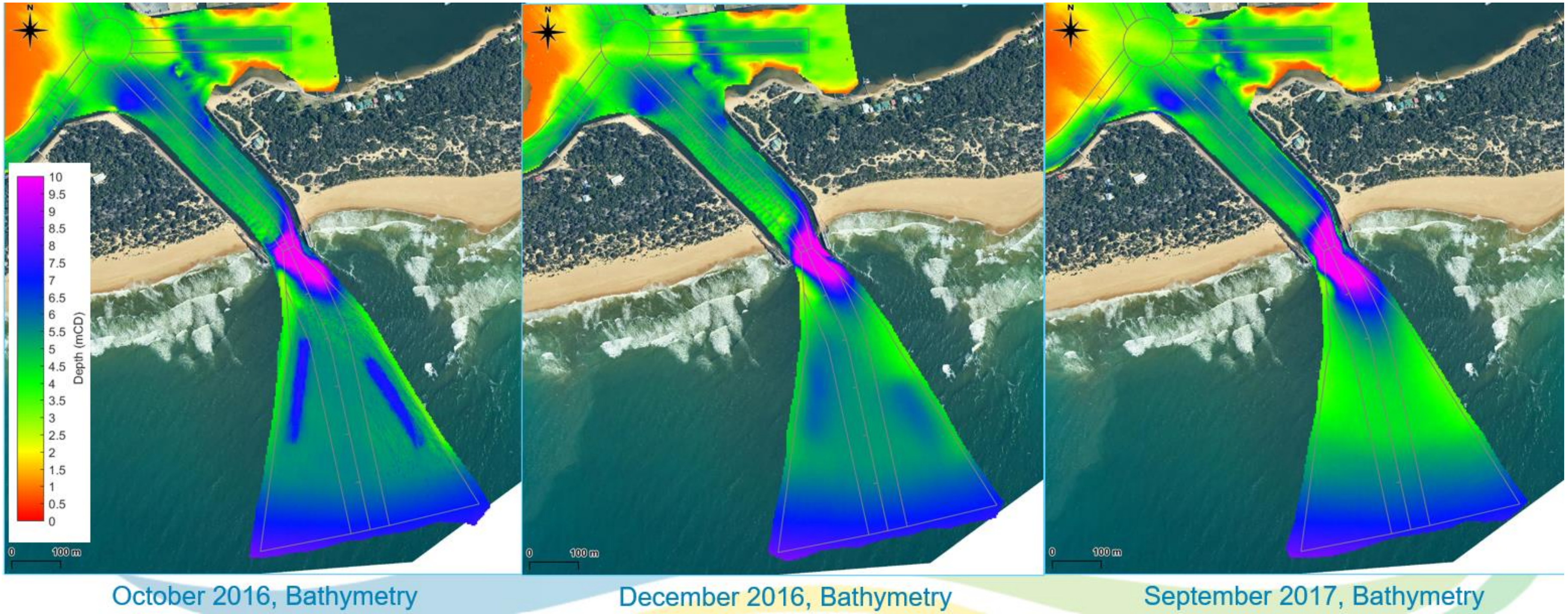


Figure 32: Bathymetry of Bar and Entrance Channel for the 11-month period without dredging following the last dredging works with contracted TSHD Pelican (October 2016) and prior to arrival and operation of Gippsland Ports owned and operated TSHD Tommy Norton in September 2017. (PCS, 2021)

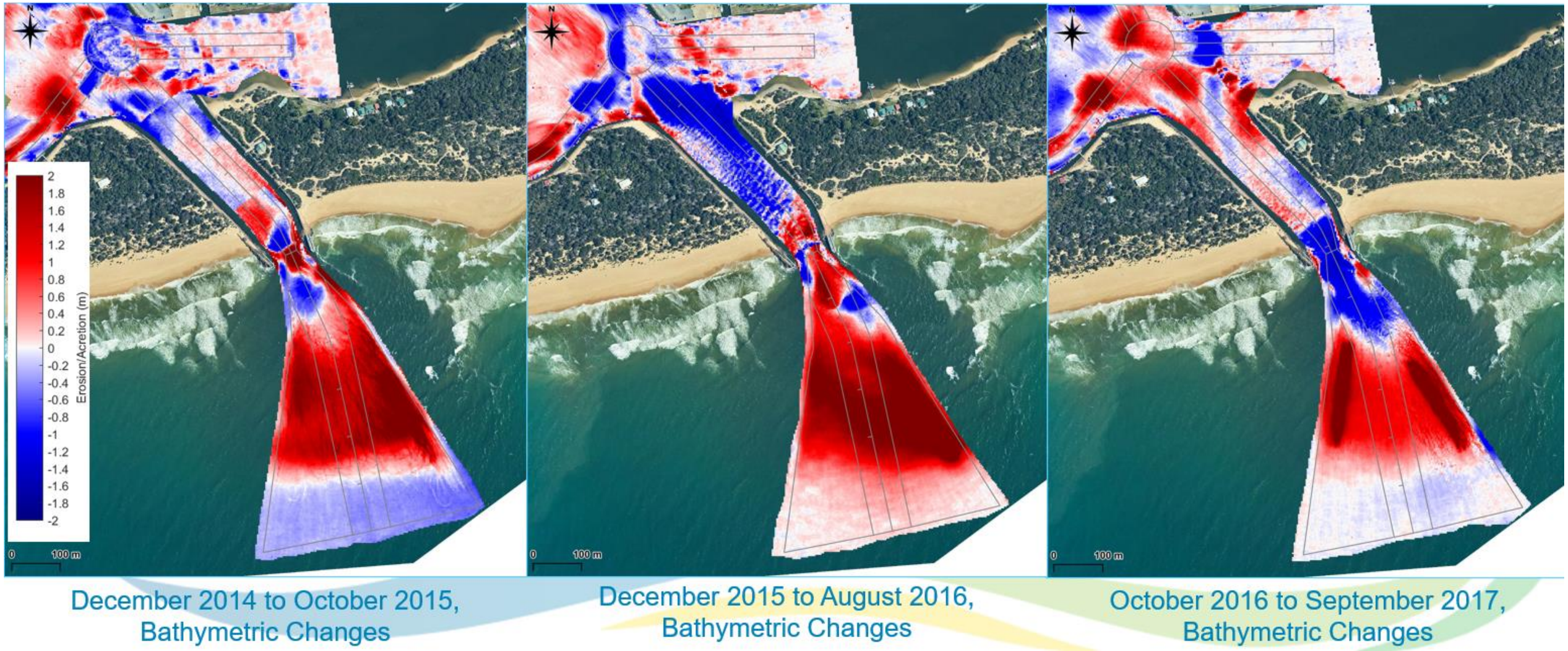


Figure 33: Change in depth at the Bar and Entrance Channel between 2014 and 2017 (PCS, 2021)

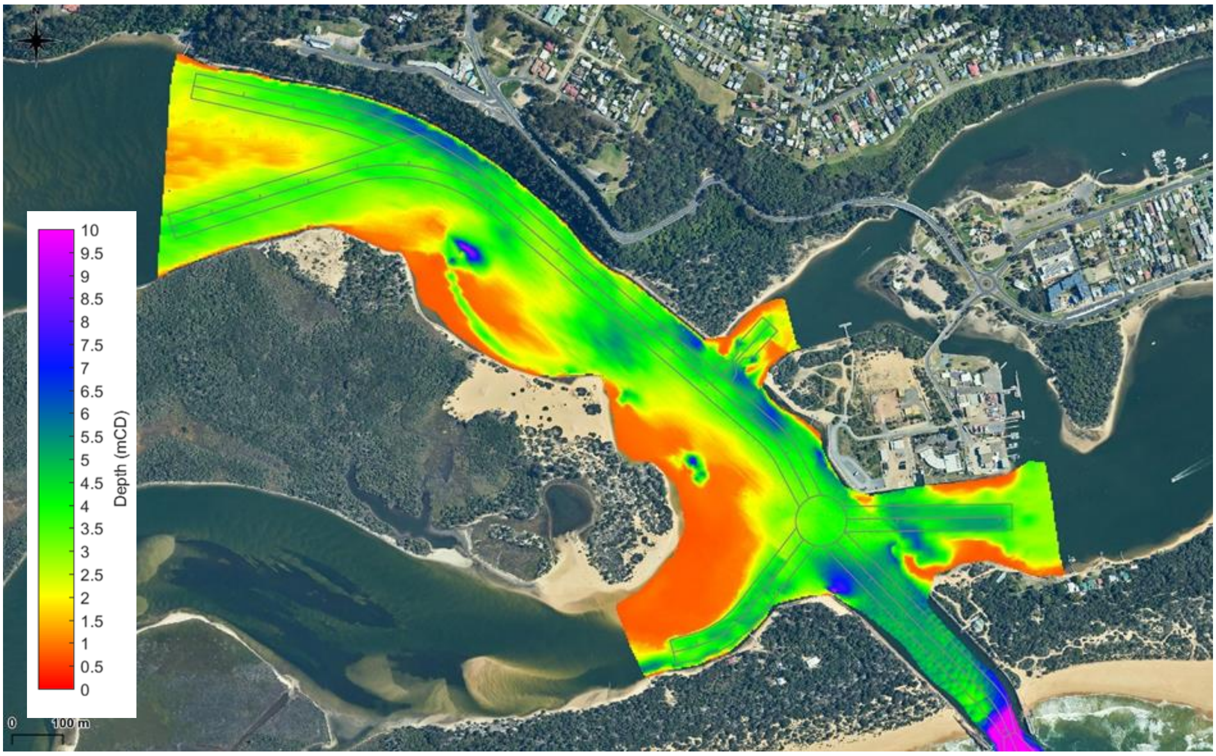
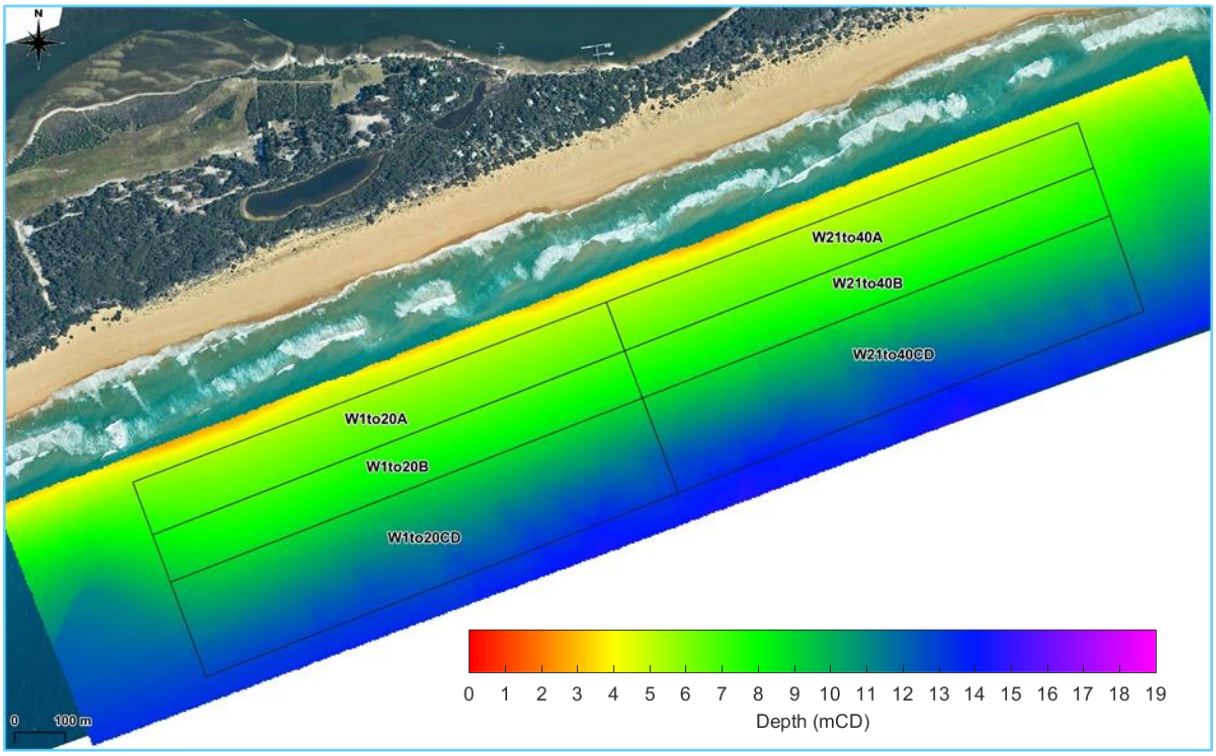


Figure 34: GLOA Inner Channels bathymetry (November 2020) (PCS, 2021)

Figure 35: GLOA Inner Channel depths relative to design depths (November 2020) (PCS, 2021)



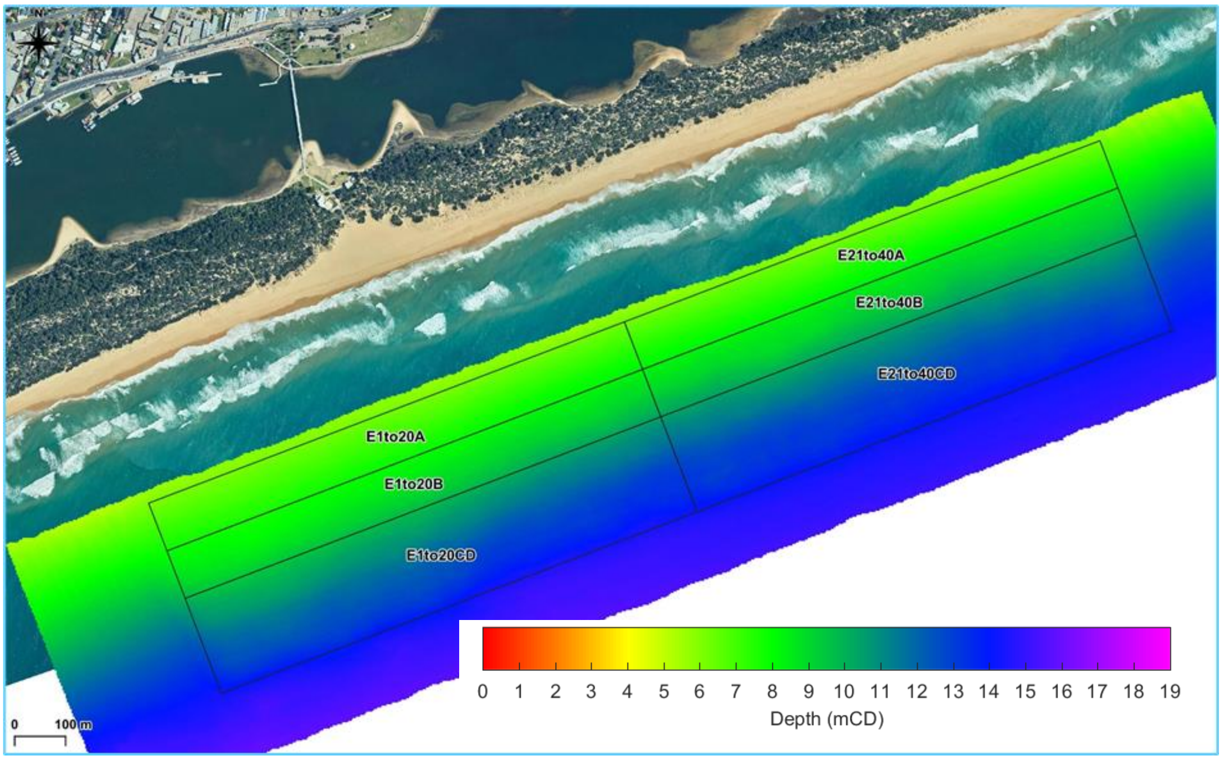


Figure 36: West (top) and East (bottom) bathymetry, January 2021 (PCS, 2021)

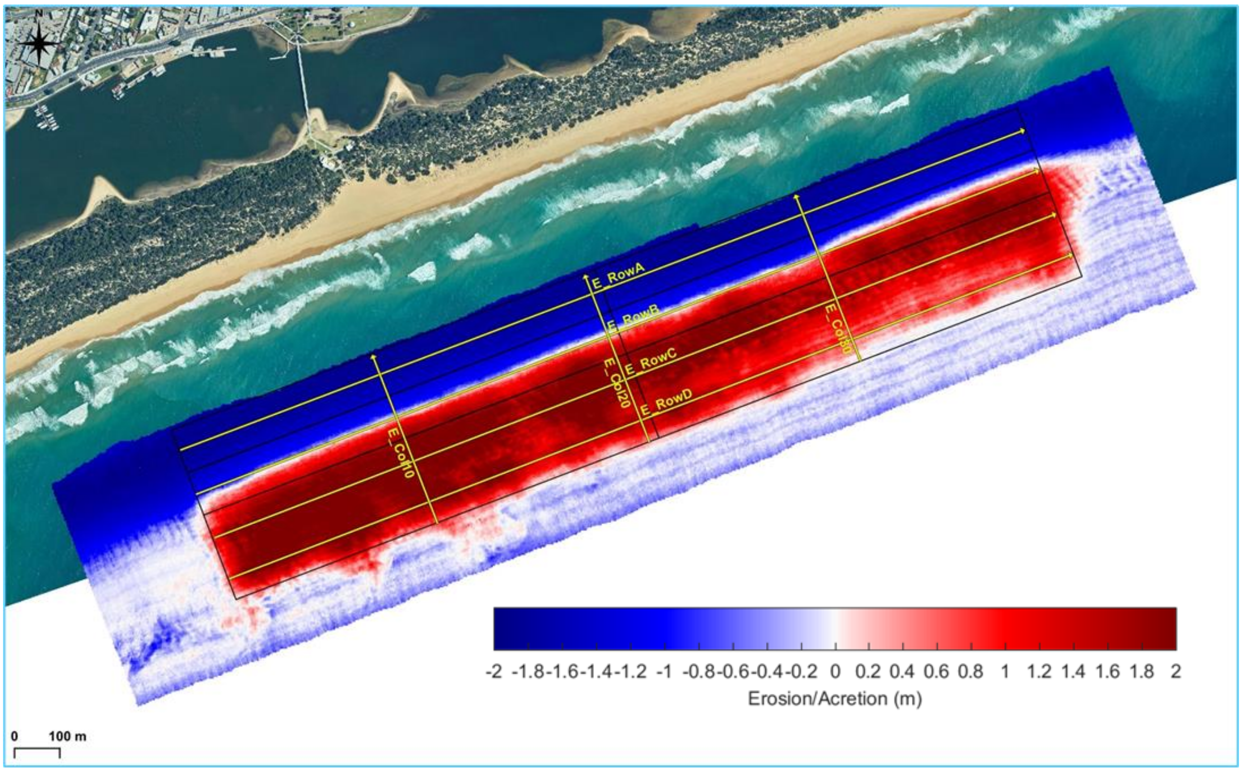
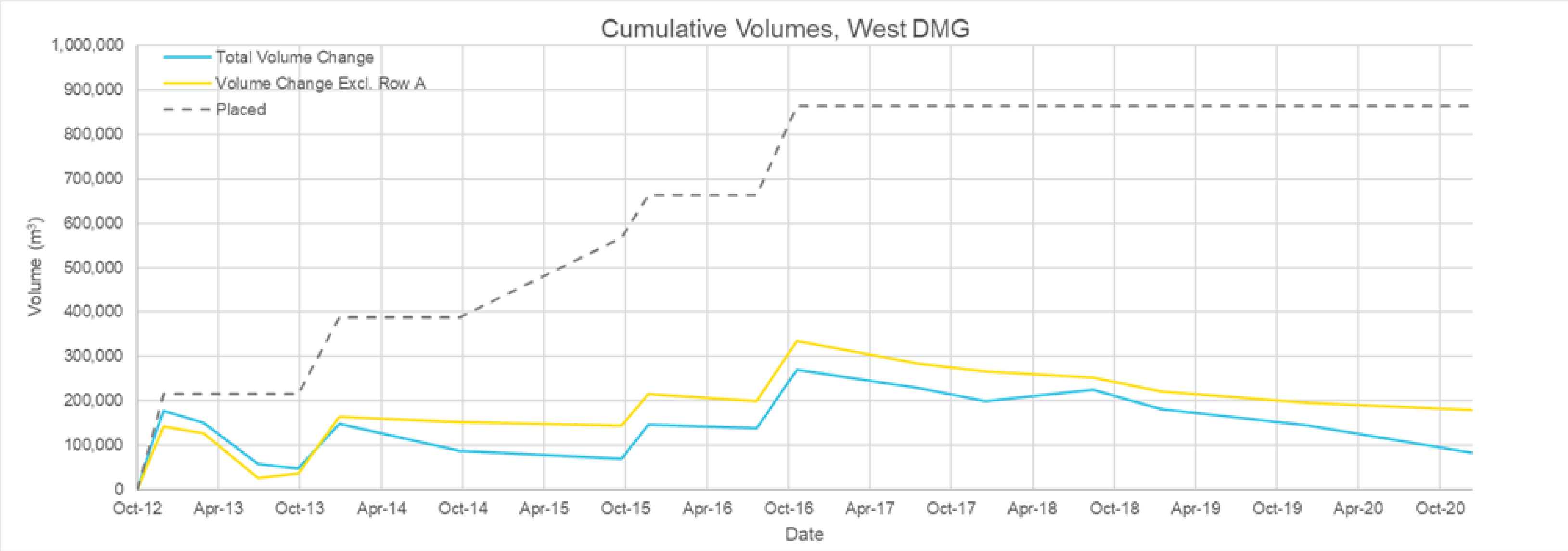


Figure 37: East DMG change in bathymetry October 2012 to January 2021 (PCS, 2021)



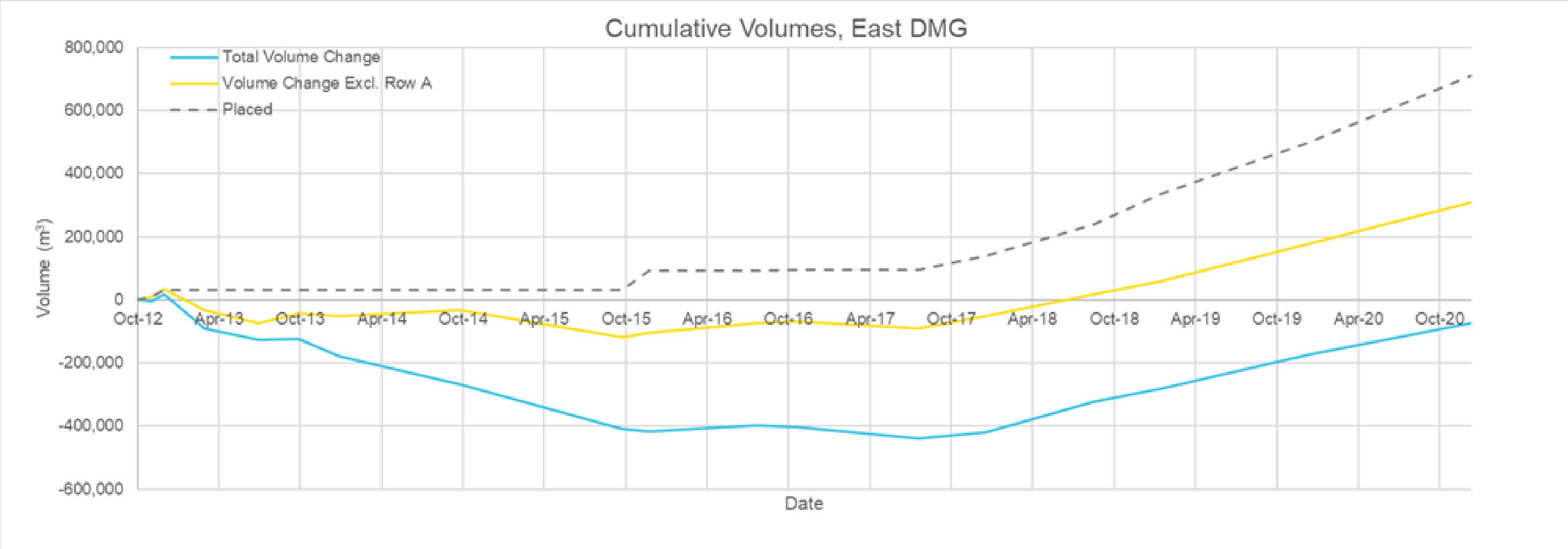


Figure 38: Cumulative change in net volume at the West and East DMGs with and without Row A included (PCS, 2021)

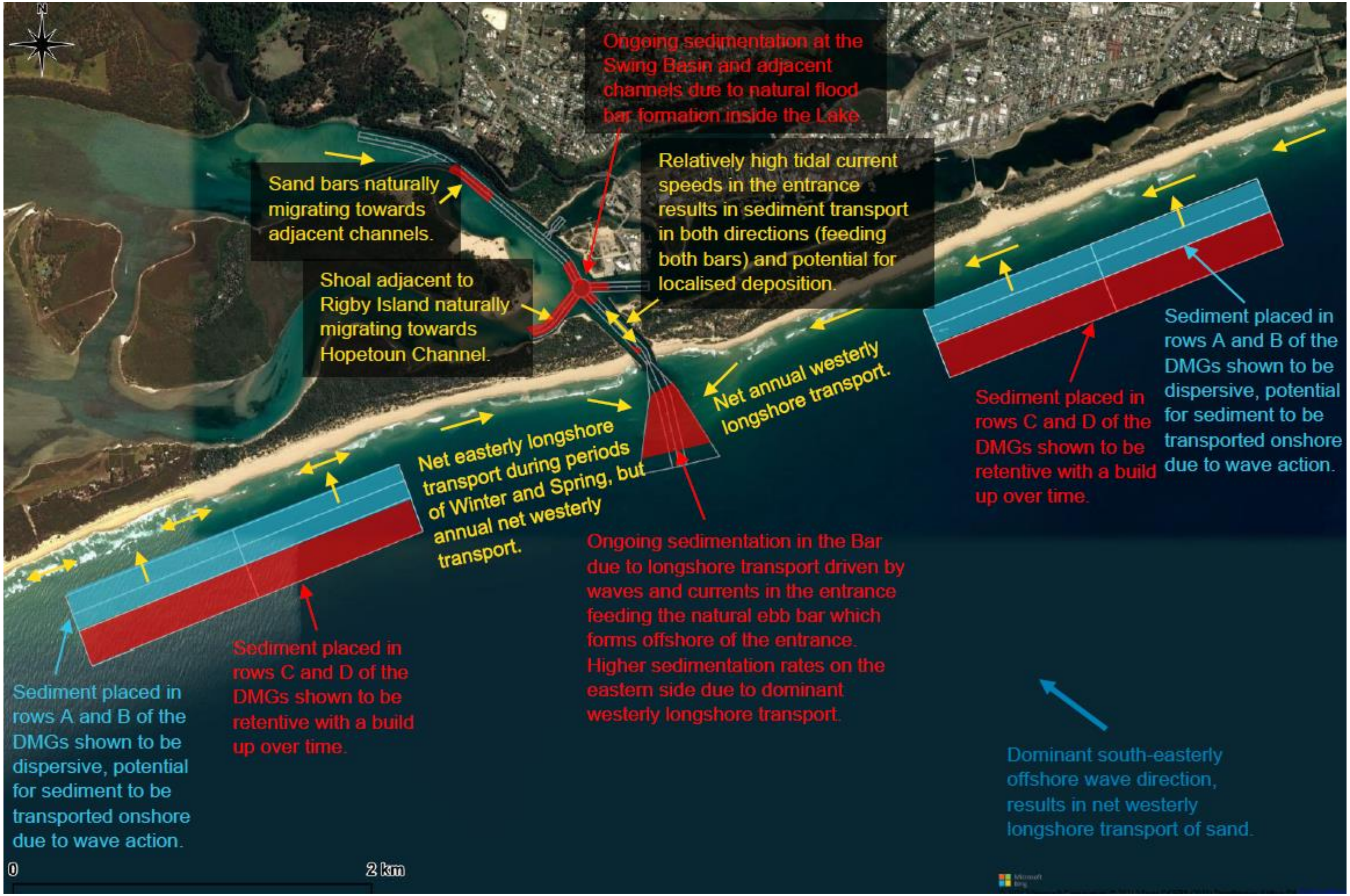


Figure 39: Conceptual sediment transport understanding for Lakes Entrance

5.3 Beneficial Reuse (Placement for Purpose)

Gippsland Ports undertook a beneficial reuse assessment (PCS, 2021) to review recent (2008 – 2021) dredged sand management practices, and identify and assess realistic reuse options to ensure that an optimal approach to beneficial reuse is adopted.

This assessment included:

- A summary of relevant findings from the bathymetric analysis assessment (Section 5.2)
- An analysis of historical shoreline movement
- An assessment of existing and potential alternative beneficial reuse approaches

5.3.1 Recent historical beneficial reuse

Gippsland Ports is proud of its history and capacity to support, and collaborate, with local agencies in providing beneficial sand nourishment services. Since 2008, Gippsland Ports' CSD *Kalimna* has been utilised for beneficial placement of sand both at Lakes Entrance and at other locations within the Port of Gippsland Lakes (refer Figure 40). These locations include:

- Lakes Entrance beaches east and west of the entrance through nearshore ocean outfalls (ongoing)
- Rigby Island – north side (14,000 m^3, 2009)
- Rigby Island – south-east corner for bird habitat purposes (20,000 m^3, 2013)
- Loch Sport – beach nourishment from Seagull Drive boat ramp dredging (33,000 m^3, 2013)
- Boole Poole – erosion protection for Parks Victoria heritage crane site and behind western training wall (3,000 m^3, 2014)
- Crescent Island – sand nourishment for migratory and shore-bird habitat improvement (60,000 m^3, 2015) including nearby placement of sand at Albifrons, Barton and Waddy islands. (Winner of 2018 Victorian Coastal Awards for Biodiversity Conservation).
- Pelican (Baxter) Island – sand nourishment for bird habitat improvement (27,000 m^3, 2016)
- Loch Sport – beach nourishment from marina and approach dredging (42,000 m^3, 2019)

5.3.2 Shoreline analysis

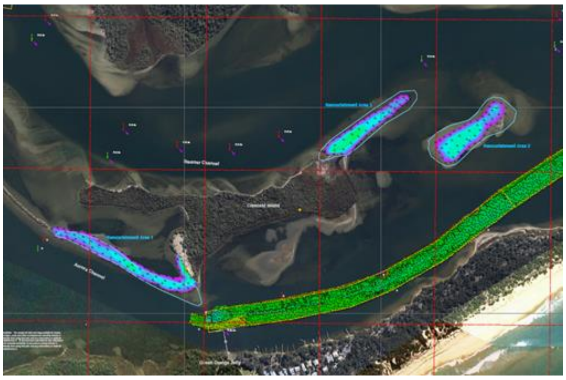
Analysis of historic shoreline positions (through aerial and satellite imagery) has shown that the sediment placed at the nearshore sites (outfalls) is the most successful approach in providing beach nourishment to the local beaches at Lakes Entrance. Further, the western nearshore (outfall) placement appears to be more successful than the eastern one, most likely due to the net westerly longshore transport resulting in the sediment placed at the western site feeding all the beach to the west, while the eastern site only feeds a small section which seems to be more sensitive to the breakwater and so natural variations in shoreline location will exceed variations due to nourishment. The shoreline analysis has also shown that the placement of dredged sediment at the offshore Dredged Material Grounds (DMGs) can result in an increase in volume at the adjacent area of the shoreline.

35 **aerial images** of the Lakes Entrance shoreline from 2007 to 2020 were analysed. The results, which are illustrated in Figure 41, indicated that:

- during periods with no placement at the STS outfall sites, the trend was typically shoreline erosion.
- the main exception was directly onshore of West DMG where there was a trend of accretion throughout, indicating offshore placement at West DMG was nourishing adjacent beach.
- during nearshore placement at the western STS outfall site there was a trend for net accretion along the beach to the west of the Entrance Channel, both to the west and east of the STS outfall.
- during periods of nearshore placement at the eastern STS outfall there was a trend for net accretion along the beach to the east of the Entrance Channel, but only to the east of the STS outfall.

Analysis of **satellite imagery** between 2000 and 2020 also found:

- analysis results were consistent with results from aerial imagery.
- show seasonal variations, with summer shoreline position seaward of winter shoreline position.
- shoreline position to the east of Entrance Channel undergoes greater seasonal variations than the shoreline to the west of the Entrance Channel.
- shoreline position also shows some correlation with wave energy, position further landward during years with more energetic wave conditions.



a) Crescent and Albifrons Island nourishment areas (blue)

b) CSD Kalimna sand nourishment and bird habitat improvement work near Crescent Island

c) Aerial image of Crescent Island sand nourishment locations (2015)

d) Crescent Island providing habitat for Fairy and Little Terns, as well as one of Victoria's largest, active Pelican rookeries.

e) Heritage 'Jib' Crane restored by Parks Victoria with assistance from Gippsland Ports including sand nourishment of site for erosion protection.

f) Boole Poole (west of entrance channel) was later renourished with sand to protect heritage artefacts, vegetation loss and erosion protection.

g) CSD Kalimna dredging Seagull Drive boat ramp access at Loch Sport for DEECA.

h) Beach nourishment with sand from Seagull Drive boat ramp dredging.

Figure 40: Beneficial sand nourishment and bird habitat improvement locations

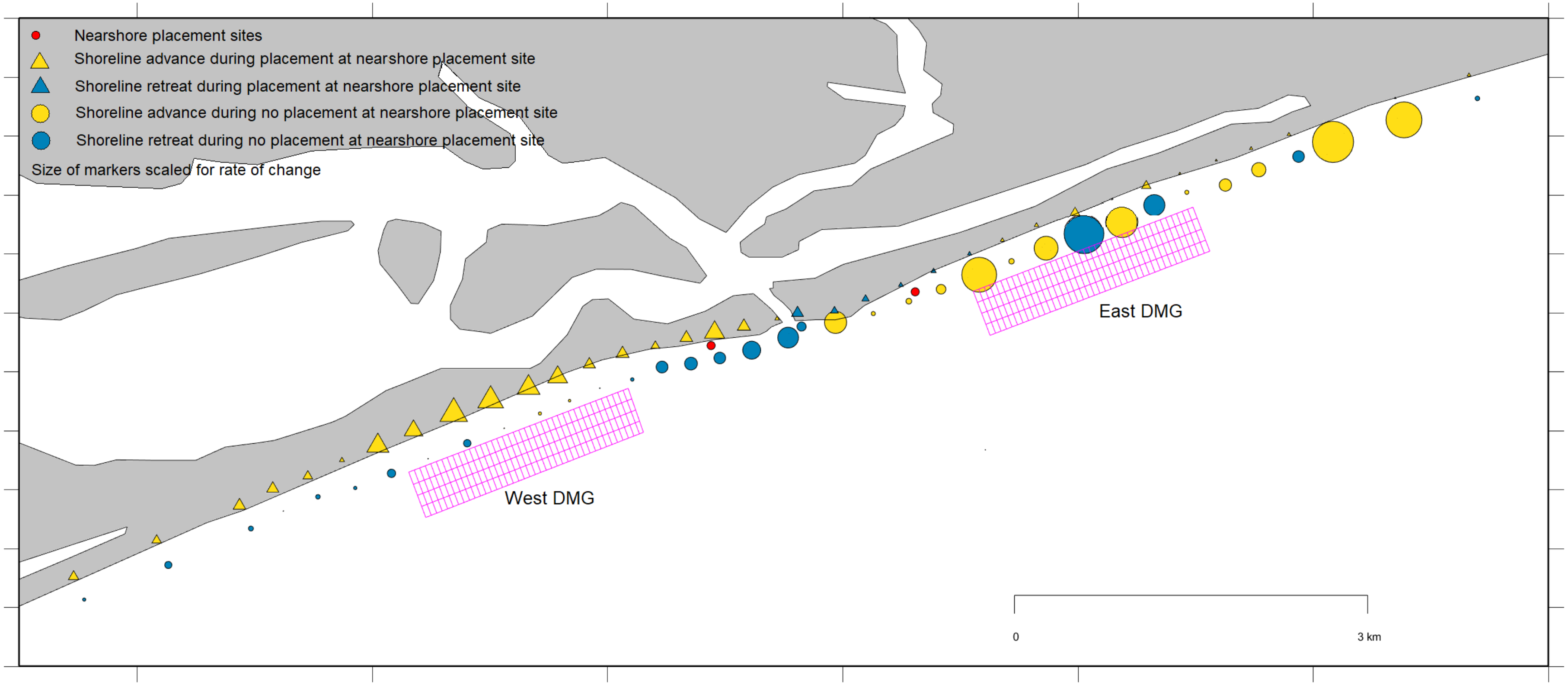


Figure 41: Rates of shoreline change from aerial imagery (2007 to 2020) (PCS, 2021)

5.3.3 Existing and alternative beneficial reuse options

Existing sand placement options consist of:

- Offshore-nearshore placement at DMGs (water depths 5 – 14 metres)
- Nearshore placement at ocean outfalls
- Within the port, such as Rigby Island (bird habitat) and Boole Poole
- Other (e.g., the CSD *Kalimna* completes other sand and sediment management works within the Gippsland Lakes).

As part of Gippsland Ports' commitment to continuous improvement, an assessment of alternative beneficial reuse options was undertaken (PCS, 2021) as summarised in Table 10 and Figure 42.

Table 10: GLOA alternative beneficial reuse options

Alternative placement option	Beneficial reuse	Comments
Surfing amenity	Recreation, Shoreline protection Ongoing nearshore beach nourishment	Initial sand placement of 40,000 m^3, with ongoing annual placement of 10,000 - 15,000 m^3. Locate near beach access (main or eastern beach). Additional dredging / rainbowing discharge time. Risk of surf bank being completely removed during a very large wave event
Rigby Island	Stabilise shoreline Maintain bird habitat	20,000 m^3 every five (5) years As directed by Parks Victoria and DEECA Reduced energy consumption relative to STS
Boole Poole	Shoreline protection Protection of heritage artifacts	5,000 m^3 every 10 years Reduced energy consumption relative to STS
The Barrier (lake-side)	Shoreline protection Asset protection	Reduction of sand fronting properties and assets Distance too great to utilise sand from GLOA footprint CSD *Kalimna* would be suitable for relocating sand from Hopetoun Channel (outside of GLOA approvals)
Lakes Entrance golf course	Shoreline protection Nearshore beach nourishment	Initial sand placement of 25,000 - 30,000 m^3, with potential ongoing annual placement of 15,000 m^3. Naturally low-lying area which can be breached by large waves. Additional dredging / rainbowing discharge time.
Commercial use	Sale of sand for commercial use	Assume limited to around 25,000 m^3 / year Require sand bunding and stockpiling on north side of Bullock Island. Removes sand from coastal system

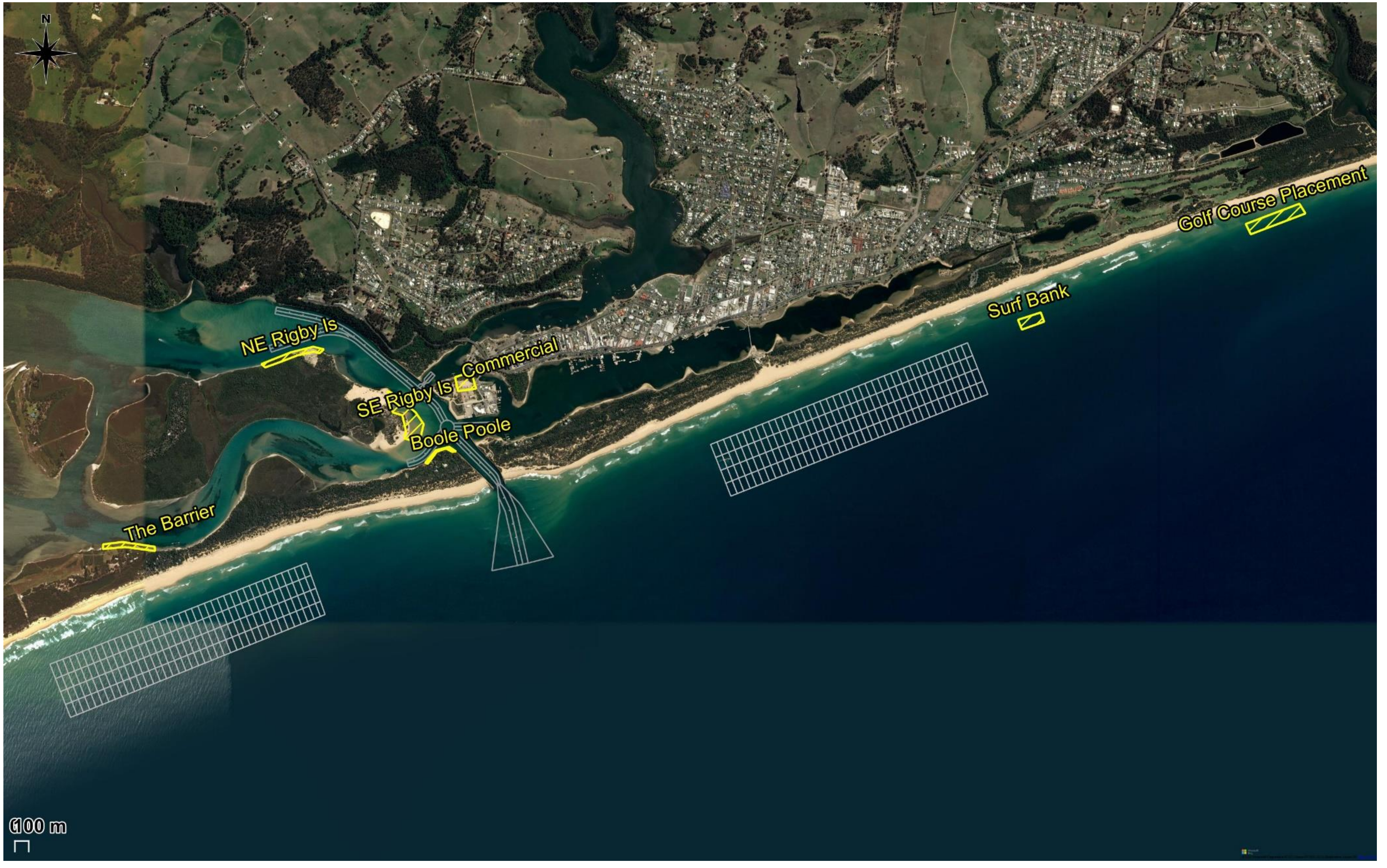


Figure 42: GLOA alternative beneficial reuse options

5.3.4 Preferred options

The future preferred beneficial reuse options for sand relocated by both the TSHD *Tommy Norton* and CSD *Kalimna* are summarised in Table 11 and Table 12 respectively.

Table 11: Prioritised GLOA beneficial reuse options (TSHD Tommy Norton)

Option	Approximate Sediment requirement	Resource requirement (relative to existing)
Sand dredged from Bar and Entrance Channel (estimated annual dredge requirement = 200,000 m^3)		
1) Surf amenity and beach nourishment	40,000 m^3 initially, then 10,000 to 15,000 m^3/yr	50 hours additional dredging time (relative to same volume placed at DMG) initially and then 22 hours additional dredging time annually.
1) Placement at the East/West DMG	80,000 m^3/yr to West DMG >100,000 m^3/yr to East DMG	-
3) Shoreline protection at Lakes Entrance Golf Course	30,000 m^3 initially, then 15,000 m^3/yr	75 hours additional dredging time (relative to same volume placed at DMG) initially and then 37.5 hours additional dredging time annually.

Table 12: Prioritised GLOA beneficial reuse options (CSD Kalimna)

Option	Approximate Sediment requirement	Resource requirement (relative to existing)
Sand dredged from Inner Channels (estimated annual dredge requirement = 140,000 to 170,000 m^3)		
1) Placement at west and east nearshore placement sites	90,000 m^3/yr to West nearshore outfall 80,000 m^3/yr to East nearshore outfall	-
2) Beach nourishment at Rigby Island using sand dredged from Inner Channels	20,000 m^3 every five years	Pipeline to pump sand to site. 14 hours of land based plant operation. No increase to dredge time. Reduced energy requirement for pumping due reduced distance.
2) Shoreline protection at Boole Poole using sand dredged from Inner Channels	5,000 m^3 every ten years	Pipeline to pump sand to site. Four hours of land based plant operation. No increase to dredge time.
4) Commercial use	25,000 m^3/yr	Pipeline extension to pump sand to site. Development of rehandling facility. No increase to dredge time. Reduced energy requirement for pumping due reduced distance.

5.3.5 Beneficial reuse recommendations

Beach nourishment, where sand is returned to the active sediment system where it remains mobile and has the potential to be transported onshore, was the **equally preferred option for beneficial reuse** of sand from both the inner channels and the bar.

Beach nourishment provides a broad number of benefits including:

- a nature-based management alternative for conserving beach environments and protecting shoreline development from the impacts of coastal erosion and sea level rise, minimising the need for more costly and potentially unsightly hard engineering options;
- maintaining (or increasing) beach width to maintain or provide additional resilience during seasonal cycles and erosion events, benefiting recreational and cultural activities;
- a healthy beach which attracts visitors providing a boost to the local economy;
- reduced threat of backshore erosion reducing risk of coastal flooding, protecting coastal infrastructure and maintaining public safety; and
- beach restoration protects habitat on and behind the beach.

It is recommended (PCS, 2021) that Gippsland Ports continue to place sediment both sides of the Entrance Channel to try and ensure an ongoing supply of sand to the beaches on both sides. The west nearshore outfall was found to be the most effective placement approach to maintain a stable shoreline and so it is recommended that at least 90,000 m^3/year should be aimed to be pumped here. To help optimise placement to the eastern nearshore outfall site, and retain as much sediment as possible along the adjacent beach, it is recommended that sediment should be pumped to this site when easterly longshore transport occurs (approximately 30% of the time). As a lower volume of sediment is proposed to be pumped to the east nearshore outfall compared to the west one, a larger volume of sediment should be placed by the TSHD *Tommy Norton* either in the East DMG (at least 100,000 m^3/year) and/or used to create a surf bank (within or) to the east of the East DMG (40,000 m^3) to help maintain the stability of the shoreline to the east of the Entrance Channel.

5.4 Maintenance dredging and deposition requirements

5.4.1 Historical

Since the permanent artificial entrance (the Entrance) to the Gippsland Lakes was completed at Lakes Entrance in 1889, regular maintenance dredging has been required to ensure navigable access to and from the ocean to the Gippsland Lakes. A summary of dredges used at Lakes Entrance is included in Table 13 below.

For over thirty years up to 2008, Gippsland Ports, and its predecessors, used the side-casting dredge *April Hamer* on an almost-daily basis to maintain a channel through the Bar. Over the years the Bar continued to grow and eventually comprised a shallow area (cut by a dredged navigation channel) containing several million cubic metres of sand.

Table 13: Summary of dredges used at Lakes Entrance

Dredge name	Period of use	Type of dredge
Wombat	1879 to 1928	Bucket Dredge
Pioneer	1906 to unknown	Suction Dredge
Priestman	Pre 1908 to 1963	Grab Dredge
W.H. Edgar	1922 to 1936	Side Suction Dredge
Paynesville	1936 to 1963	Suction Dredge
Sandpiper	1963 to 2005	Cutter Suction Dredge
Mathew Flinders	Circa 1970	Trailing Suction Hopper Dredge
April Hamer	1979 to 2011	Side-casting Dredge
Melbourne	2006 to 2007	Cutter Suction Dredge
Kalimna	**2007 to present**	**Cutter Suction Dredge**
Pelican	2008 to 2016	Trailing Suction Hopper Dredge
Tommy Norton	**2017 to present**	**Trailing Suction Hopper Dredge**

5.4.2 Present

From 2008 to 2016, Gippsland Ports used a trailing suction hopper dredge (TSHD) *Pelican* contracted from Van Oord Australia on nine occasions for the maintenance of the channel through the Bar and also, to a minor extent, for clearing some sand from the Inner Channels. Each TSHD program from 2008 – 2016 was a concentrated 24/7 program completed over a period of weeks.

From 2017 Gippsland Ports has used a new build TSHD *Tommy Norton* (Figure 48) to conduct ongoing, year-round maintenance dredging of the Bar and Inner Channels. The *Tommy Norton* is owned by the state of Victoria, managed by Gippsland Ports and permanently located at Lakes Entrance. The *Tommy Norton* works as required, year-round, weather and sea conditions permitting, daylight hours only and 9 days per fortnight.

All TSHD programs have placed dredged material at offshore Dredged Material Grounds (DMGs) east and west of the Entrance (Figure 45).

To maintain the navigability of the inner channels, Gippsland Ports also uses a Cutter Suction Dredge (CSD *Kalimna*). Initially dredged sand slurry from the CSD was pumped onto adjacent land, but since 2001 the CSD has connected to the Sand Transfer System and the material has been pumped from the Sand Transfer Station to nearshore beach outfalls east and west of the Entrance (refer to Figure 51, Figure 52 and Figure 53). The CSD *Kalimna* has been performing this work since 2007 (Figure 48).

Table 14: Maintenance dredge volumes and DMG placement volumes at the Port of Gippsland Lakes.

Year	Volume (m^3)[1]			DMG Placement	
	Bar	Entrance[2]	Inner Channels	West	East
2008	Unknown	Unknown	Unknown	215,280[3]	143,520[3]
2009	Unknown	Unknown	Unknown	150,268	90,273
2010	Unknown	Unknown	Unknown	97,593	67,146
2011	355,579	23,179	Unknown	379,175	0
2012	228,910	1,356	132,194	214,251	30,315
2013	162,539	10,141	135,182	173,892	0
2014	160,786	16,269	118,562	179,774	1,158
2015	149,735	4,063	158,824	96,330	60,459
2016	198,435	2,333	176,330	198,911	1,857
2017	43,585	2,013	165,233	0	45,598
2018	132,966	45,668	135,585	0	184,401
2019	108,909	49,551	102,432	0	172,271
2020	152,600	34,667	132,962	0	210,787
Total	1,694,044	189,240	1,257,304[4]	1,705,474	1,007,785

[1] the volume shown represents the volume reported by the dredge vessel as the transported volumes. Based on previous comparison by GPs it was estimated that the in-hopper volume for the TSHD is approximately 16% more than the in-situ volume due to bulking and sand infill into the dredged areas prior to post dredge survey.
[2] this includes the Entrance Channel and the Swing Basin.
[3] the exact breakdown of the placement between the east and west DMGs in 2008 is unknown but has been estimated based on the relative increase at volume following the placement at the two sites.
[4] the majority of the sediment dredged from the Inner Channels region was pumped to the nearshore beach discharge points using the STS.

5.4.3 Future

The GLOA Bathymetric Analysis (PCS, 2021) analysed 6-years (2014 – 2020) of monthly Bar and Inner channel surveys. The results of this bathymetric analysis were used to provide predictions of the sedimentation likely to require future maintenance dredging (Table 15 and Table 16).

In 2021, the TSHD Tommy Norton removed 313,000 m^3 from the Bar and Inner channels. This occurred over 148 operating days (due to weather) from 225 available dredging days.

Gippsland Ports estimated 10-year TSHD maintenance dredging volume is 10 times an annual average volume of 400,000 m^3 plus a 1,000,000 m^3 contingency (associated with extreme weather events, such as La Nina, and increased shoaling events on the Bar) totalling **5,000,000 m^3 over a 10-year period (2023 – 2033).** This is 33% less than annual volumes in previous sea dumping permits.

Table 15: Annual GLOA predicted sedimentation rates

Dredge area	Minimum sedimentation rate (m^3/year)	Maximum sedimentation (m^3/year)	2021 Dredge volumes
Bar	90,000	240,000	157,022
Entrance Channel	3,000	7,000	3,240
Swing Basin	20,000	30,000	28,965
Inner channels	140,000	170,000	123,729 (TSHD) 29,860 (CSD)
Total	**253,000**	**447,000**	**342,816**

Note: Kalimna CSD typically annual dredge volumes around 100,000 – 120,000 m^3.

Table 16: Annual GLOA predicted maintenance dredging requirements

Dredge	Minimum average dredging requirement (m^3/year)	Maximum average dredging requirement (m^3/year)
CSD *Kalimna* (via Sand Transfer Station and nearshore ocean outfalls)	90,000	140,000
TSHD *Tommy Norton* (via East and West DMGs)	160,000	400,000
TSHD contingency volume		100,000

5.4.3.1 Capital dredging

Gippsland Ports propose minor modifications and extensions to existing GLOA navigational channels to ensure reliable access for recreational and commercial vessels is maintained.

North Arm extensions to maintain reliable access to both North Arm and to fuel jetty on north side of Bullock Island for recreational vessel users.

Hopetoun channel extension to allow dredging of sand shoal that is currently restricting vessel movements.

Swing basin and Cunninghame arm modifications to facilitate safer operation of TSHD *Tommy Norton*, and its crew, during dredging and for access to berths at both Bullock Island wharf (south side) and Gippsland Ports depot (east side of Bullock Island)

Existing GLOA channel depths and widths are to be maintained.

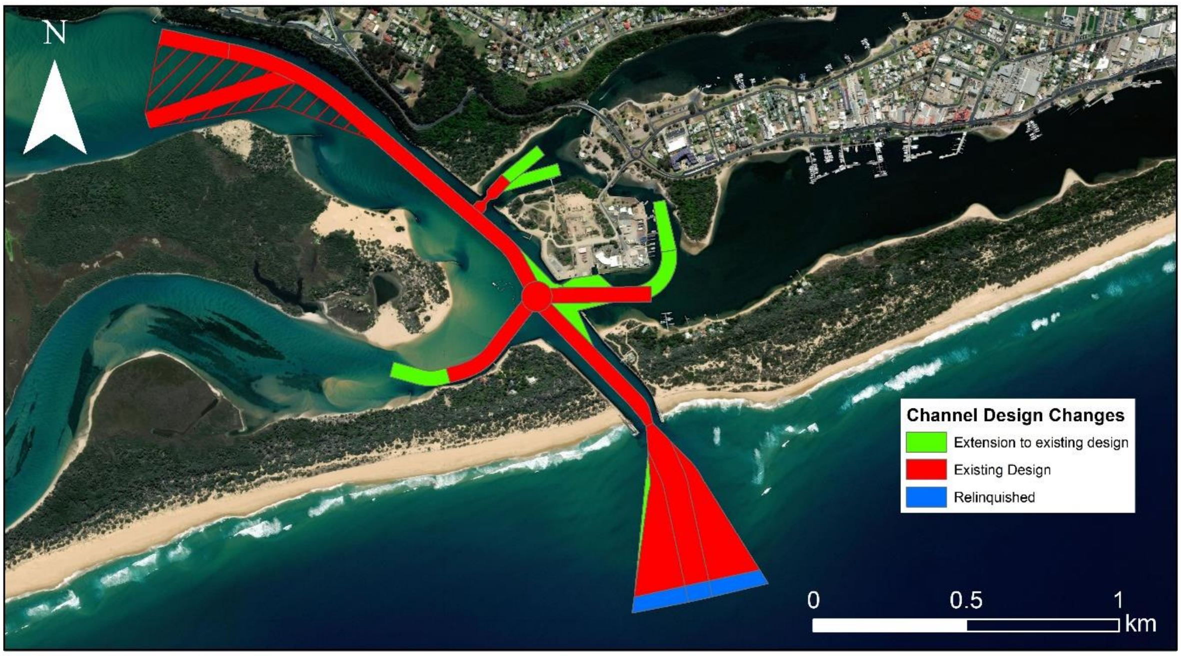


Figure 43: GLOA proposed navigational channel design modifications (2022)

Figure 44: Bullock Island east (Cunninghame Arm) where TSHD Tommy Norton requires safe and reliable access to berthing at Gippsland Ports depot.

5.4.4 Dredge Material Grounds

The coordinates (Table 17) and locations (Figure 45) of the Eastern and Western DMGs are provided below. The dispersive nature and bathymetric analysis (section 5.2.3) of DMGs confirms there remains sufficient capacity for sand placement over the next 10-years.

The seabed at both DMGs is characterised by a flat sandy bottom with 100mm high sand ripples; comprising of predominantly coarse sand and no sign of marine growth (Water Technology, 2022). Refer Figure 46).

AME (2012, 2007) stated "*The coastal study areas outside the entrance have no aspects that would qualify them as of regional, state or national significance. The communities and habitats were generally represented over larger areas with no ecological or environmental features apparent to indicate any increased importance to the study area (DMGs) over other areas of coast in the Lakes Entrance region*".

Table 17: Coordinates of GLOA Dredge Material Grounds (DMGs)

Corner	Western DMG		Eastern DMG	
	Longitude	Latitude	Longitude	Latitude
North-west	147°56.17616 E	37°54.12' S	147°59.43972' E	37°53.26315' S
South-west	147°56.2776' E	37°54.3274' S	147°59.53999' E	37°53.46463' S
South-east	147°57.44375' E	37°53.72533' S	148°00.70888' E	37°52.86686' S
North-east	147°57.53540' E	37°53.92621' S	148°00.80920' E	37°53.06770' S

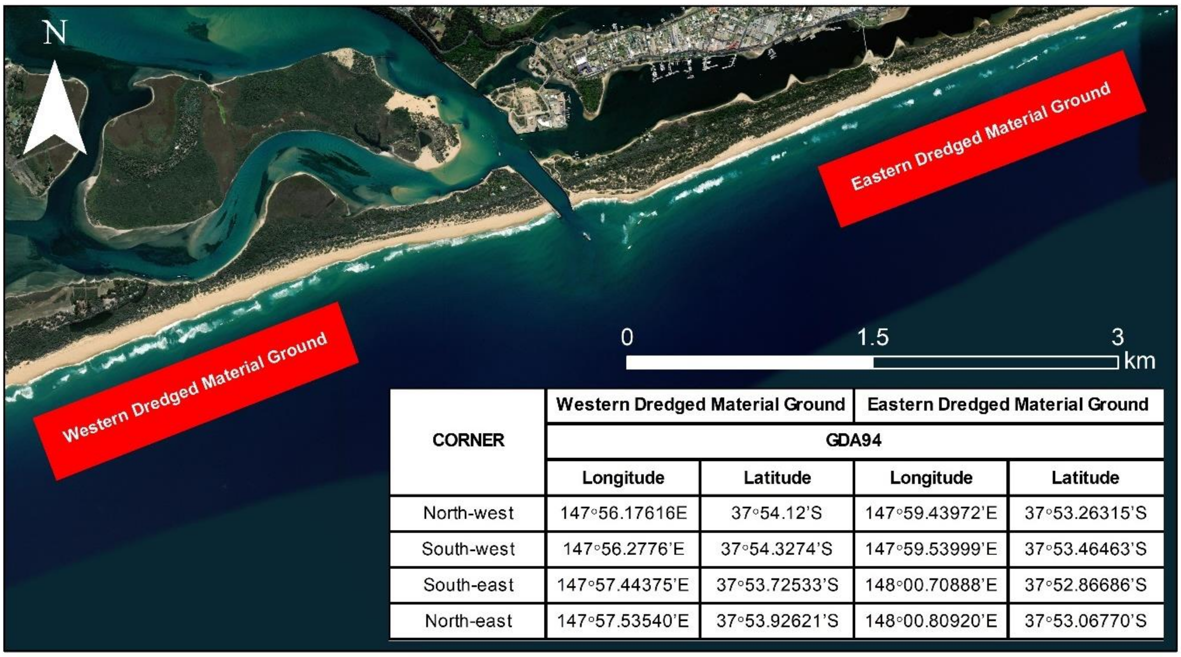
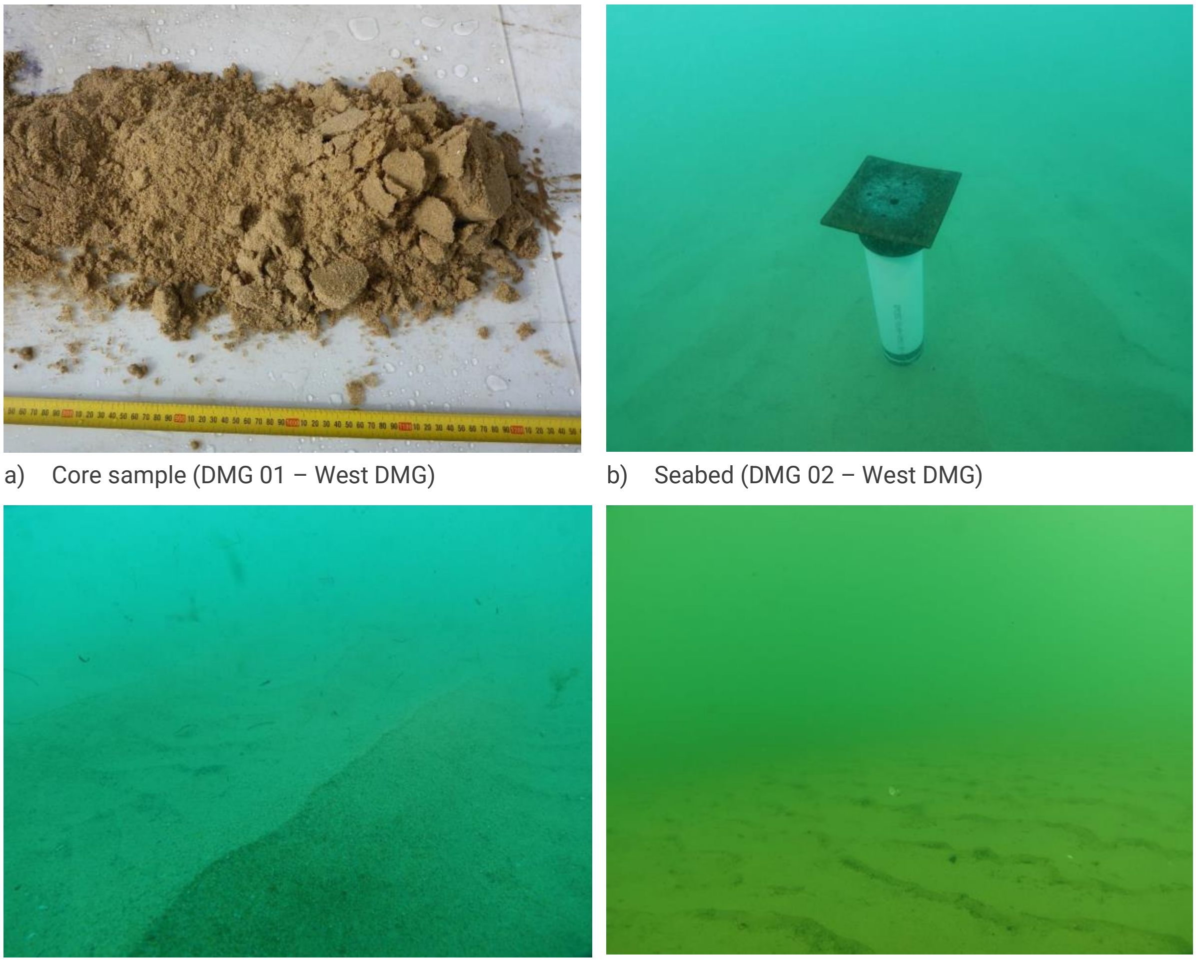


Figure 45: GLOA Dredge Material Grounds



a) Core sample (DMG 01 – West DMG)

b) Seabed (DMG 02 – West DMG)

c) Seabed (DMG 04 – East DMG)

d) Seabed (DMG 04 – East DMG)

Figure 46: Photos of East and West DMG seabed during sediment sampling 9-11th November 2021 (Water Technology 2022)

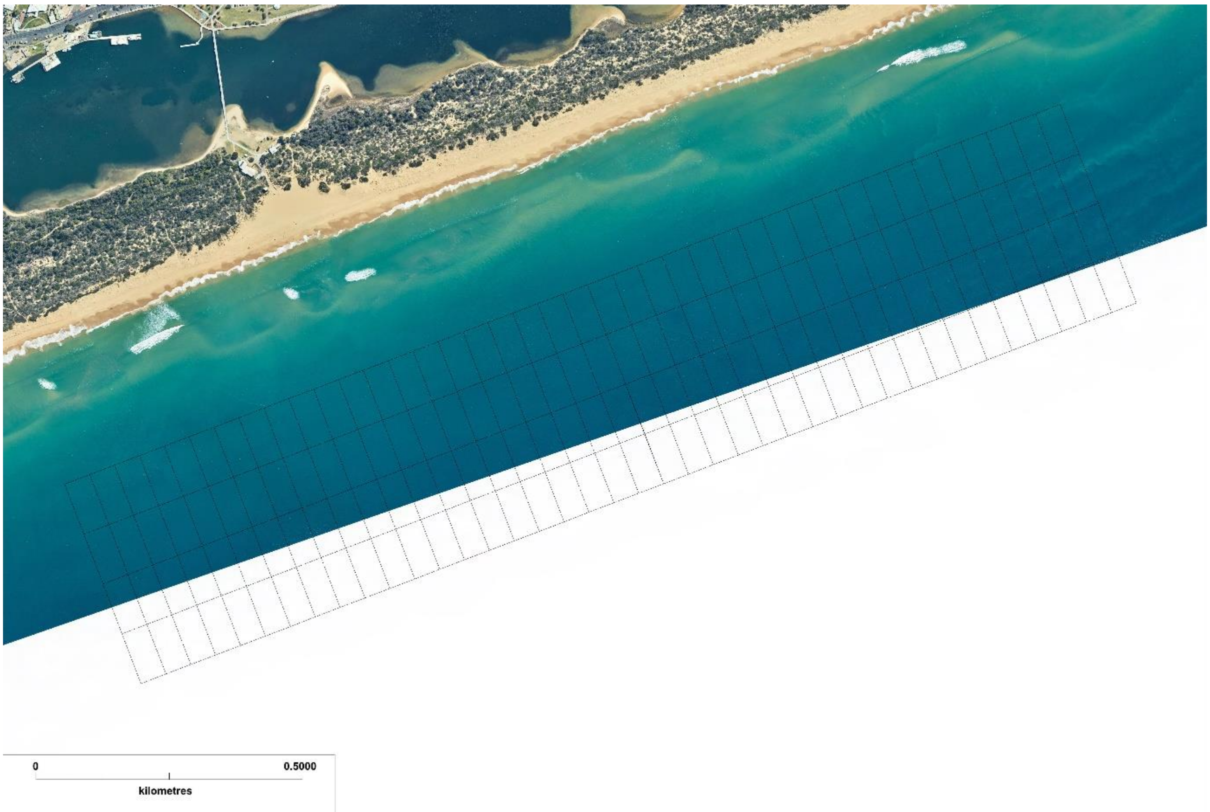


Figure 47: Aerial images of the West (top) and East DMGs (bottom) from October 2019.

5.5 Dredging and Sand management plant and equipment

Gippsland Ports owns and operates two dredges – the cutter suction dredge (CSD) *Kalimna* and the trailing suction hopper dredge (TSHD) *Tommy Norton* which were procured in 2007 and 2017 respectively.

Figure 48: The CSD 'Kalimna' (left) and TSHD 'Tommy Norton' right at Lakes Entrance

5.5.1 TSHD *Tommy Norton*

The TSHD *Tommy Norton* was built by Damen Gorinchem and delivered to Gippsland Ports at Lakes Entrance, Victoria on 1 September 2017. It is a 60.4-metre-long vessel with a hopper volume of 650 m^3. Dredged sand can be loaded into the hopper, relocated and placed offshore or onshore via single-sided bottom opening doors, pump ashore (up to 850m via pipeline) or 'rainbowing' capability (<41m)

It is purpose-built for the conditions at Lakes Entrance, with the world's leading design, technology and personnel for Gippsland Ports' dredging requirements.

5.5.1.1 Environment

- Double walled fuel tanks – reduced risk of spill.
- Capacity to lighten itself and reduce draft in case of shallow water.
- 'Green' overflow valve to reduce turbidity

5.5.1.2 Navigation

- Fully electronic chart system, monitoring wind, sea state, current and other conditions.
- Twin azimuth propulsion units and bow thruster for manoeuvrability.
- Echo sounders located fore and aft to provide accurate depth data.

5.5.1.3 Dredging

- Extended dredge automation and tracking system.
- Automatically records time, location and quantity of dredging.

5.5.1.4 Operation

- Smartships' full mission simulator – used for training crews and reviewing operation.
- Enhanced bridge design – improved space, layout, visibility and working conditions.
- Full bridge controls for all engine and dredging functions

5.5.2 CSD *Kalimna*

The CSD *Kalimna* is a 29-metre non-self-propelled cutter suction dredge, built by Port Macquarie-based ship building firm Birdon Group in 2007. The CSD *Kalimna* uses a rotating cutter head on the sea floor, and onboard pumps transfer the sand slurry to ocean outfalls via additional pumps at the Sand Transfer Station. The *Kalimna* is named after the area at the top of the hill in Lakes Entrance. Kalimna is the Gunai-Kurnai word for “beautiful” or “view of the water”.

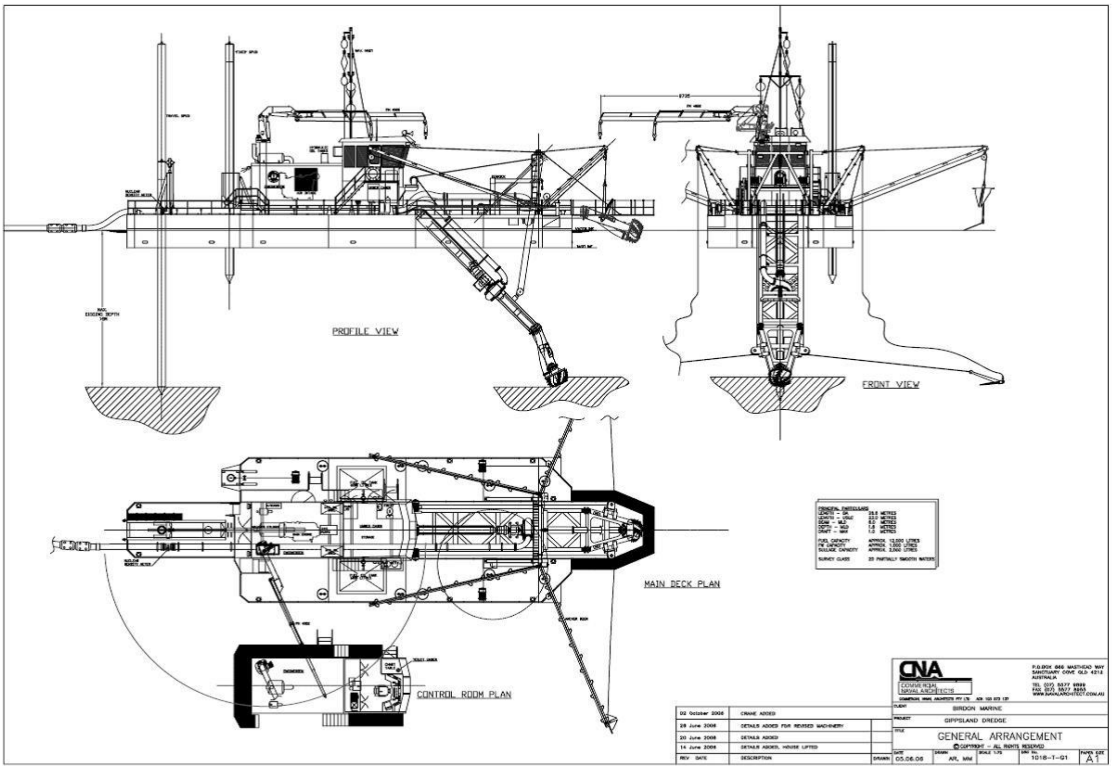


Figure 49: General layout of Cutter Suction Dredger Kalimna

Figure 50: Cutter suction head on Dredger Kalimna

5.5.3 Sand Transfer System

The Sand Transfer System (STS) (Figure 51) was constructed in 2001 and upgraded during the Lakes Entrance Sand Management Program between 2006 – 2013. The STS consists of the following elements:

- a pump house called the Sand Transfer Station (Figure 52)
- transfer pipelines and risers to bring dredge sand slurry from the Cutter Suction Dredge to the STS building
- two discharge pipelines to deliver pumped material to Ninety Mile Beach about one kilometre east and west of the Entrance

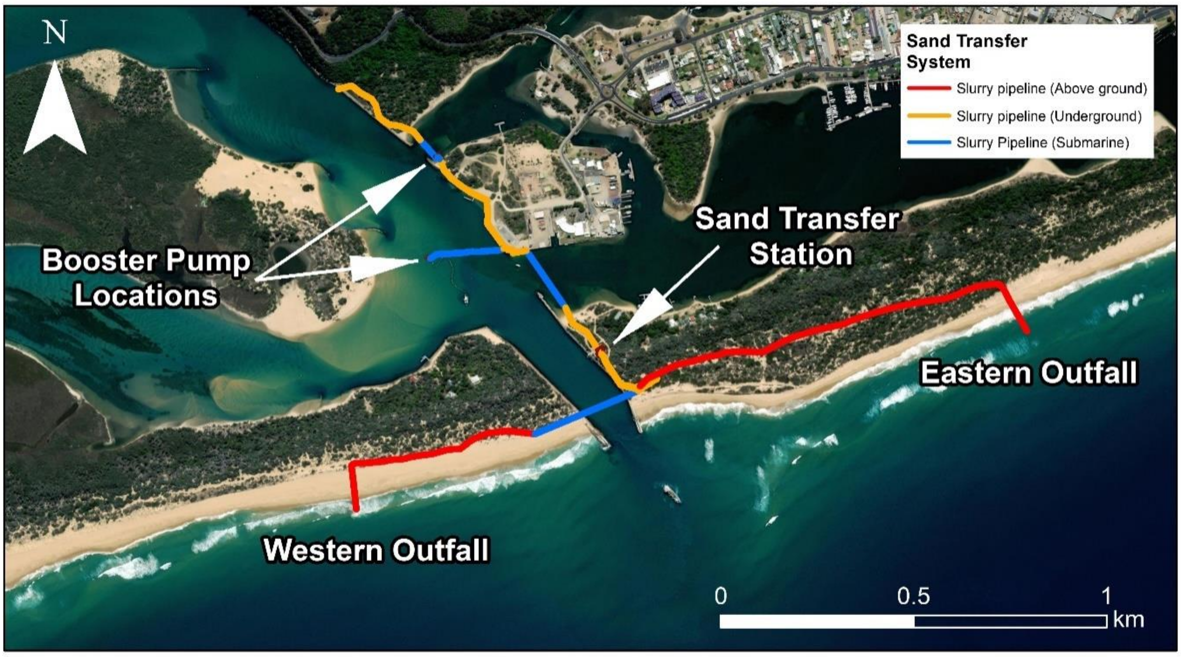


Figure 51: Sand Transfer System infrastructure locations

Figure 52: Sand Transfer Station pump building

Figure 53: Eastern outfall (discharge location)

5.5.4 Other sand management operations

Gippsland Ports may utilise other dredging or sand management methodologies, if current resources (TSHD *Tommy Norton*, CSD *Kalimna* and STS) are unavailable or if an emergency shoaling event occurs.

Alternative plant, equipment or methodologies may include:

- Comparable CSD or TSHDs (DCCEEW and DEECA would be notified if this was required)
- Bed-levelling vessels to remove high spots and smooth out channel sea floor.
- Propellor wash to remove isolated high spots
- Smaller suction dredges (not likely required for GLOA but elsewhere in Gippsland Lakes)
- Barge or onshore based excavators (not likely required for GLOA but elsewhere in Gippsland Lakes).

6 Risk Assessment Framework

Prior to the commencement of the Gippsland Lakes Ocean Access (GLOA) program, an **Environmental Risk Assessment** workshop was undertaken in January 2011. Key stakeholder representatives and specialists, with a history of working in the Gippsland Lakes system, advised on selection of impact pathways and analysis of risks.

This resulted in the establishment of the **GLOA Environmental Risk Register**, which is a live document and has been periodically reviewed and updated as required between 2011 and 2022.

6.1 Aims

The initial, and ongoing, aims of the environmental risk assessment are to:

- Evaluate and communicate the impacts and risk posed by the proposed action (i.e. residual risk after risk treatment measures);
- Identify measures to minimise the risk of environmental harm; and
- Link the risk assessment outputs to on-going risk management via the **Environmental Management Plan (EMP).**

6.2 Method

The risk assessment method is consistent with the Australian/New Zealand Standard: Risk Management (AS/NZS 4360:2004; Standards Australia and Standards New Zealand 2004) and the Standards Australia Handbook: Environmental risk management - principles and process (HB 203-2000; Standards Australia and Standards New Zealand 2006). The risk assessment approach (Figure 54) follows a structured and iterative process, with the following steps:

1. Establish the context – project description and existing environmental conditions;
2. Identify risks – activities and associated potential impacts;
3. Analyse risks – assign likelihoods and consequences to determine level of risk;
4. Evaluate risks – compare risks with benefits;
5. Treat risks – identify mitigation for moderate to high risks

Integral to the risk assessment process is communication and consultation with stakeholders and development and implementation of monitoring programs to inform on and manage identified risks.

The likelihood and consequence descriptions and the risk categories used in this risk assessment are provided in Table 18 and Table 19; and the risk assessment matrix is provided Table 20.

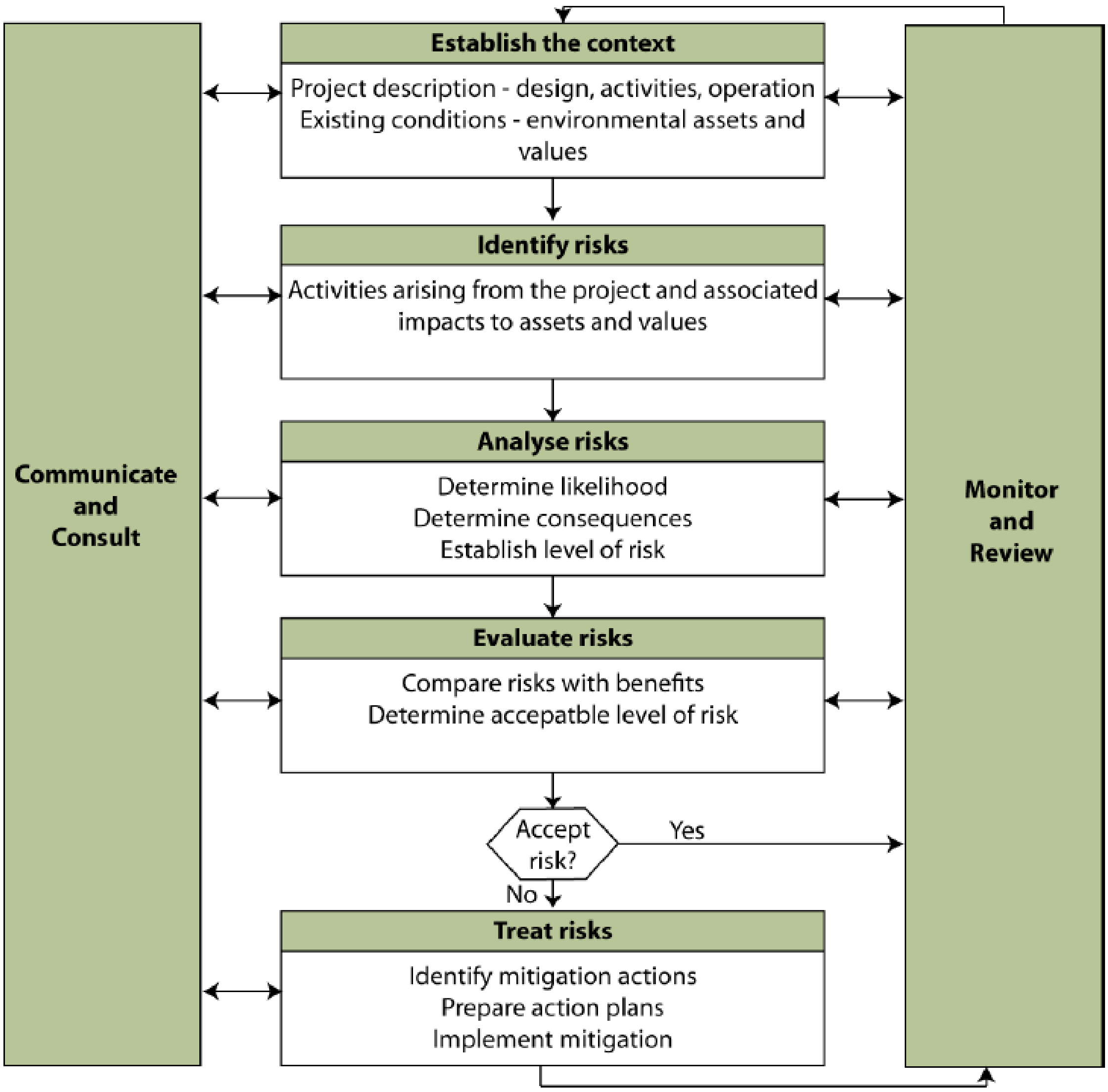


Figure 54: Risk assessment method (adapted from AS/NZS 2004)

Table 18: Likelihood table (AS/NZS 2006)

Almost certain	Likely	Possible	Unlikely	Rare
75-100%	50-75%	25-50%	5-25%	0-5%
Expected to occur in almost all similar projects	Will probably occur in most similar projects	Could occur in about half of similar projects	Could occur in some similar projects but not expected	Expected to occur in almost no similar projects and only in exceptional circumstances

Table 19: Consequence table (adapted from Port of Melbourne Corporation 2007)

	Negligible	Minor	Moderate	Major	Catastrophic
	Minimal, if any impact for some communities. Potentially some impact for a small number (<10) of individuals.	Low level impact for some communities, or high impact for a small number (<10) of individuals.	High level of impact for some communities, or moderate impact for communities across the Gippsland Lakes.	High level of impact for communities across the Gippsland Lakes.	High level of impact State-wide.
Ecosystem Function (need to consider resilience and resistance)	Alteration or disturbance to ecosystem within natural variability. Ecosystem interactions may have changed but it is unlikely that there would be any detectable change outside natural variation / occurrence.	Measurable changes to the ecosystem components without a major change in function (no loss of components or introduction of new species that affects ecosystem function).	Measurable changes to the ecosystem components without a major change in function (no loss of components or introduction of new species that affects ecosystem function).	Measurable changes to the ecosystem components with a major change in function.	Long term and possibly irreversible damage to one or more ecosystem function.
Habitat, communities and / or assemblages	Alteration or disturbance to habitat within natural variability. Less than 1% of the area of habitat affected or removed.	1 to 5% of the area of habitat affected in a major way or removed.	5 to 30% of the area of habitat affected in a major way or removed.	30 to 90% of the area of habitat affected in a major way or removed.	Greater than 90% of the area of habitat affected in a major way or removed.
Species and / or groups of species (including protected species)	Population size or behaviour may have changed but it is unlikely that there would be any detectable change outside natural variation / occurrence.	Detectable change to population size and / or behaviour, with no impact on population viability (recruitment, breeding) or dynamics.	Detectable change to population size and / or behaviour, with minimal impact on population viability (recruitment, breeding) or dynamics.	Detectable change to population size and / or behaviour, with an impact on population viability and or dynamics.	Local extinctions are imminent / immediate or population no longer viable.

Table 20: Risk matrix (AS/NZS 2006)

		Consequence				
		Insignificant	Minor	Moderate	Major	Catastrophic
Likelihood	Almost certain	High	High	Extreme	Extreme	Extreme
	Likely	Medium	High	High	Extreme	Extreme
	Possible	Low	Medium	High	Extreme	Extreme
	Unlikely	Low	Low	Medium	High	Extreme
	Rare	Low	Low	Medium	High	High

7 Identification and Treatment of Key Risks

7.1 Risk identification

In assessing risks arising from dredging and at-sea placement activities, an impact pathways approach has been adopted. This uses a hierarchical process to identify potential risks as follows:

- Activities – the events that are undertaken as part of the GLOA program;
- Stressors – the physical or chemical changes that could potentially arise as a result of an activity;
- Potential effects – the potential responses caused by the stressors.

Taken together these three elements form the impact pathway as illustrated in this example:

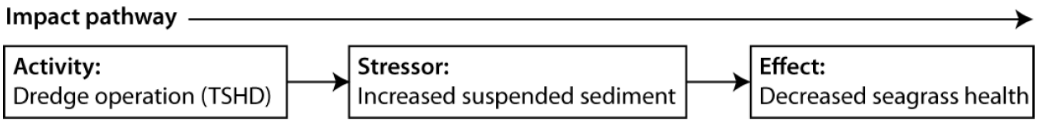


Table 21 summarises the list of identified activities and stressors.

7.2 Risk analysis and evaluation

The likelihood, consequence and risk level of each of the identified impact pathways are analysed and presented in the **GLOA environmental risk register**, together with a description of the supporting evidence that contributed to the assignment of risk levels to each pathway. Mitigation measures are documented and residual risk calculated.

The AS/NZS (2006) states that:

> *"The risk evaluation step compares risks against risk evaluation criteria or tolerability, and considers the costs and benefits. Before this step can proceed, the criteria against which risks will be judged, the principles and policy that will be followed, and the way in which costs and benefits will be compared, must be defined."*

Impact pathways that were assigned a risk rating of "low" or for which the consequence was assessed as "insignificant" are considered to meet the evaluation criteria of minimal impact. This was the case for the overwhelming majority of impact pathways assessed.

Inherent risks that are identified as "medium" or "high" are noted below and will be controlled through monitoring and management actions as detailed in the EMP, leading to a lower residual risk rating.

- loss, or disturbance, of shorebird nesting habitat (medium);
- translocation of marine pests (high);
- disturbs heritage site "The Shark" (medium);
- increased suspended / settled sediments affecting fish migration through the channel (high);
- airborne noise affects nesting birds and migratory shorebirds (medium);
- placement of dredge material at DMGs smothering benthic organisms (medium);
- placement of dredge material at DMGs creates habitat for marine pests (high);
- oil spill impacts marine organisms (high);
- disturbs native vegetation from pipeline maintenance (medium);

Table 21: GLOA identified risk activities and stressors

		Activity							
		1	2	3	4	5	6	7	8
Stressor		Dredging GLOA channel footprint	Introduction of a new vessel	TSHD dredge operation	CSD dredge operation	At-sea material placement	Onshore material placement	Vessel manage-ment	Sand Transfer Station
1	Hydrodynamic processes causing scour and erosion	●							
2	Hydrodynamic processes causing changes in salinity in the Lakes	●							
3	Translocation of marine pests		●						
4	Removal of seabed			●	●				
5	Suspended sediment			●	●	●			●
6	Settled sediment			●	●				
7	Release of nutrients			●	●				
8	Release of toxicants			●	●				
9	Underwater noise			●	●				
10	Airborne noise			●	●				●
11	Lighting at night			●					●
12	Visual amenity			●					
13	Exhaust			●					
14	Dredge collides with whales			●	●	●			
15	Dredge collides with dolphins			●	●	●			
16	Dredge translocates introduced marine pests				●				
17	Placement of material					●	●		
18	Waste disposal from vessel							●	
19	Oil spill							●	
20	Pipeline maintenance								●

8 Environmental Management

8.1 Overview

The implementation of the GLOA Environmental Management Plan (EMP) is underpinned by the systems procedures of GP's integrated Safety Environmental Management Plan (SEMP), which is prepared consistent with Part 6A of the Port Management Act 1995 (Vic.). The development of Gippsland Ports Risk Assessment Framework is based on the application of the following Australian-New Zealand and International Standards:

- ISO 31000-2009 Risk management – Principles and guidelines;
- AS/NZS 4801:2001 Occupational health and safety management systems – Specification with guidance for use;
- AS/NZS ISO14001:2004 Environmental management systems – Specification with guidance for use; and
- AS/NZS ISO14004:2004 Environmental management systems – General guidelines on principles, systems and supporting techniques.

This EMP has been prepared to fulfil the following objectives:

- To establish the processes and controls that will be implemented to ensure that GLOA activities are delivered with no greater risk or effects than those identified in the environmental risk assessment.
- To communicate the environmental management requirements of the EMP to the dredging Masters and crews
- To embed environmental management requirements in the GLOA activities of Gippsland Ports.

8.2 Environmental Management Plan

Gippsland Ports' GLOA EMP was established in 2011 and has been independently audited and updated on an annual basis as part of GP's commitment to best practice and continuous improvement.

Gippsland Ports' GLOA EMP identifies the specific management actions required under the following relevant Australian Government and Victorian Government legislation:

- Environment Protection (Sea Dumping) Act 1981
- Environment protection and Biodiversity Conservation Act 1999
- Marine and Coastal Act 2018 (Victoria – replaces the Coastal Management Act 1995)
- Environment Protection Act 2017 (Victoria).
- Wildlife Act 1975 (Victoria)

The above requirements have been addressed by developing Project Delivery Standards (PDS) each of which sets controls, environmental limits, monitoring requirements or contingency plans to address risks identified by the Risk Assessment.

8.3 Project Delivery Standards

GLOA Project Delivery Standards (PDS) have been identified for GLOA to address key environmental risks, effects and legal requirements. The GLOA PDS are a collation of the management and mitigation measures, environmental performance monitoring and contingency plans for the project.

The GLOA Project Delivery Standards (PDS) contained and detailed within the EMP are:

- Hours of operation
- Airbourne noise
- Waste management
- Equipment maintenance
- Fuels, oils, chemicals and hazardous goods
- Emergency response preparedness
- Marine pests
- Vessel anchoring
- Vessel bunkering
- Cetaceans
- Heritage – identification of potential relics
- Dredging
- Dredging schedule
- Consideration of seasonal sensitivities
- Dredged material placement
- Placement site dissipation monitoring.

8.4 Record keeping

During ongoing dredging activities, Gippsland Ports (or their contractors) will keep records which detail:

- the times and dates of when each material placement run is commenced and finished.
- the position (by GPS) of the vessel at the beginning and end of each placement run with the inclusion of the path of each dredge material relocation run.
- the volume of dredge material (in cubic metres) placed for the specific operational period. These records will be retained for audit purposes.
- detail of any spill of oil, fuel or other potential contaminant, details of remedial action and monitoring instigated as result.
- details of any marine mega fauna observations during dredging activities.
- time and duration of any alterations to the program, including stop work actions, as a result of any environmental mitigation measure.

Gippsland Ports will also:

- undertake monthly bathymetric surveys of the dredged area
- undertaken annual surveys of the dredge material grounds (DMGs)

- within two months of the completion of the DMG bathymetric surveys provide a digital copy of the final survey results to the Australian Hydrographic Office (AHO), copied to relevant regulatory agencies
- continue monitoring as per Section 9

8.5 Reporting

External notification and reporting requirements are outlined in Table 4 of the GLOA EMP and Table 24 of this LTMMP.

8.6 Auditing, Non-conformance and Corrective Actions

Conformance with the EMP and all approval conditions will be assessed by observation of activities, interviews, review of records and internal audits (Section 3.2 of the EMP).

In addition, an independent external auditor will continue to be engaged to assess Gippsland Ports' implementation of the GLOA EMP during delivery of each annual dredging program. Gippsland Ports' continuous improvement with respect to EMP compliance between 2011-2021 is evident in Table 22.

Corrective actions are continually implemented based on:

- Recommendations from annual (typ.) independent EMP auditor reports
- Periodic reviews and updates of the GLOA Environmental Risk Register
- Reviews and updates of GLOA Environmental Management Plan
- Monitoring records

These corrective actions mitigate future risks associated with TSHD dredging programs.

Table 22: Summary of previous EMP audit findings

Audit Criteria (Excluding Not Applicable)	**Fully Compliant**	**Compliant** but improvements required	**Minor Non-Compliance**	**Major Non-Compliance**	**Critical Non-Compliance**	**Undetermined**
2011 % TOTALS	73	14	2	0	0	11
2012 % TOTALS	94	4	2	0	0	0
2013 % TOTALS	96	2	0	0	0	2
2014 % TOTALS	96	2	2	0	0	0
2015 % TOTALS	100	0	0	0	0	0
2016 % TOTALS	100	0	0	0	0	0
2018 % TOTALS	100	0	0	0	0	0
2019 % TOTALS	100	0	0	0	0	0
2020 % TOTALS	100	0	0	0	0	0
2021 % TOTALS	100	0	0	0	0	0
2022 % TOTALS	100	0	0	0	0	0

8.7 Contingency planning

8.7.1 Inclement weather

In the event of inclement weather and associated wave and wind conditions, the TSHD will go on standby within the Port of Gippsland Lakes.

Gippsland Ports' provides real time monitoring of the following variables on their website: https://www.gippslandports.vic.gov.au/boating/waves-tides-and-weather/lakes-entrance-waves-tides-and-weather/

- Significant and maximum wave height
- Peak and average wave period
- Wave direction
- Measured and predicted tide water level
- Measured and predicted current speed
- Wind speed and direction
- Air temperature
- Relative humidity
- Mean seal level pressure
- Daily rainfall

8.7.2 Flood event

In the event of a flood occurring during the annual TSHD program, the TSHD will berth within the Port of Gippsland Lakes away from the main flood stream through Hopetoun Channel, The Narrows and Entrance Channel.

If a flood is forecast Gippsland Ports would receive notification alerts through the Bureau of Meteorology and local media.

Following a flood event, no dredging will occur until after a bathymetric survey of the Bar and Inner Channels has been undertaken. A survey may not be possible until one to two weeks post a flood event due to excessive current speeds and floating debris compromising the safety of hydrographic surveyors.

Once bathymetric surveys are available, the extent of bathymetry change and works remaining will be reassessed, and dredging will continue as required.

8.7.3 Oil spill

In the event of an oil spill from the TSHD or CSD, Gippsland Ports will implement their oil spill contingency measures. Gippsland Ports will also enact its 'Gippsland Region Marine Pollution Contingency Plan'.

An oil spill incident will be reported to the DCCEEW, DEECA, DoT and EPA as per Table 4 and Annexure 2 of the GLOA EMP.

8.7.4 Compromised Under-keel clearance of dredge

Due to the nature of dredging works and wave conditions in which the TSHD operates, there are times when the vessel's under-keel clearance may be compromised.

The current speed, tide level, wave angle and wind direction all play a part in determining how the TSHD is positioned during dredging. At times, up to half of the TSHD may be positioned over the 'Bar' while dredging occurs at greater depths adjacent to a vertical 'wall' of sand. During loading of the hopper, the TSHD sits lower in the water and on occasions clearance between the Bar and the TSHD keel may be compromised.

In this event two actions will immediately be implemented:

- The TSHD operator contacts onshore Gippsland Ports' staff for tug boat assistance and with immediate response taking between 5 - 30 minutes (depending on time of day, i.e. within or outside of normal office hours)
- The TSHD operator commences routine procedure of "Rainbowing" to lighten the load in the hopper. "Rainbowing" is the spray pumping of material from the TSHD hopper through a nozzle over the bow of the vessel.

It is noted that a TSHD can lighten its load, and therefore increase its buoyancy, quicker than water level would drop on a falling tide.

In the extreme case, where under-keel clearance is compromised and swell conditions present an immediate risk to the safety of the TSHD and crew, the TSHD operator may decide to perform an emergency 'dump' of hopper material.

9 Monitoring Framework

Gippsland Ports' major GLOA reporting and monitoring requirements are summarised in Table 24.

Further details of mitigation and monitoring requirements are included in the GLOA EMP Project Delivery Standards.

Environmental performance will be monitored through:

- Operational monitoring – GPS tracking, dredge logs, track plots, daily reports
- Physical conditions – wind, wave, tidal and weather conditions; webcams, sediment sampling
- Process monitoring – noise, turbidity (if required)
- Surveys – Bar, Inner channels and DMGs
- Inspections – marine fauna, marine pests, visual plumes, oil spills, waste management

Monitoring of dredging and environmental data informs any additional adaptive management action that may be required as detailed in the GLOA EMP.

Gippsland Ports commits to reporting to DCCEEW and DEECA, and publishing on our website, annual analysis of water levels, tidal harmonic constituents, and salinity (EPA Victoria data).

9.1 Gippsland Lakes monitoring

In addition to monitoring and reporting undertaken by Gippsland Ports, results of monitoring and reporting undertaken by other Agencies on the Gippsland Lakes are also considered and form part of the auditing and reporting process. Some links to recent and relevant monitoring and reports are included in Table 23 below.

Table 23: Gippsland Lakes monitoring and reporting

Agency	Monitoring	Link
EPA Victoria DEECA	Water quality IMS	https://data.water.vic.gov.au/ Environment - Groups - Victorian Government Data Directory
EGCMA	Seagrass and Saltmarsh	Gippsland Lakes Seagrass and Saltmarsh 2021 Seagrass-Mapping-2016-Final-Report.pdf (loveourlakes.net.au)
EGCMA	Ramsar site management plan	Gippsland Lakes Ramsar Site Management Plan - Summary Gippsland Lakes Ramsar Site Management Plan - Full
EGCMA	All	EGCMA_GL_EnvironmentReport2022_TechnicalReport_digital_FINAL.pdf (loveourlakes.net.au)
EGCMA / WGCMA	Reports	Love Our Lakes: Scientific Reports

Table 24: GLOA major reporting and monitoring requirements

Reporting and Monitoring requirements		Frequency				
		Daily	Monthly	Annual	Other	Comment
1	Dredge logs	●				Records dredge activities for each trip
2	Track plots	●				Records GPS position of dredge and drag head during dredging, sailing and placement (PDS 13 and 16 of EMP)
3	Daily reports	●				Summary of daily dredging activities and volumes
4	Marine fauna observation register	●				Record of whale and dolphin sightings; and standby time in accordance with PDS 10 and 11 of EMP
5	Wind, wave, tide and weather monitoring	●				Lakes Entrance waves tides and weather and annual water level analysis
6	Webcam monitoring	●				Lakes Entrance Jemmy's Point - Gippsland Ports
7	Surveys of Bar and Inner channels		●			Bathymetric Surveys - Gippsland Ports Waterways Online (Web Map) - Gippsland Ports
8	Surveys of DMGs			●		Undertaken annually (PDS 17, EMP) and supplied to AHO
9	Noise monitoring				●	In accordance with PDS 2 of EMP (if required)
10	Turbidity & water quality monitoring				●	In accordance with PDS 13c of EMP (if required). 10-years of continuous turbidity monitoring has shown that dredging plumes are well within acceptable turbidity levels.
11	Sediment sampling				●	Comprehensive sampling undertaken in Nov-2022. Further continuous sampling from hopper material will be undertaken in 2025, 2028 and 2031 to determine any long-term trends.
12	GLOA performance report			●		Annual report to DEECA
13	GLOA monitoring report			●		Annual report to DCCEEW (including water level and salinity analysis)
14	International Maritime Organisation report			●		Annual report to IMO (via DCCEEW) by 31 January each year.
15	TACC meeting			●		Annual (typ.) meetings
16	LTMMP review			●		Annual (typ.) reviews or where change to conditions require interim reviews.
17	Independent EMP Audit			●		Independent audit of compliance with GLOA EMP
18	Incident reporting				●	In accordance with s3.1 and Annexure 2 of EMP
19	Marine pest inspection				●	In accordance with PDS 7 of EMP

10 Performance Review

The *Environmental Code of Practice for Dredging And Dredging Material Relocation* (Ports Australia 2016) identifies that 'transparent and open information sharing is important to improve knowledge and to understand community values, client needs and government expectations. Communication and reporting are an important component of this, to demonstrate performance and provide for community accountability'.

In fulfilment of this principle, reporting under this Plan will involve:

- updates to the TACC on ongoing dredging activities
- publication (on Gippsland Ports' website) of an annual report detailing:
    - dredging activity in the past 12 months
    - results of any environmental monitoring or audits associated with dredging actions

For any operations covered by a Commonwealth Sea Dumping Permit, an annual report meeting the International Maritime Organisation's reporting requirements will be submitted to the Australian Government each year. The report will summarise the dredging and monitoring activities undertaken during the year, including:

- permit number
- permit start and expiry dates
- locations and type of material dredged
- volume dredged at each location
- placement locations used
- placement method used.

10.1 Continuous improvement

Gippsland Ports commits to continuous improvement to prevent, minimise or mitigate environmental impacts in the longer term.

This has been demonstrated through the 2017 Victorian state-government funded, procurement of the TSHD *Tommy Norton*. This TSHD was purpose-built for the conditions at Lakes Entrance, with the world's leading design and technology (e.g. 'green' overflow valve) to ensure compliance with stringent State and Commonwealth environmental approvals.

In 2021/22, Gippsland Ports has undertaken further investigations and assessments to ensure improved operational processes and that potential environmental impacts continue to be prevented, minimised or mitigated.

Gippsland Ports will continue to collaborate with other Agencies, and the TACC, with respect to the Gippsland Lakes and potential beneficial reuse opportunities at both Lakes Entrance and within the greater Gippsland Lakes.

11 Supporting Information

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Water Technology. 2013. Hydrodynamic Modelling of Lakes Entrance Channel – Dredge Design Scenarios including sand traps.

12 Acronyms and abbreviations

Acronym	Meaning
AHD	Australian Height Datum
AHO	Australian Hydrographics Office
AME	Australian Marine Ecology
CD	Chart Datum
CSD	Cutter Suction Dredge
DAWE	Department of Agriculture Water and Environment (Commonwealth)
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Commonwealth, previously DAWE)
DEECA	Department of Energy, Environment, and Climate Action (Victoria)
DSE	(previous) Department of Sustainability and Environment (Victoria)
DSEWPAC	(previous) Department of Sustainability, Environment, Water, Population and Communities (Commonwealth)
DoT	Department of Transport (Vic)
EMP	Environmental Management Plan
EPBC Act	Environment Protection and Biodiversity Conservation Act (Commonwealth)
GLOA	Gippsland Lakes Ocean Access
LESMP	Lakes Entrance Sand Management Program
LTMMP	Long Term Monitoring and Management Plan
MTL	Maintenance Trigger Level
NAGD	National Assessment Guidelines for Dredging (2009)
PDS	Project Delivery Standards
SAP	Sampling and Analysis Plan
SAPIR	Sampling and Analysis Plan Implementation Report
SCD	Side Casting Dredge
SEMP	Safety and Environmental Management Plan
STS	Sand Transfer System or Sand Transfer Station
TACC	Technical Advisory and Consultative Committee
TSHD	Trailing Suction Hopper Dredge

Appendix A – Gippsland Lakes Ocean Access Program – Water Level and Salinity Modelling and Analysis (PCS, 2023)