Appendix K:

Worley Gisborne Port Maintenance Dredging Engineering Report

EASTLAND PORT LTD

Maintenance Dredging and Disposal

Port Navigation Channel, Vessel Turning Basin and Wharves 4-8

Coastal Permit Applications

Engineering Report

Document No Rev 0: 301015-04045-CS-REP-001
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EcoNomics

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PROJECT 301015-04045 - Maintenance Dredging and Disposal - Port Navigation Channel, Vessel Turning Basin and Wharves 4-8

Coastal Permit Applications

Engineering Report

Rev	Description	Originator	Reviewer	Worley Approver	Revision Date	Customer Approver	Approval Date
Rev A	Issued for Review	D. Aubourg	B. Morgan	D. Aubourg	06 December 2019		
Rev B	Issued for Review	D. Aubourg	B. Morgan	D. Aubourg	10 February 2020		
Rev 0	Final	D. Aubourg	C. Thomas	D. Aubourg	20 February 2020		

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1. Introduction

Eastland Port Ltd (EPL) has a requirement to 'renew' the coastal permits for the maintenance dredging and dredge spoil disposal operations at the port of Gisborne. This report has been prepared to provide engineering information regarding the maintenance dredging aspect of these coastal permit applications. Reports have been prepared by others regarding the disposal aspects. Further details on the full application and associated reports can be found in the Assessment of Effects on the Environment prepared for this application (4Sight Consulting, 2019) (AEE). As noted in the AEE, there are currently 3 areas which either have had, or currently have, coastal permits (or coastal permits under appeal) for maintenance dredging which are covered by the maintenance dredging and disposal coastal permits application this report has been prepared for. These areas are:

- Port Navigation Channel (PNC), Vessel Turning Basin (VTB), Wharves 7 and 8. The existing coastal permits for maintenance dredging of the PNC, VTB and Wharf 7 and 8 areas were issued on 10 September 2015 and expire in 2020.
- Wharves 4, 5 and 6. The existing coastal permit for maintenance dredging of the Wharf 4, 5 and 6 areas was issued by the Council on 30 June 2013 and expired in 2018.
- Wharf 6. As part of a consent application to upgrade Wharves 6 and 7 lodged in October 2017, the coastal permit application included an application for maintenance dredging of newly created berth pockets at Wharf 6. Coastal permits were approved for these applications, however these applications are currently under appeal.

This report covers the following areas:

- Section 2 details the proposed maintenance dredge design levels, volumes and areas
- Section 3 discusses the dredge material
- Section 4 documents the proposed method of dredging and disposal.

1.1 Acronym and Glossary List

Acronym and Glossary List Table

A		**a**
	AEE	Assessment of Effects on the Environment
B		**b**
	BHD	Backhoe Dredge
C		**c**
	CSD	Cutter Suction Dredge
E		**e**
	EPL	Eastland Port Ltd

I	**i**
IH	Inner Harbour
M	**m**
mCD	Metres Chart Datum (1.056 m below MSL (1926))
MDLGAR 2019	Maintenance Dredging Liaison Group Annual Report 2019
MSL	Mean Sea Level
O	o
OSDG	Offshore Spoil Disposal Ground
P	**p**
PNC	Port Navigation Channel
S	**s**
SWMS	Safe Work Method Statement
T	**t**
TSHD	Trailing Suction Hopper Dredge
V	**v**
VTB	Vessel Turning Basin

2. Dredge Layout and Material

2.1 Dredge Levels and Areas

2.1.1 Operational Level and Design Dredge Level

In relation to this report, when designing structures and undertaking dredging two levels are considered. These are:

- Operational dredge level – this is the minimum level the dredge must achieve during a dredging campaign and is subsequently used by the port to determine the maximum draft of vessels using a particular area.
- Design dredge level. Due to construction tolerances associated with dredging and hydrographic surveying, it is not possible to dredge to the exact Operational dredge level. An allowance for these tolerances is added to the Operational dredge level to determine the maximum level which may actually be dredged in an area. Within Eastland Port this level can not be exceeded due to undermining of adjacent structures. For Eastland Port these tolerances have been set at:
  - Dredge Tolerance +0.5 m (i.e. deeper)
  - Survey Tolerance +/- 0.1 m
  - Total Maximum Tolerance +0.6 m (i.e. deeper).

The actual level at any given location, after dredging, will be a value somewhere between the Operational and Design dredge level.

Previous consents applied for by EPL has included either the Operational or Design dredge level. For this consent, all levels have been provided as the Design dredge level.

2.1.2 Historic Consents

Capital and maintenance dredging activities have been undertaken at the port since the 1880's (4Sight Consulting, 2019). While levels within most areas of the port have been maintained at their capital dredge levels, as vessel requirements change some areas have been maintained at shallower levels as vessels did not require the original capital dredge level. There are currently 3 sets of coastal permits (or coastal permits under appeal) for maintenance dredging which are covered by the maintenance dredging and disposal coastal permits application this report has been prepared for. These sets of coastal permits are:

1. Port Navigation Channel (PNC), Vessel Turning Basin (VTB), Wharves 7 and 8. The existing coastal permits for maintenance dredging of the PNC, VTB and Wharf 7 and 8 areas were issued on 10 September 2015 and expire in 2020.
2. Wharves 4, 5 and 6. The existing coastal permit for maintenance dredging of the Wharf 4, 5 and 6 areas was issued by the Council on 30 June 2013 and expired in 2013.
3. Wharf 6. As part of a consent application to upgrade Wharves 6 and 7 lodged in October 2017, the coastal permit application included an application for maintenance dredging of newly created berth pockets at Wharf 6. These applications were approved in 2018 and are currently under appeal.

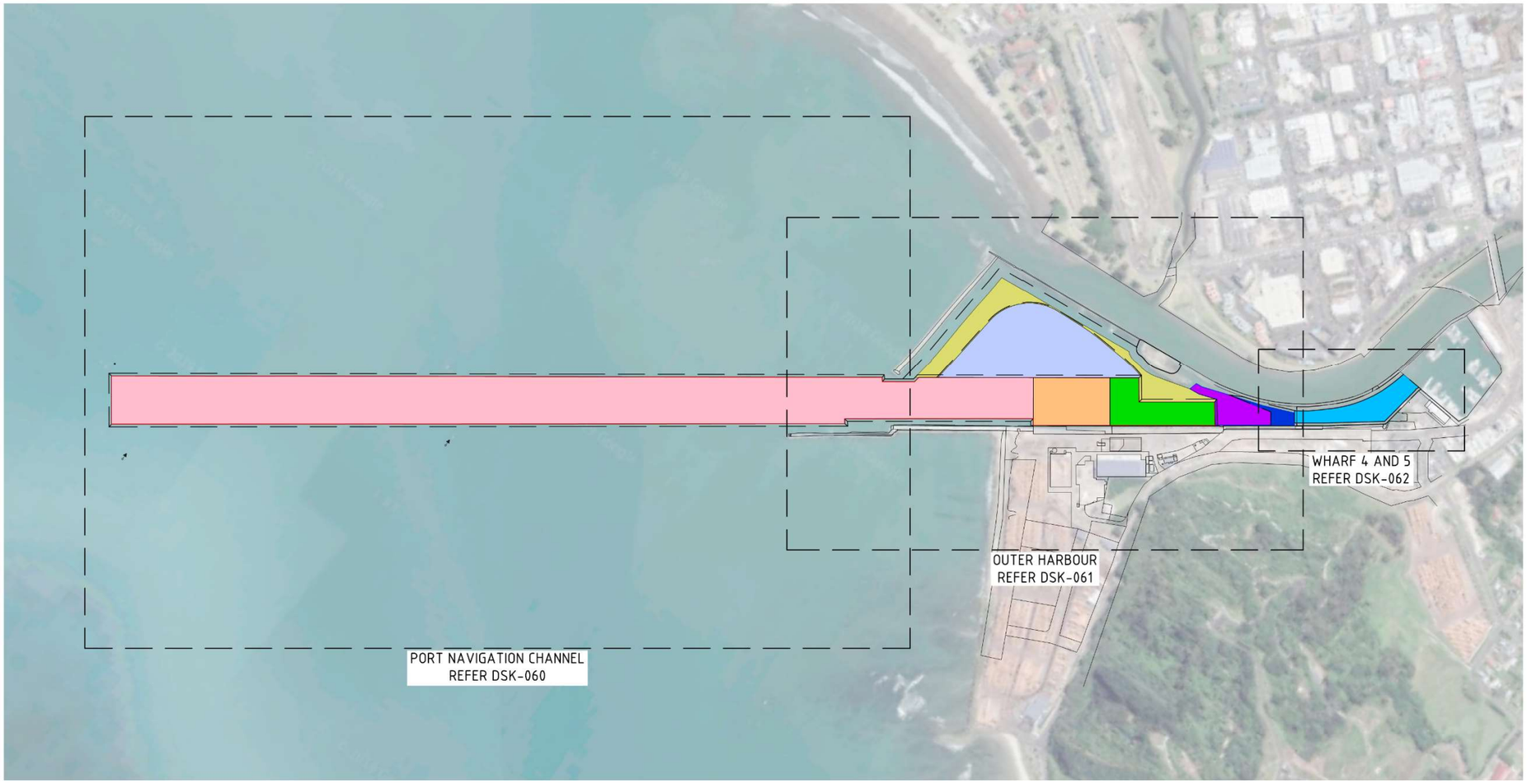
Table 2-1 provides a summary of the previous consents, approved dredge levels and associated area (m^2).

2.1.3 Proposed

EPL are proposing to include all the areas with previously approved maintenance dredging coastal permits under the present application. The method for determining these dredge levels is discussed in Sections 2.1.3.1 to 2.1.3.7, which in all cases included consideration of the impact of dredging on the stability of existing structures. While most levels and areas are unchanged from these previous coastal permits, it is proposed to modify

- the level and area associated with the VTB, Wharf 7 and Wharf 8 berth pockets compared to the 2015 coastal permit
- the level associated with Wharves 4 and 5.

Figure 2-1 to Figure 2-4 show the areas and proposed Design Dredge Level.



LEGEND

- DREDGING LEVEL -11m CD
- DREDGING LEVEL -10.9m CD
- DREDGING LEVEL -10.5m CD
- DREDGING LEVEL -9.7m CD
- DREDGING LEVEL -8.1m CD
- DREDGING LEVEL -7.5m CD
- DREDGING LEVEL -6.6m CD
- DREDGING LEVEL -4.8m CD
- TOP OF BATTER (INDICATIVE)

NOTES:

1. VERTICAL DATUM IS GISBORNE CHART DATUM WHICH IS 1.056m BELOW MSL (1926).
2. ALL LEVELS INCLUSIVE OF ALL TOLERANCES (EG: SURVEY AND DREDGING TOLERANCE). MATERIAL SHALL BE REMOVED NO DEEPER THAN INDICATED.

Worley energy | chemicals | resources

OneWay empowered | enabled | ethical

ISSUE	DATE	ISSUE DESCRIPTION	DRAWN
B	03.07.20	ISSUED FOR CONSENT	KM
A	16.12.19	ISSUED FOR REVIEW	VIP

NORTH

EASTLAND PORT MARINE DEVELOPMENT
MAINTENANCE DREDGE LEVELS - SITE LAYOUT

301015-03380-CS-DSK-059

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Figure 2-1 Proposed Maintenance Dredge Levels – Site Layout

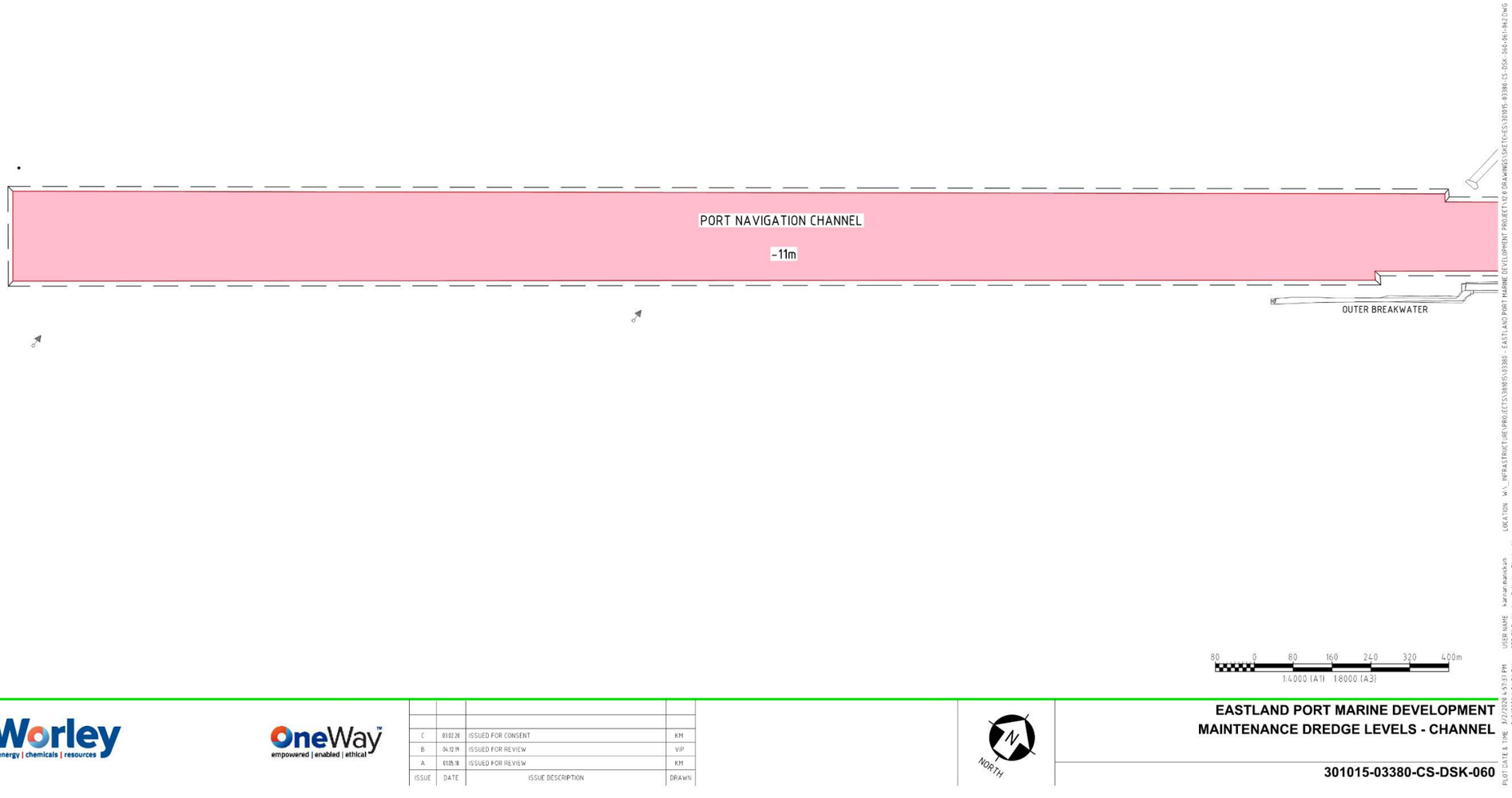
NOTES:

1. VERTICAL DATUM IS GISBORNE CHART DATUM WHICH IS 1.056m BELOW MSL (1926).
2. ALL LEVELS INCLUSIVE OF ALL TOLERANCES (EG: SURVEY AND DREDGING TOLERANCE). MATERIAL SHALL BE REMOVED NO DEEPER THAN INDICATED.
3. BATTER SLOPES ARE 1V : 1.732H NORTH OF BUTLERS WALL UNO.
4. BATTER SLOPES ON THE WESTERN SIDE OF THE CHANNEL SOUTH OF BUTLERS WALL ARE 1V : 5H.
5. BATTER SLOPES ON THE EASTERN SIDE OF THE CHANNEL BETWEEN BUTLERS WALL AND THE SOUTHERN END OF THE BREAKWALL EXTENSION ARE 1V : 1.732H.
6. BATTER SLOPES ON THE EASTERN SIDE OF THE CHANNEL, SOUTH OF THE BREAKWATER EXTENSION, ARE 1V : 5H.

LEGEND

DREDGING LEVEL -11m CD

TOP OF BATTER (INDICATIVE)



ISSUE	DATE	ISSUE DESCRIPTION	DRAWN
C	03.02.26	ISSUED FOR CONSENT	KM
B	04.12.19	ISSUED FOR REVIEW	VIP
A	01.05.18	ISSUED FOR REVIEW	KM

EASTLAND PORT MARINE DEVELOPMENT
MAINTENANCE DREDGE LEVELS - CHANNEL

301015-03380-CS-DSK-060

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Plotter-None

Figure 2-2 Proposed Maintenance Dredge Level – Channel

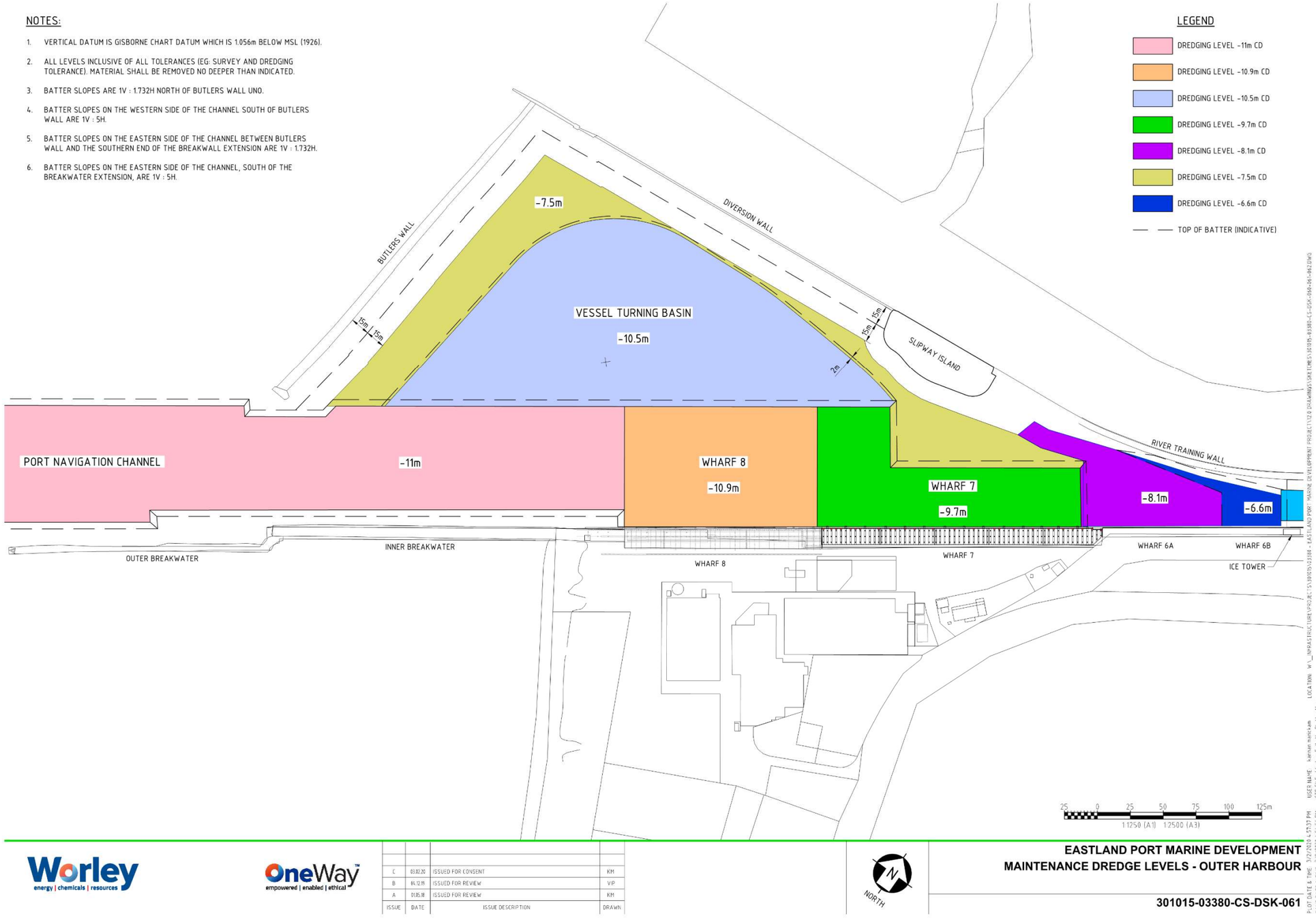

Figure 2-3 Proposed Maintenance Dredge Level – Outer Harbour

NOTES:

1. VERTICAL DATUM IS GISBORNE CHART DATUM WHICH IS 1.056m BELOW MSL (1926).
2. ALL LEVELS INCLUSIVE OF ALL TOLERANCES (EG: SURVEY AND DREDGING TOLERANCE). MATERIAL SHALL BE REMOVED NO DEEPER THAN INDICATED.
3. BATTER SLOPES ARE 1V : 1.732H NORTH OF BUTLERS WALL UNO.
4. BATTER SLOPES ON THE WESTERN SIDE OF THE CHANNEL SOUTH OF BUTLERS WALL ARE 1V : 5H.
5. BATTER SLOPES ON THE EASTERN SIDE OF THE CHANNEL BETWEEN BUTLERS WALL AND THE SOUTHERN END OF THE BREAKWALL EXTENSION ARE 1V : 1.732H.
6. BATTER SLOPES ON THE EASTERN SIDE OF THE CHANNEL, SOUTH OF THE BREAKWATER EXTENSION, ARE 1V : 5H.

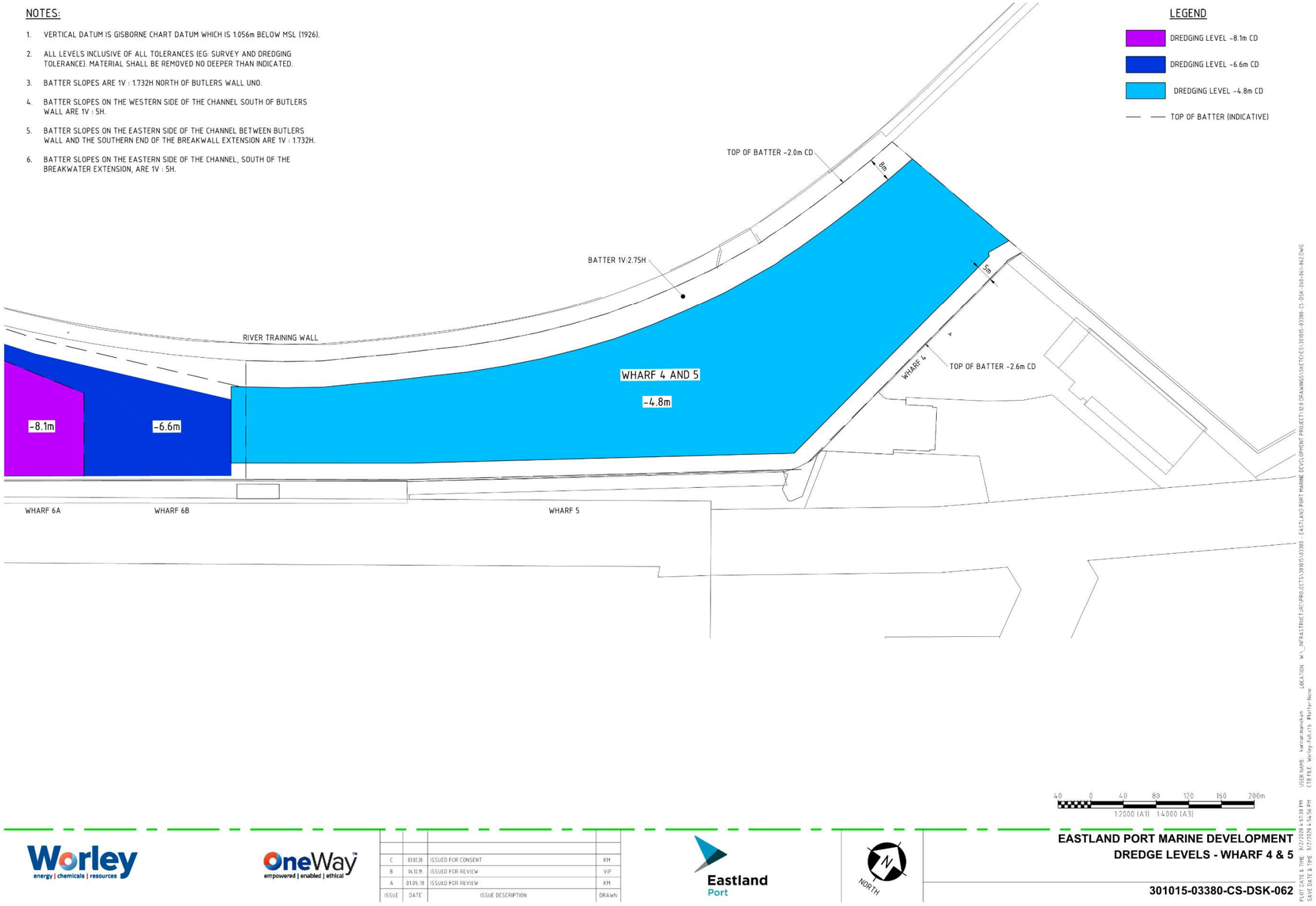

Figure 2-4 Proposed Maintenance Dredge Level – Wharf 4 & 5

2.1.3.1 Port Navigation Channel

The previous dredge consent applied for a level of -10.5 mCD, however this was for the Operational dredge level. WorleyParsons has undertaken a study to determine the Design dredge level and found this to be -11.0 mCD (WorleyParsons, 2018).

2.1.3.2 Vessel Turning Basin

The original capital dredge level for the VTB allowed loaded ships to turn within the port, however within recent years it has only been maintained to a level allowing the turning of ballasted (unloaded) ships. This reduced dredge level restricts which vessels presently use the port, such as

- part loaded log vessels, which visit many other NZ ports
- cruise ships, which instead needing to lighter people ashore. This means that in bad weather these vessels cancel their Gisborne stop as they cannot safely transfer people into the lighters.

EPL is also considering the opportunity for coastal ships, such as Pacifica's "Moana Chief", to visit the port, however this may not be possible due to the shallow level of the VTB.

Due to these reasons, within the life of the coastal permit being applied for EPL are expecting to maintain the VTB at its historical capital dredge level. It is important to note that the VTB is presently dredged as part of maintenance activities and therefore this is not an expansion of the present dredging area and affected environment, just an increase in level.

Dredging consent applications approved in 2000 (Whiting, 2000) and 2009 (Wilkinson, 2009) were for capital and maintenance dredging within the VTB to levels of -10.5 and -10.7 mCD respectively, but for different areas. Given the future vessels arriving and swinging within the harbour, it is expected that a maintained Design dredge level of -10.5 mCD will be sufficient, and a refinement of the required area has been undertaken. This refinement includes part of the VTB to be dredged to -7.5 m to allow for manoeuvring of tugs and other shallow draft vessels while ships are turning.

2.1.3.3 Wharf 8 Berth Pocket

The 2015 coastal permit did not separate the Wharf 8 berth pocket from the PNC. Following further investigations by Worley (WorleyParsons, 2017) it has been determined that the Design Dredge Level is -10.9 mCD.

2.1.3.4 Wharf 7 Berth Pocket

The 2015 coastal permit did not separate the Wharf 7 berth pocket from the PNC. Following further review of the design drawings (John Booth, Sweetman and Wolfe, Nov 1964) it has been determined that the Design Dredge Level for the Wharf 7 Berth Pocket is -9.7 mCD.

2.1.3.5 Wharf 6 Tug Berth 1 and Manoeuvring Areas

In 2017, EPL applied for a resource consent to rebuild Wharf 6 to allow EPL's new tug Waimata to berth safely at Wharf 6. This application included capital dredging of an area to an Operational dredge level of -8.1 mCD due to the greater draft of the Waimata compared with previous tugs. This is detailed in the WorleyParsons engineering report submitted as part of the consent application (WorleyParsons, 2017).

The area shown in Figure 2-3 is the same area consent was applied for at this time. Consent was granted for this capital dredging in 2018.

Based on this, maintenance dredging to a Design dredge level of -8.6 mCD is included within this application.

Worley notes that Wharf 6 will need to be rebuilt to allow dredging for this level as the existing wharves are not designed for this greater level.

2.1.3.6 Wharf 6 Tug Berth 2 and Manoeuvring Areas

In 2017, EPL applied for a resource consent to rebuild Wharf 6 to allow a potential new tug to berth safely at Wharf 6. This application included capital dredging of an area to an Operational dredge level of -6.6 mCD due to the greater draft of the proposed tug compared with previous tugs. This is detailed in the WorleyParsons engineering report submitted as part of the consent application (WorleyParsons, 2017). The area shown in Figure 2-3 is the same area consent was applied for at this time. Consent was granted for this capital dredging in 2018, however these applications are currently under appeal.

Based on this, maintenance dredging to a Design dredge level of -7.1 mCD is included within this application.

Worley notes that Wharf 6 will need to be rebuilt to allow dredging for this level as the existing wharves are not designed for this greater level.

2.1.3.7 Wharves 4 and 5

The previous application for Wharves 4 & 5 assumed deeper draft tugs would be berthing at Wharf 4, and therefore a suitable maintained level channel and berth pocket alongside Wharves 4 and 5 would be required. This level was applied for; however, the channel was not maintained to this increased level. Following further planning by EPL, it has been determined that deeper draft tugs would berth at Wharf 6, therefore removing the requirement to maintain the channel alongside Wharves 4 and 5.

Based on the expected vessels using these wharves, maintenance dredging to a Design Dredge Level of -4.8 mCD is included within this application.

2.1.4 Summary

Based on the available historical and recently approved capital and maintenance dredge level information, Worley has prepared the information presented in Table 2-1, and Figure 2-1 to Figure 2-4. Worley notes

- the proposed dredge levels will not impact the existing structures
- Figure 2-2 to Figure 2-4 show the area to the toe of the dredging, and for information only include a dashed line to indicate the top of batter. During maintenance dredging, only areas within the toe are dredged.
- As noted in Section 2.1.1, previous consents applied for by EPL has included either the Operational or Design dredge level. For this consent, all levels have been provided as the Design dredge level.

Port Area	Approved Maintenance Dredge Level (m below chart datum)	Approved Capital Dredge Level (m below chart datum)	Recent Approved Coastal Permits	Proposed Maintenance (Design) Dredge Level (m below chart datum)	Proposed Area (Ha)
Port Navigation Channel (PNC)	-10.5 mCD		10/9/2015	-11.0 mCD	15.5
Vessel Turning Basin (VTB)	-9.3 & -8.0 mCD		10/9/2015	-10.5 & -7.5 mCD	5.11
Wharf 8 Berth Pocket	-10.5 mCD		10/9/2015	-10.9 mCD	1.34
Wharf 7 Berth Pocket	-10.5 mCD		10/9/2015	-9.7 mCD	1.16
Wharf 6 Tug Berth 1	-8.1 mCD	-8.1 mCD	27/8/2018*	-8.1 mCD	0.56
Wharf 6 Tug Berth 2	-6.6 mCD	-6.6 mCD	27/8/2018*	-6.6 mCD	0.16
Wharves 4 & 5	-7.0 mCD		30/6/2013	-4.8 mCD	0.865
				Total Area	24.695

Table 2-1: Summary of Previous and Proposed Maintenance Dredge Areas and Levels

* These applications are currently under appeal

2.2 Dredge Volumes

For the purposes of this report, Worley has relied on two main sources of information for dredge volumes. For consistency with the Maintenance Dredging Liaison Group Annual Report 2019 (MDLGAR 2019) (Eastland Port, 2019), annual periods cover the period from the 1st July to 30th June.

- For the period 1st July 2013 to 30th June 2019 (i.e. years 2015, 2016, 2017, 2018 and 2019), daily dredge logs provided by EPL have been used.
- For period 1st July 2002 to 30th June 2013, annual dredge volumes included within the MDLGAR 2019 have been used as daily dredge logs were not available.

Figure 2-5 shows the annual total dredge volumes, volumes using EPL's dredge, the Pukunui, and the average annual dredge volume (72,800 m^3) over the 17-year period. This figure shows that the inter-annual rate varies significantly, from a minimum of 16,500 m^3 in 2005 to a maximum of 138,200 m^3 in 2011, with some period of years being consistently higher than average (e.g. 2009-2014) while other periods are lower than, or close to average (e.g. 2004-2008). This variation is predominantly due to the varying amounts of deposition that occurs due to climatic effects (e.g. rainfall, wave events etc.).

It is expected that the long-term average for the port will continue to be around 70-80,000 m^3. However, to allow for annual spikes in deposition, caused by the inter-annual variability of storm events, and some localised "catch-up" dredging of the VTB to bring it back to its capital dredged level, an annual rate of up to 140,000 m^3 is recommended for this consent.

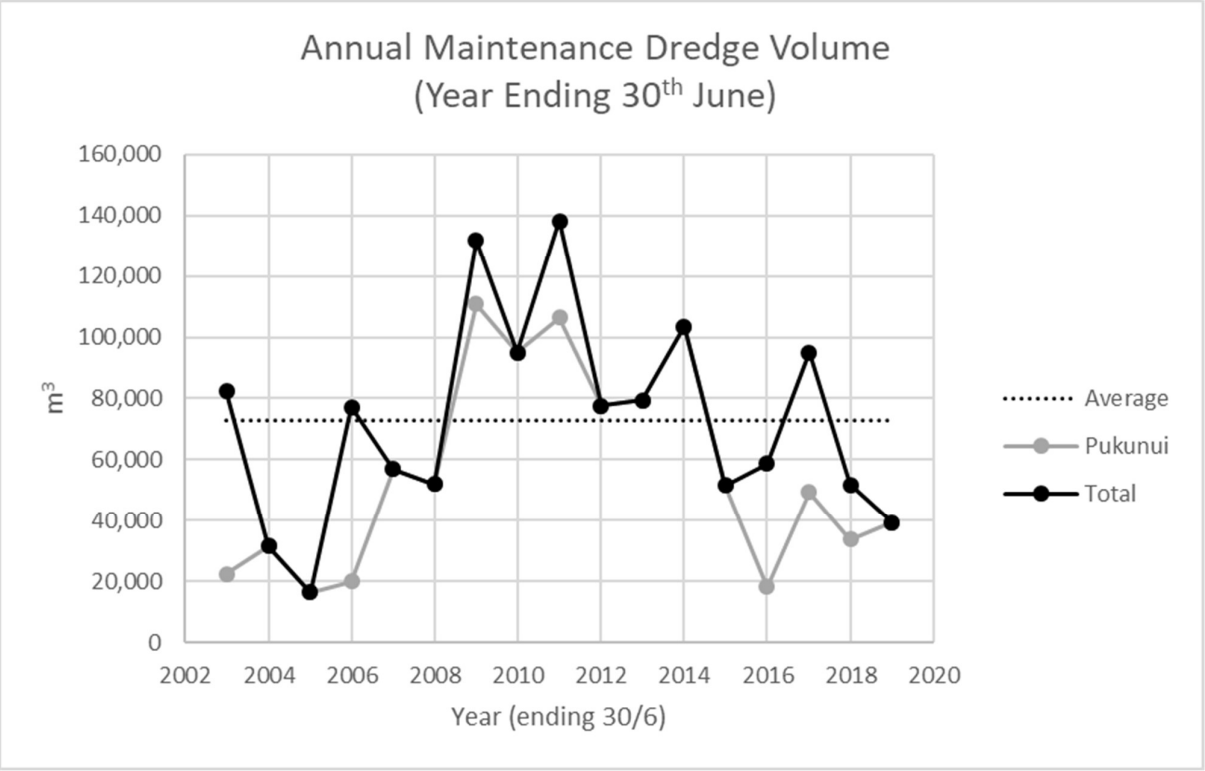

Figure 2-5 Annual Maintenance Dredge Volumes for Eastland Port

2.3 Dredging Frequency

Table 2-2 and Figure 2-6 shows the number of annual days of dredging over the period that daily dredging logs were available for this report. Like the annual dredging volumes, the number of days of dredging varies significantly from 51 in 2016 up to 134 in 2014, although the average number of days is approximately 95 days. The shape of the graph is similar to the total dredging volumes, however there is some variation due to the use of higher productivity dredgers (see Section 4) in some years reducing the number of days required to remove the required volume of material (e.g. 2016, 2017 and 2018).

Year	# Days Dredging
2014	134
2015	77
2016	51
2017	123
2018	87
2019	99

Table 2-2: Number of Days of Dredging

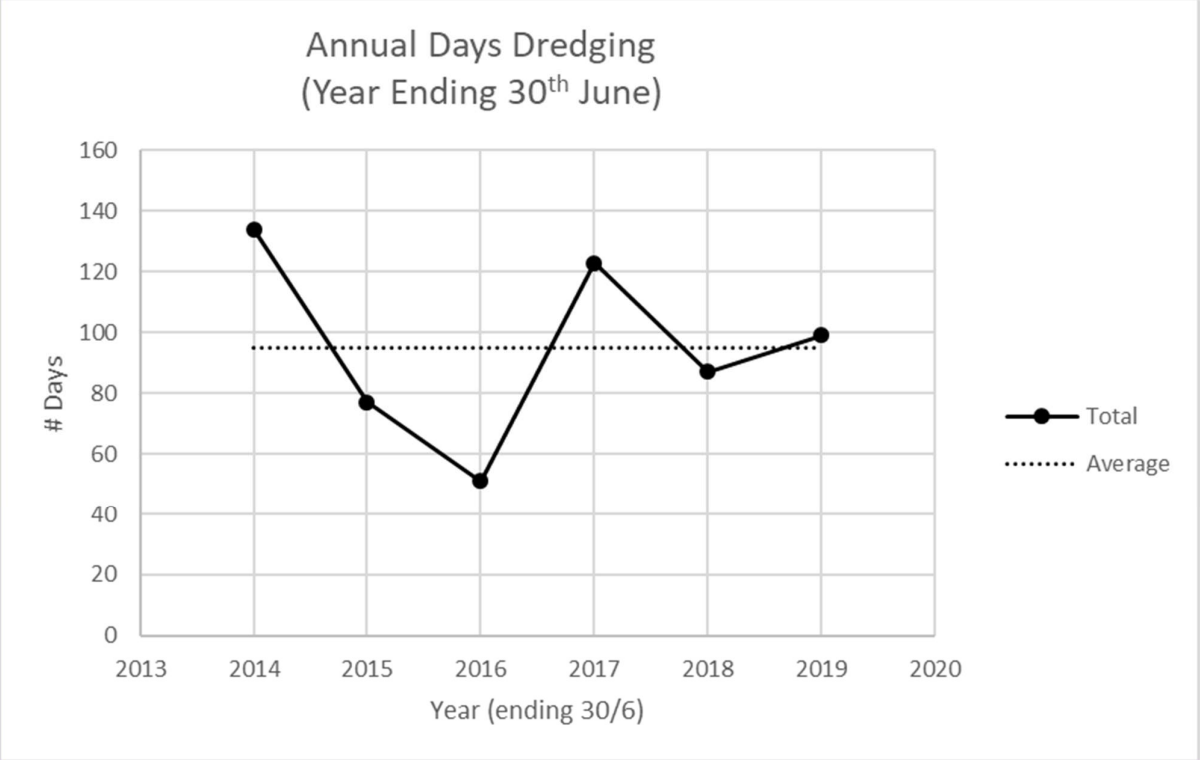

Figure 2-6 Annual Maintenance Dredging Days for Eastland Port

Figure 2-7 shows the average, minimum and maximum number of days of dredging/month over the 6 years of available data. This shows that for a single month (e.g. January, February, March), the number of days of dredging can vary from 0 to 29 days.

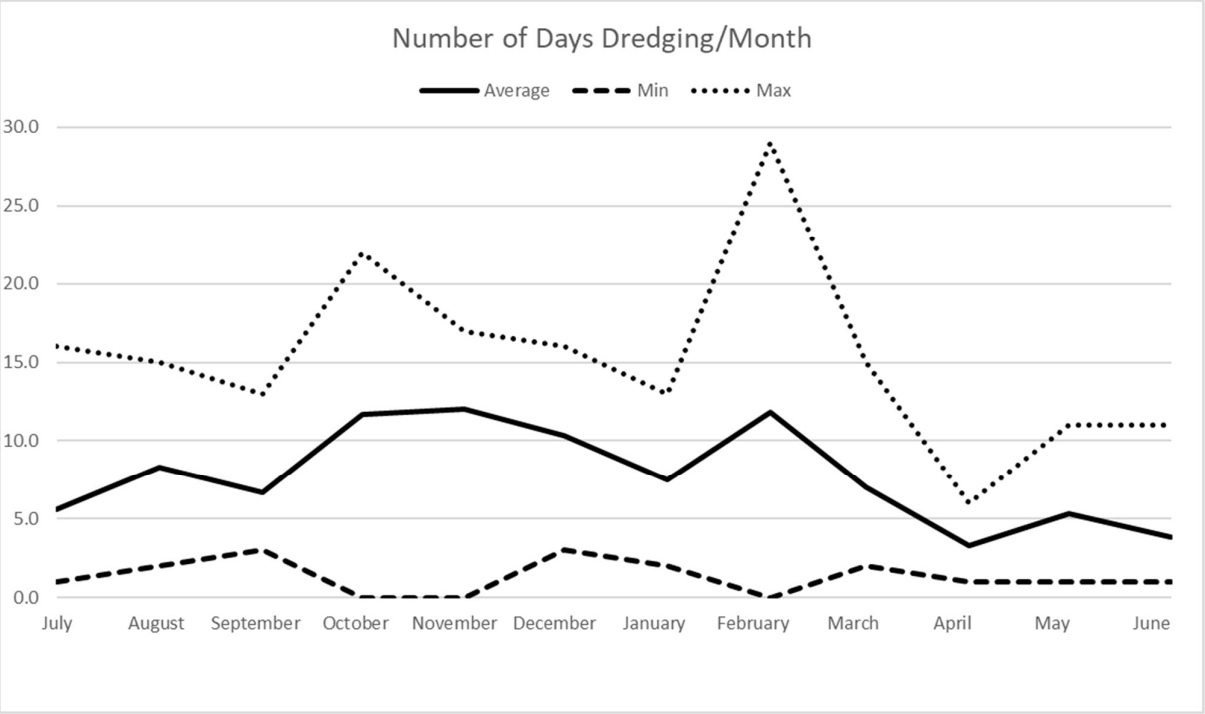

Figure 2-7 Number of Days of Dredging

2.4 Sedimentation 'Hot-Spots'

Figure 2-8 shows the average dredge volumes for the 7 areas identified in the daily dredging logs for the period 2014-2019. This graph shows that the Inner Channel area has the greatest levels of sedimentation, with over 50% of the total volume, and the next greatest area attracting less than 30% of the volume of the Inner Channel.

Figure 2-9 contains shows the definition of the Inner, Centre and Outer Channel areas where most of the sedimentation occurs.

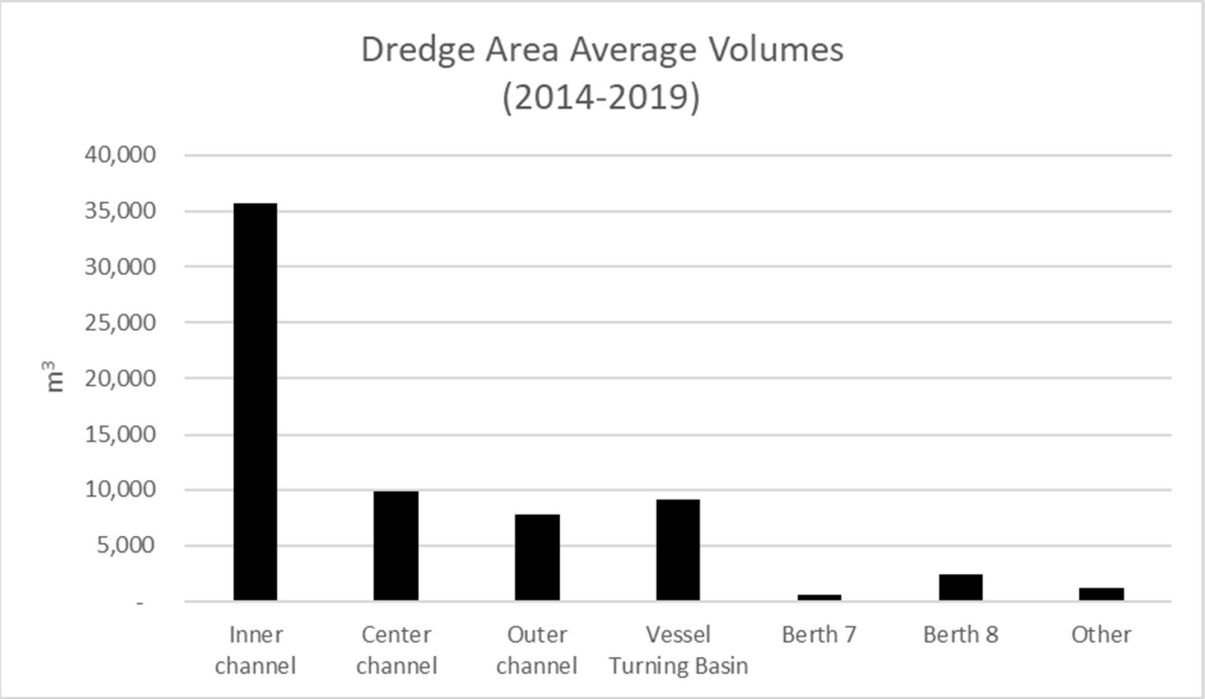

Figure 2-8 Dredging Area Average Volume (2014-2019)

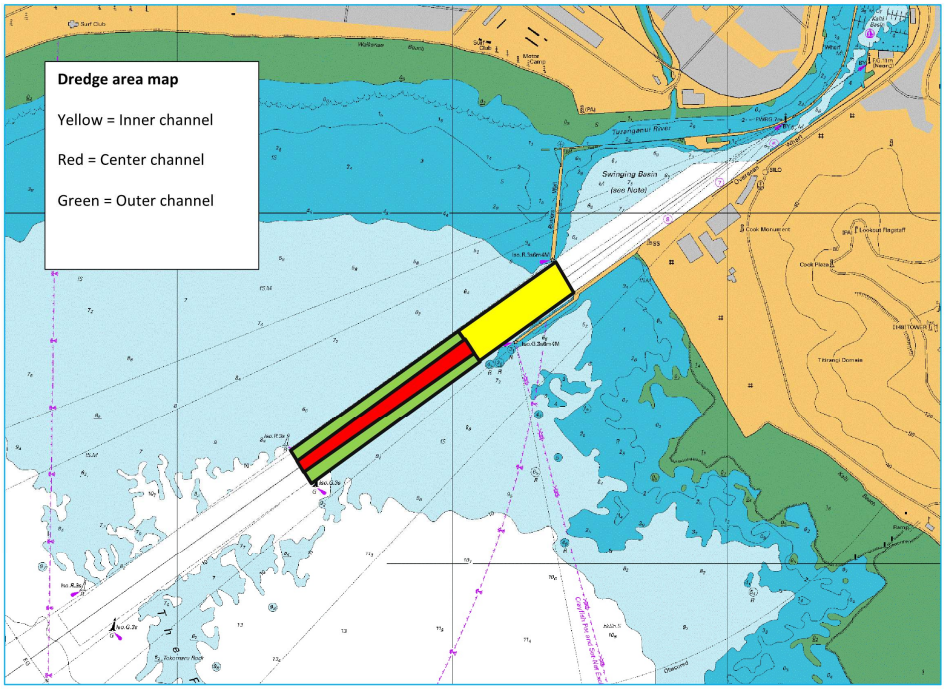

Figure 2-9 Channel Dredge Areas (email Bayley M. to Aubourg D., 21/1/2020)

3. Dredge Material

Information on the material being dredged is reported on in a number of documents, including reports by Metocean Solutions (Metocean Solutions Ltd, 2018), 4Sight (4Sight Consulting, 2019) and EPL (Eastland Port, 2019). In summary these reports show that material within the port is

- predominantly silt, while material in the channel is predominantly sand. Table 3-1 is reproduced from data in (Metocean Solutions Ltd, 2018).
- has contaminants below required sediment quality limits (4Sight Consulting, 2019).

	Percentage (%)	Median Diameter d_{50} [µm]
Inner Basin		
Sand	20%	180
Silt	60%	20
Clay	20%	2
Channel Entrance		
Sand	80%	170
Silt	10%	20
Clay	10%	2
Outside of Port		
Sand	70%	110
Silt	20%	30
Clay	10%	2

Table 3-1: Surficial sediment distribution within the port basin and outer bay (Metocean Solutions Ltd, 2018)

4. Proposed Method of Dredging and Disposal

During the period of the consent being sought by EPL, works will need to be conducted in a similar manner to that proposed and approved in the most recent Coastal Permits for maintenance dredging (4Sight Consulting, 2019). EPL has undertaken maintenance dredging under these and similar Coastal Permits for the last 19 years, with 75% of material being removed utilising its Trailing Suction Hopper Dredge (TSHD) Pukunui, with dredging campaigns by higher productivity TSHDs (New Era, Kawatiri, Brage R and Albatross) in 2003, 2006, 2009, 2011, 2015 and 2017 (Eastland Port, 2019). Maintenance dredging is expected to occur using the Pukunui, although if there are large inflows of sediment due to large storm events, a higher productivity TSHD may be required to ensure the required port and channel levels can be maintained.

Disposal of dredged material is covered by separate reports which are detailed within the AEE (4Sight Consulting, 2019).

A Backhoe Dredge (BHD) or Cutter Suction Dredge (CSD) may be used for maintenance dredging as they are being utilised for capital dredging works within the port, and maintenance dredging is required. The methodology for a BHD has been included below as this is historically more likely to be utilised than a CSD.

4.1 TSHD Dredging Methodology

"In a standard design a trailing suction hopper dredger is equipped with:

- One or more suction pipes with suction mouths, called dragheads that are dragged over the seabed while dredging.
- One or more dredge pumps to suck up the loosened soil by the dragheads.
- A hold (hopper) in which the material sucked up is dumped.
- An overflow system to discharge the redundant water.
- Closable doors or valves in the hold to unload the cargo.
- Suction pipe gantries to hoist the suction pipes on board.
- An installation, called the swell compensator, to compensate for the vertical movement of the ship in relation with the sea-bed." (Vlasbom, 2007)

TSHDs operate by sailing to the area requiring dredging, reducing speed to approximately 1-3knots, lowering the draghead to the seabed and starting the dredge pumps. The draghead disturbs the seabed material, causing it to become loosened. Combined with water, the loosened material is sucked up the suction pipes, with the resultant slurry being pumped into the hopper.

Commonly an overflow system is used in areas where the sediment in the slurry settles quickly into the base of the hopper, leaving a relatively clean layer of water on top. If an overflow device is fitted, once the slurry reaches the entry to the overflow device, the clean water can flow out of the hopper back into the area being dredged. This leaves additional room for more slurry to enter the hopper, until the hopper becomes too full and the water at the overflow becomes unclean.

To reduce the impact of surface plumes, if finer material does not settle quickly, dredging stops once the hopper is filled with slurry and before it is allowed to overflow.

When the hopper is filled, and dredging has stopped, the suction tubes are lifted and placed on the deck of the TSHD, which then sails to the unloading area. Once on location, the doors are opened to allow the slurry to empty out.

4.2 BHD Dredging Methodology

Basically, these stationary dredgers are large excavators mounted at the front of a pontoon, generally with extended booms and sticks to provide increased reach. During dredging the pontoon is anchored by three spud poles; two fixed at the front of the pontoon and one movable aft. Bucket sizes vary from a few cubic metres to 20 m^3 (Vlasbom, 2007).

During dredging, the pontoon is lifted a small distance out of the water by wires running over the spud poles. A part of the weight of the dredger is now transferred via the spuds to the bottom, resulting in sufficient anchoring to counteract the digging forces (Vlasbom, 2007).

The bucket is then lowered, similar to an excavator operating on land, dragged through the material to be dredged material until full, raised and the bucket swung around to deposit the material usually into a barge moored temporarily alongside. Once the barge is fully loaded, it is removed from the side of the pontoon, replaced with an empty barge and the full barge taken to the disposal site. It is most likely that the barges will be unpowered split hopper or bottom dumping barges, manoeuvred using a tug. Similarly, to a TSHD, the barges will be towed to the disposal site and, once in location, open the hopper/doors to allow disposal of the sediment.

Similar to TSHDs, in suitable material that settles quickly, the barge may be allowed to overflow to increase productivity. Alternatively, a silt curtain may be placed around the digging area of the dredge to reduce turbidity outside of this area and the water allowed to empty out of the bucket before the material is placed into the barge.

BHDs have a significantly lower productivity than TSHDs. However, they are more accurate and can dredge a wider range of materials, including weak rock, can remove less water during dredging, and operate in shallower water levels. Due to potential wharf upgrades being undertaken within the port, there is a possibility that a BHD will be operating within the port and the opportunity taken to use this dredge to assist with the removal of sediment deposited close to the existing wharves. For this reason, a BHD may be used as part of maintenance dredging, although it is not the preferred method.

4.3 Eastland Port Specific Dredging Methodology

EPL's TSHD Pukunui is a converted split hopper barge with a single suction pipe and draghead. It was upgraded around 2012 with new pumps and a new draghead, as well as improvements in the sealing of the hopper doors. As it does not have its own power, the Pukunui is towed through the area to be dredged (at approximately 1 knot) and to the OSDG (at approximately 6.5 knots). Overflow dredging is used until the draft marks of 3.0 m are reached, at which stage dredging is stopped.

If higher productivity dredgers are required, they will dredge and transit under their own power.

TSHDs will navigate to the disposal site and, once in location, open the hopper to allow disposal of the sediment.

Dredging and disposal will be conducted primarily during daylight hours although dredging will also be undertaken for 4-5 hours during night-time hours in winter. If a higher productivity dredge is required, these are likely to operate 24 hours/day.

A Safe Work Method Statement (SWMS) or similar will be prepared by EPL management and operations personnel and include a review of safety and navigation related issues. Input will also be sought from the Harbour Master. All personnel involved in dredging operations will be required to sign the SWMS before commencing work, and a copy of the SWMS shall be stored on all associated equipment.

The SWMS will be reviewed on an at least annual basis to determine whether new risks or hazards have been identified, with the updated SWMS needing to be signed by management and operations personnel, then replacing all other versions.

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