TOWNSVILLE PORT EXPANSION PROJECT

Additional Information to the Environmental Impact Statement

TOWNSVILLE PORT EXPANSION PROJECT

SECTION 2

Project Description

AECOM BMT WBM

2.0 Project Description

2.1 Introduction

Throughout the Port's history a number of upgrades to the channel and harbour have been required to cater for larger vessels visiting the Port as the global shipping fleet and trading partners changed. A capital dredge campaign in 1993 was the most recent example of a significant increase in channel capacity and at the time was considered industry leading, in terms of stakeholder cooperation and environmental management. The Port Expansion Project (PEP) has built on this benchmark, also incorporating current industry standards and available technology, to develop a design that balances engineering, environmental and economic drivers.

In order for the Port to continue to service its customers effectively, the Port must remain internationally competitive and able to accommodate expected medium to long term changes in vessel sizes and shipping requirements. The global shipping fleet is incrementally increasing, as some of the world's significant limiting infrastructure, such as the Panama Canal, is upgraded. To accommodate larger vessels, there is a requirement to upgrade the existing channel.

The need for the PEP was originally identified through a master planning process, which was completed in 2007. As a result of this process it was determined that a steady increase in trade over future decades will exceed existing port capacity and require increased port infrastructure. Following this process, the Project has undergone a preliminary engineering design process that has considered environmental, social and economic factors culminating in the PEP "EIS design".

The PEP Environmental Impact Statement (EIS) was informed by the technical studies undertaken in accordance with the Queensland State Government Terms of Reference and the Australian Commonwealth Government Guidelines, as well as the Port's extensive experience, particularly in dredging.

This section of the AEIS has been structured to provide additional information on the following:

- development of the PEP, including assessment of alternatives that informed the PEP EIS design
- the design refinement process to address legislative changes since the EIS and in response to submissions
- description of the refined design which forms the basis of the PEP and the subject of this Additional Information to the Environmental Impact Statement (AEIS).

2.2 Development of the PEP and Assessment of Alternatives

Recognising there is limited availability for growth in the existing harbour, coupled with long lead times typically associated with port development, POTL has undertaken continual and evolving investigations and assessments to inform master planning since the original PEP concept in 2007.

The development of the EIS design commenced with the development of a Master Plan (2007) which was optimised through a series of studies, being the Preliminary Engineering and Environment Studies (PEES), and finally assessed through the EIS process. These steps are summarised below.

2.2.1 Port Master Plan

The Master Plan was completed in 2007 by the Townsville Port Authority (now POTL) to guide future development of the Port. The objective of the Master Plan was to provide the context for staged future development, as a competitive and efficient trading port co-existing alongside the city of Townsville and sensitive environments. The master planning process investigated future trade demand under low, medium and high growth scenarios, and developed associated trade forecasts. Existing port characteristics, capacity and constraints were analysed, and options for future port capacity were developed and assessed. The resulting Master Plan recommended a number of upgrades within the existing harbour to maximise the available capacity from existing port assets, and the development of a new harbour to the north of the existing harbour with six new berths to augment the existing Berth 11 and proposed Berth 12 in that location. This proposed new harbour became the PEP.

The Master Plan included an assessment of alternative port sites including an option for a new port development at Cape Cleveland. This option had previously been investigated by the port as a part of the considerations around the development of Berth 11 (SKM, 1994), and concluded on both environmental and economic grounds, a new port adjacent to Cape Cleveland was an inferior solution to the incremental development of the existing port to the north of the existing northern breakwater. The Master Plan review concluded that there was no new evidence or information to suggest the outcomes of the original study will be any different if updated as similar trades and development scenarios to the use expected in the PEP. Planning work therefore concentrated on redevelopment of the existing inner harbour and the incremental expansion of the Port seaward of the existing breakwater.

The Master Plan proposed the assessment of two preferred layouts for port operations within the new harbour based on the following scenarios.

- Scenario A, which entails an incremental expansion seaward of the eastern breakwater with minimum disruption to existing users and lessees. It will be driven by growth in general cargo and potential new cargoes such as magnetite. It was identified as a less than optimal future layout with a mix of general cargo and bulk cargoes in both the inner and expanded harbour areas with some existing inefficiencies prolonged.
- Scenario B, supports a staged program of redevelopment and relocation of existing bulk operations, resulting in all general cargo operations (plus sugar) located in the inner harbour and all bulk liquid and dry bulk (except sugar) located in the expansion seaward of the existing breakwater.

Common to both scenarios was the eventual port expansion seaward of the existing breakwater and creation of new berths, dredged basin and land areas protected by a new breakwater. The options also contained the potential for a new breakwater west of the existing channel adjacent to the new harbour. The need for this western breakwater will be confirmed during the detailed design phase of the Project.

2.2.2 Preliminary Engineering and Environment Study

The Preliminary Engineering Environmental Study (PEES) was undertaken to continue to progress the planning for the PEP following the finalisation of the Master Plan. The study identified the requirement for demand responsive expansions of the existing port to meet North Queensland's predicted growth and expected changes to the global shipping fleet. Port of Townsville's long-term development requires additional capacity and infrastructure to meet future demand. This requires an extension of the port and its infrastructure into Cleveland Bay to cater for changes and increases in demand for trade and port capacity, including a greater emphasis on bulk materials handling.

The PEES included a number of technical engineering and environmental studies that collectively informed the development of the PEP. It also outlined the scope for environmental investigations and engineering design to be undertaken as part of the subsequent environmental impact assessment and detailed engineering design stage of the PEP.

The preferred dredging and reclamation strategy was developed based on the following guiding principles.

(a) Beneficial reuse of material is preferable and should be maximised.

(b) The extent of reclamation for the port expansion should be sufficient to allow for the future operational needs of the port but maintain a reasonable size.

(c) Selection of the material to be reused as reclamation fill or to be disposed offshore should consider the opportunities and constraints of *in situ* material location, dredging processes and material properties.

The Offshore Disposal Study in the PEES looked at the existing disposal site, its capacity and detailed the historical use and the former ecological state of the area. Three other potential alternative offshore disposal locations were also considered, including a site seaward of the existing offshore disposal site, a site to the north of Magnetic Island, and site at a distant offshore location.

The design elements and the concept design developed as a part of the PEES are outlined in Part A, Chapter A.1.3.2 of the EIS.

2.2.3 Port Expansion Project Environmental Impact Statement

Part A, Chapter A.1.6 of the EIS summarises the options and alternatives to the PEP and builds upon the master plan process that identifies the new outer harbour on the seaward side of the existing inner harbour as the most appropriate location from both an environmental and an operational perspective.

Existing berths in the port are fully committed to other uses, either through long-term lease arrangements with specific exporters/importers, or through the requirement to provide intermittent berth allocation for general cargo. It is not possible to handle the changing and long-term increased trade on a large-scale across the existing berths and many of the berths are not suitable for export of dry bulk trades in Panamax sized vessels on a regular basis. This will require dredging the existing harbour and channel, for which the existing berth structures are not designed.

Both previously identified and new alternatives were further considered in the EIS, including:

- new harbour to the west of the existing harbour (Option A)
- new harbour to the east of the existing harbour (Option B)
- additional berthing outside existing harbour using exposed port berths (Option C)
- new protected harbour without reclamation – remote land cargo storage (Option D)
- new port harbour at Cape Cleveland (Option E).

The locations of Options A to E from the EIS are illustrated as Figure 2.1 below.

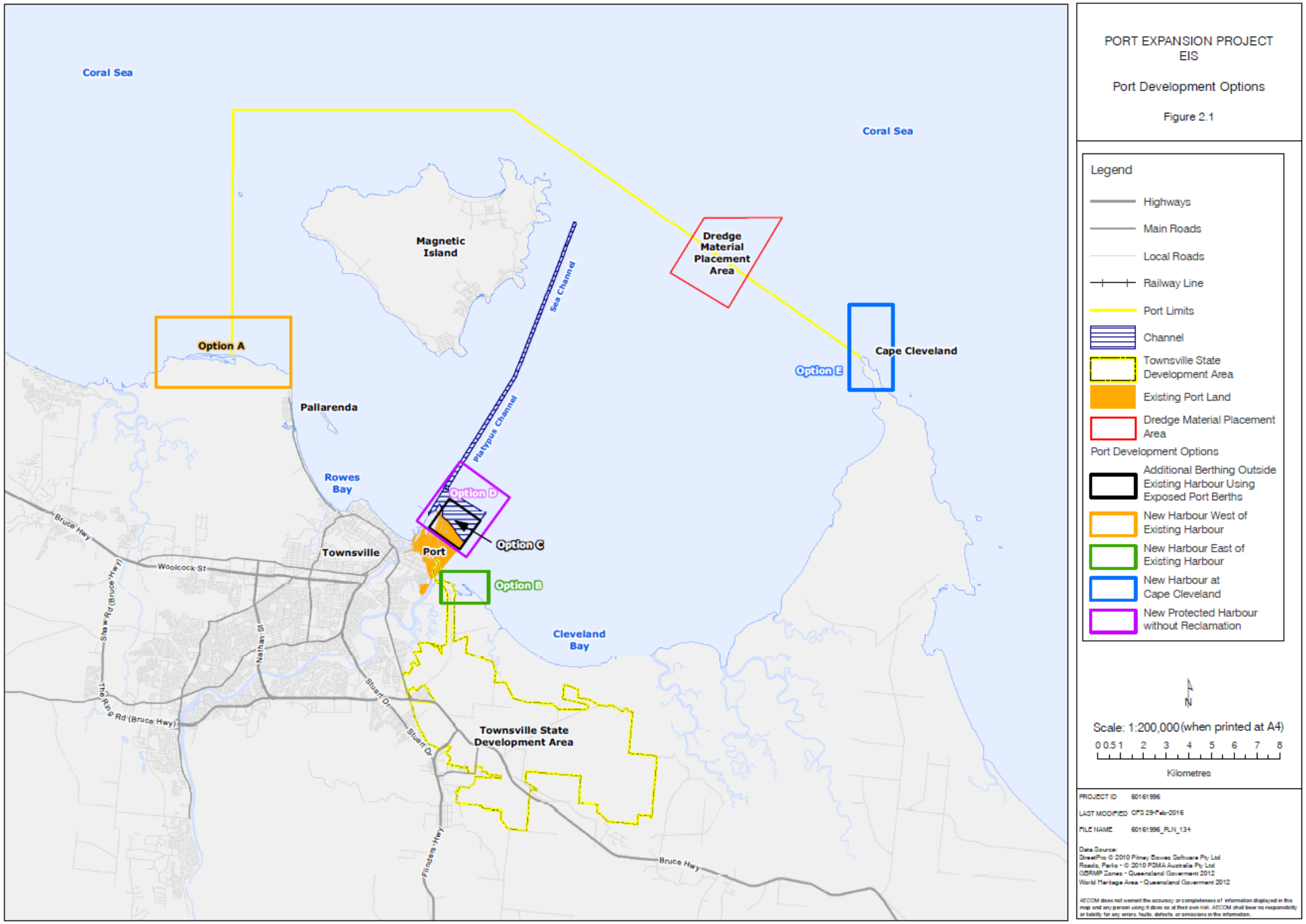

Figure 2.1 Port Development Options Considered During the PEP

The preferred EIS option is in the same general location as Option D above, but with the inclusion of land reclamation. This option provides additional berthing outside the existing inner harbour with protected berths and reclamation to provide land for cargo storage and transfer and transport infrastructure (e.g. road and rail).

The other design options assessed tended to fragment and duplicate port facilities. They are disconnected from existing land and sea access infrastructure, and require a major new approach channel to be dredged, in addition to the existing port channel. Also, these options do not provide opportunities for beneficial re-use of the dredged material produced from the harbour basin and berths. The preferred Option D was found to provide the best balance of environmental impacts, economic efficiency and safety.

2.3 Design Refinement

During the public consultation phase for the PEP EIS, undertaken in May 2013, matters raised by 84 submitters primarily related to dredging, sea placement of dredged material, and related perceived impacts to Magnetic Island and the broader Great Barrier Reef Marine Park. A number of significant changes also emerged in terms of environmental regulation and government policy as a result of national and international events. These factors are broadly summarised below.

- UNESCOs concerns triggered by the LNG projects on Curtis Island and the potential ‘in danger’ listing of the Great Barrier Reef World Heritage Area.
- A visit to Australia by a UNESCO committee and preparation of a report expressing concern about the health of the Great Barrier Reef World Heritage Area.
- Concern about dredging at other major ports along the Queensland coast.
- A review of environmental factors affecting the Great Barrier Reef World Heritage Area and preparation of a Strategic Assessment by the Commonwealth and Queensland governments (DSDIP, 2013).
- Release of the Great Barrier Reef Outlook Report 2014 (GBRMPA, 2014).
- Indications from both the Commonwealth government and Queensland government that capital dredge material should be beneficially re-used in preference to at sea disposal.
- Release of the Abbot Point dredging and sea disposal decision, subsequent legal challenges and decision by the Queensland government to investigate land based placement of the dredged material as an alternative.
- Wider and longer vessels seeking to visit Australian ports sooner than originally anticipated.
- Release of the Queensland Ports Strategy (DSDIP, 2014a) by the Queensland government as a blueprint for managing and improving the efficiency and environmental management of the State’s port network over the next 10 years. The strategy includes a commitment to concentrate port development to selected long-established major port areas (including the Port of Townsville) within or adjoining the Great Barrier Reef World Heritage Area.
- The Commonwealth Minister for the Environment ordered the creation of regulations for the Great Barrier Reef Marine Park Authority to put an end to the sea disposal of capital dredge material in the Great Barrier Reef Marine Park (The Hon. Greg Hunt MP, 2015).
- Release of complementary Queensland legislation in late 2015 with the *Sustainable Ports Development Act 2015*.
- The Act prohibits the sea-based disposal of capital dredge material into the Great Barrier Reef World Heritage Area and mandates the beneficial reuse of port-related capital dredge material such as for land reclamation, or disposal on land where it is environmentally safe to do so.
- The Act also prevents approval being granted for capital dredging areas that are in the Great Barrier Reef World Heritage Area but outside the Great Barrier Reef Marine Park unless it is for a priority port and in accordance with that port’s Master Plan, or if the development is the subject of an EIS process started before the Act came into effect. The Port of Townsville is a priority port under the Act and the PEP is the subject of an eligible EIS process.

The Project has undergone a design refinement process in direct response to submissions received during the consultation period and the changes that have occurred in government policy and legislation since the EIS was completed. This design process resulted in following key design outcomes.

- Avoiding sea disposal by relocating all capital dredge material within the reclamation for beneficial re-use which has resulted in an expanded outer harbour reclamation footprint.
- Avoiding direct impact on the Great Barrier Reef Marine Park General Use Zone by widening the channel design and only partially deepening the channel.

- Modifying the dredging methodology to reduce the bulking[1] of dredged material in order to reduce the size of the reclamation area during dewatering and consolidation. This has also resulted in improved water quality impacts during capital dredging.

The design refinement process has incorporated Berth 12 as it forms a critical component of the outer harbour swing basin. Previously, the EIS had assumed that the approved Berth 12 project will be constructed ahead of the PEP, however the introduction of the *Sustainable Ports Development Act 2015* has affected the Berth 12 approval leading to its inclusion in the revised design.

The design refinement process also included examination of in situ volumes of dredged material for each stage of the works considering different dredging and reclamation methodologies. Other critical elements included optimising the ultimate location of the rail loop within the PEP AEIS footprint, and locating any temporary breakwaters or revetments as footings to minimise the cost of installing this infrastructure when it is required.

A summary of the updates to the PEP EIS design as a result of the design refinement process is provided in Table 2.1 below. The AEIS design addresses key matters raised by respondents and is consistent with Commonwealth and State government policy and legislation changes since the EIS. Specific consideration and response to EIS submissions are provided in the relevant sections of this AEIS.

Table 2.1 Key outcomes of the AEIS design refinement process

Project Aspect	EIS Design	AEIS Design Refinement	Outcome
Reclamation size	100 ha	152 ha	Increased by 52 ha to accommodate all capital dredge material onshore
Capital dredge material placement at sea	5.6 million m^3	No placement of capital dredge material at sea	Reduced sea placement by 5.6 million m^3
Dredge Material Placement Area	Area 1,140 ha	No placement of capital dredge material at sea	No impact from placement of capital dredged material in the Dredge Material Placement Area
GBRMP*	Dredging in Stage D extending into the GBRMP* General Use Zone (extension of channel)	No dredging required within the GBRMP* General Use Zone	No direct impacts to benthic environments in the GBRMP* General Use Zone
Beneficial reuse volume (reclamation)	4.3 million m^3	11.4 million m^3	Increased by 7.1 million m^3 to accommodate all capital dredge material onshore
Dredging duration	Approximately 4 years	Approximately 10.5 years	Increased by 6.5 years due to change in dredging methodology to minimise the size of the reclamation footprint
Channel length	16.6 km	14.9 km	Channel length reduced by approximately 1.7 km
Channel width	92 m (including some minor strategic widening)	Platypus Channel – tapers from 180 to 135 m Sea Channel - tapers from 135 to 120 m	Increased channel width to accommodate longer and beamier vessels and improve vessel navigational safety
Channel navigation design depth	-13.7 m LAT	-12.8 m LAT	Reduced channel navigation design depth by 0.9 m to minimise impact in the GBRMP* General Use Zone and minimise the reclamation footprint
Number of berths for PEP	6	6	No change in number, locations have been refined
Harbour basin area	56.1 ha	51.4 ha	Reduced by approximately 4.7 ha to minimise the reclamation footprint size
Revetment wall (excluding	3.5 km	4.0 km	Increased by approximately

[1] *Bulking* - when material is disturbed from insitu giving a larger volume for the same weigh of material, usually through the realignment of particles. The level of bulking is dependent upon several variables including the type of dredging plant used and the soil characteristics

Project Aspect	EIS Design	AEIS Design Refinement	Outcome
breakwaters)			0.5 km to accommodate the reclamation increase
Project impacts	▪ Expanded reclamation footprint at an increased project cost. ▪ Reduction of total number of berths in the proposed outer harbour to seven. ▪ Shallower channel. ▪ Berth infrastructure program delayed. ▪ Modified dredge methodology and increased dredge duration. ▪ Further investigations required and undertaken as part of the AEIS.		

*Great Barrier Reef Marine Park

2.4 Port Expansion Project Revised Design

2.4.1 Project Staging

As discussed in Chapter A.3.3 of the EIS, the PEP is proposed to be developed progressively to match the demand for additional port facilities. The Project staging has been revised based on the outcomes of the design refinement process. The staging comprises 3 primary stages of development as follows:

- Stage 1 – Initial outer harbour reclamation, channel widening and Berth 12
- Stage 2 – Ultimate outer harbour reclamation, Berths 14, 15 and 16
- Stage 3 – Channel deepening, Berths 17 and 18.

The details of these stages, including approximate dredge volumes are discussed in the following sections. The AEIS Revised Design – Project Overview is illustrated in Figure 2.2.

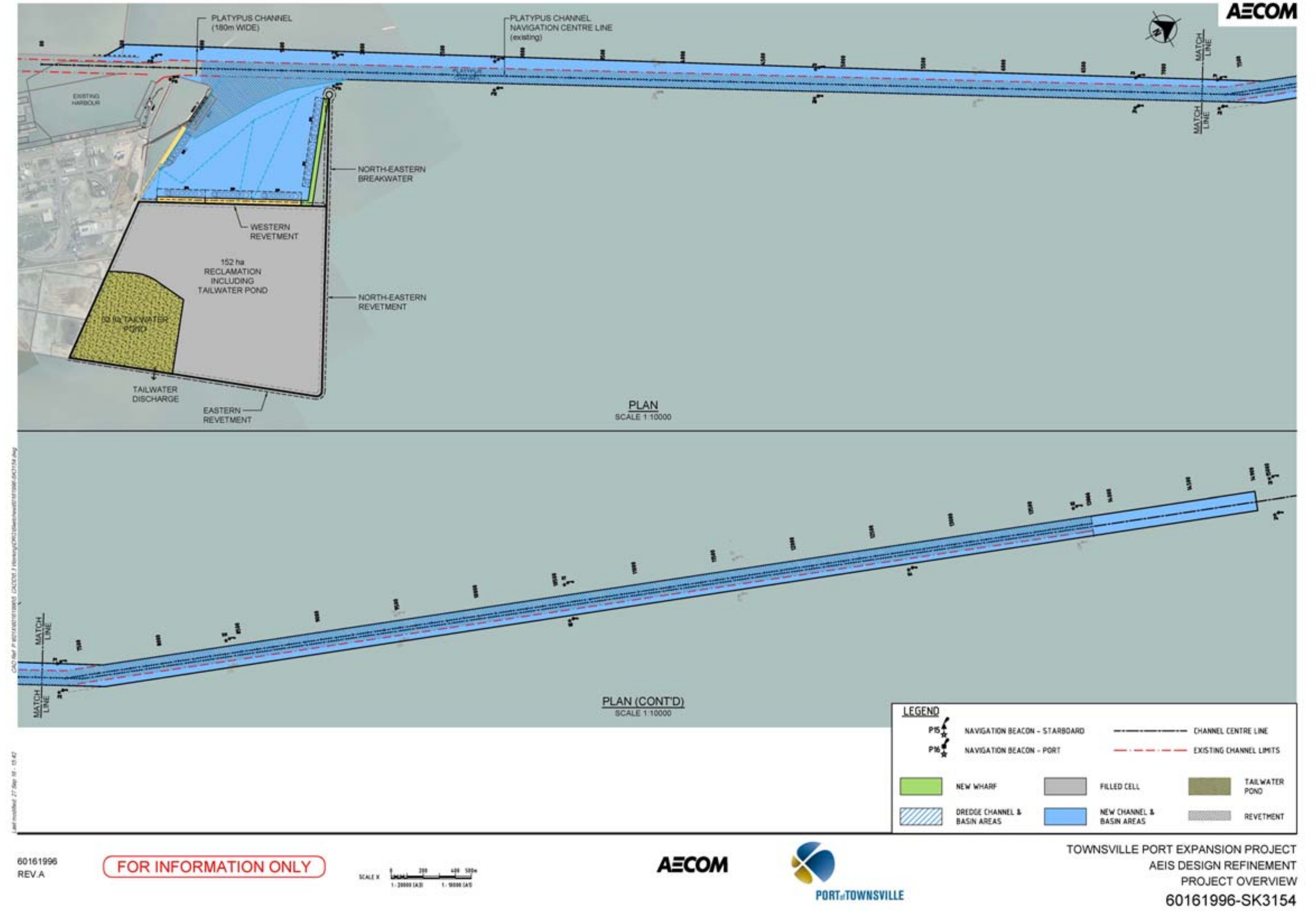

Figure 2.2 AEIS Design Refinement – Project Overview

2.4.2 Stage 1

The Stage 1 (refer Figure 2.3) development involves:

- construction of perimeter revetment structures for the initial reclamation area
- widening of the Platypus and Sea Channels
- development of Berth 12 (including dredging of basin area) and associated landside infrastructure.

Construction of revetment structures

The construction of perimeter revetment structures will create a confined area for the placement of material dredged during the channel widening and creation of the outer harbour basin. The construction of the revetment structures will involve the following activities.

- Removal of approximately 0.3 million m^3 of soft marine sediments from the area of the proposed revetment structures to form a suitable foundation and the placement of the core, filter material, secondary armour and primary armour rock. This material will be removed by a mechanical dredger and relocated to temporary bund areas within the new outer harbour reclamation area.
- Construction of revetments will consist of rock-fill bunds and rock armour layers. The material will be sourced predominantly from POTL's Granitevale quarry or other approved quarry and trucked to the site, where the rock material will be placed where previously dredged. Rock armour material from the existing north eastern revetment will also be re-used where possible. A geotextile material will be placed on the inside of the revetment structure to retain the fine sediment particles of the dredged material within the reclamation.
- The construction of the revetments may occur along one or two work faces concurrently, which will impact the duration of the activity. It is anticipated that this will occur in parallel with the removal of soft marine sediments from under the footprint of the structures, and completed over a 12 month period.

The reclamation area will include an area that will be used as a tailwater pond.

Widening of the Platypus and Sea Channels

The widened channel alignment has been determined by POTL based on simulation of likely future vessels, working in conjunction with pilots and the Regional Harbour Master. The channel widening involves the following.

- Platypus Channel
  - The widening will be on the west side of the channel and extend to just inside the inner harbour, rejoining the inner harbour channel alignment. The eastern edge will remain unchanged. The width between toelines will be 180 m at the outer harbour and reducing to 135 m at the junction with the Sea Channel. The AEIS shows the maximium width, noting the interaction with the western breakwater as a result of channel widening, will be further considered as part of detailed design.
  - A provisional allowance has been made for a small area of localised dredging on the eastern side of the channel, between Berth 11 basin and marker P16 to allow for channel batter if required.
- Sea Channel
  - The widening will be on the east side of the channel (opposite side from Magnetic Island) with the western edge remaining. The width between toelines will be 135 m at the junction with the Platypus Channel reducing to 120 m at the sea end.

Dredging will be undertaken using a Trailer Suction Hopper Dredge (TSHD) and a mechanical dredger (backhoe and/or grab dredgers). All dredged material from the channel widening will be placed in the reclamation area.

The material dredged using the TSHD will be approximately 1.5 million m^3 and typically comprise soft marine sediments and the clayey sands as these are suitable to be pumped to shore. A small TSHD (hopper capacity of approximately 3,000 m^3) is proposed due to the depth limitations during the early stages of dredging, especially in the Platypus Channel. Material will be transferred to the reclamation area by pumping in a slurry form through floating and fixed pipelines. The resultant tailwater will be managed in a tailwater pond prior to releasing it to the sea at a location on the eastern revetment. The tailwater pond is particularly important for the treatment of tailwater from the dredging undertaken by the TSHD for part of the channel widening and deepening works. The TSHD will transfer the dredged material ashore by pumping it in a slurry mix which will introduce significant volumes of water to be treated prior to release. The duration of the TSHD dredging work will be approximately 4 months.

The mechanical dredger will be used to relocate approximately 2.4 million m^3. A large backhoe dredger is proposed to excavate and place material in hopper barges. The hopper barges will transport the material to the outer harbour where they will be mechanically unloaded into the reclamation using conventional earthmoving plant. Relatively small quantities of tailwater will be generated by mechanical dredging when compared to the dredging work undertaken by a TSHD. The tailwater will be managed in a tailwater pond prior to releasing at a location on the eastern revetment. The duration of the mechanical dredging operation is estimated to be approximately 2.3years.

Construction of Berth 12

Berth 12 will be for ship operations which do not require breakwater protection from waves, such as export of bulk cargoes, i.e. similar to the current Berth 11. The development of Berth 12 will involve the following.

- Deepening of the existing outer harbour basin area and dredging of the basin area and berth pocket associated with Berth 12 (approximately 1.4 million m^3). This will be undertaken using a large mechanical dredger, with the dredged material placed in hopper barges. The barges will travel to a transfer location adjacent to the constructed revetments where the material will be unloaded and placed into the reclamation area using conventional earthmoving plant. It is anticipated dredging will be done over a period of approximately 15 months.
- If required, additional fill material will be placed on top of the dredged material so that trucks and equipment can work on the reclamation area. This fill material will be trucked in from an approved land source or sourced from within the Port.
- The wharf will be similar to the current Berth 11 as it will initially not be protected by a breakwater. The wharf structure will most likely be designed and constructed as a conventional reinforced concrete deck that is supported on steel piles. The deck level will be designed high enough to allow waves to pass under the deck.

Berth 12 terminal operations may be performed on existing port land or in the new outer harbour reclamation area. Should there be a requirement for land to be developed in the outer harbour to support Berth 12, ground improvement works may be required at this stage. It is assumed that development of the land for port operations, including the installation of services, will be undertaken in a similar manner to that described in the EIS (refer to Chapter A.3.5). The timing will be dependent on the rate at which the ground improvement is achieved.

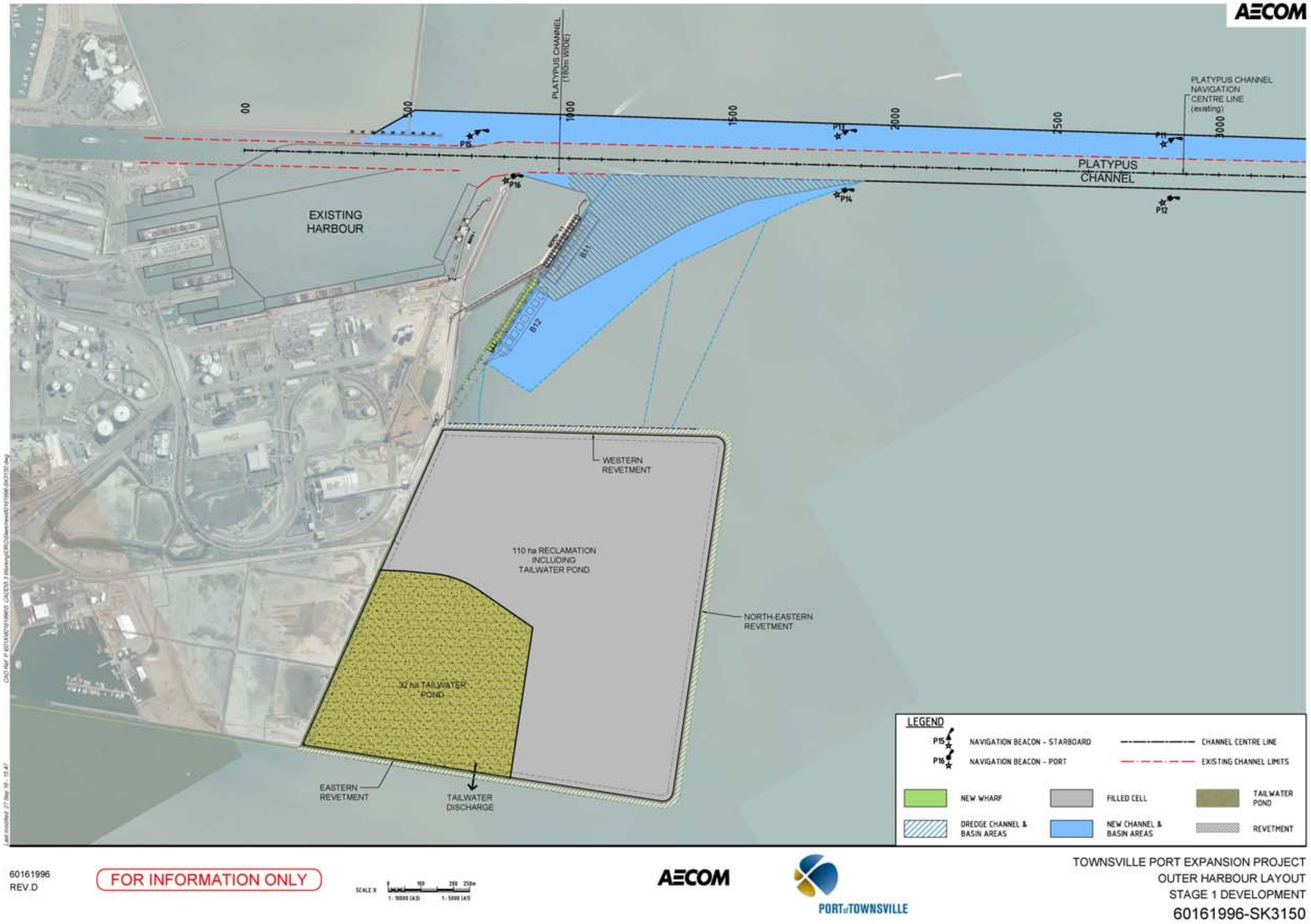

Figure 2.3 PEP AEIS Stage 1 Development

2.4.3 Stage 2

The Stage 2 (refer to Figure 2.4) development involves:

- construction of the remainder of the perimeter revetments for the ultimate outer harbour reclamation area as well as construction of the North Eastern Breakwater
- development of Berths 14, 15 and 16 in the outer harbour, including dredging of basin areas and associated landside infrastructure.

Revetment and breakwater structures

The main construction activities will be similar to the development of the revetment structures described in Section 2.4.2 for Stage 1 and comprise the following activities.

- Removal of approximately 0.2 million m^3 of soft marine sediments from the area of the proposed revetment and breakwater structures. This material will be removed by a mechanical dredger, placed directly into hopper barges and transported to be placed in the PEP Stage 1 reclamation area. It is anticipated that this will occur over a period of approximately 12 months.
- Construction of revetments will consist of rock-fill bunds and rock armour layers. The material will be sourced predominantly from POTL's Granitevale quarry or other approved quarry and trucked to the site, where the rock material will be placed. A geotextile will be placed on the inside of the structure to retain the fine particles of the dredged material.
- The construction of the revetments may occur along one or two work faces, which will impact the duration of the activity. It is anticipated that this will occur in parallel with the removal of soft marine sediments from under the footprint of the structures, and completed over a 12 month period.

Construction of a new western breakwater to protect the outer harbour, which may or may not be required depending on the results of further hydrodynamic and engineering studies to be undertaken as part of the detailed design is still relevant, as described in the EIS (Part A). If required it is envisaged that it would be constructed during Stage 2.

Berths 14, 15 and 16

Dredging for the new basin areas and berth pockets will be done after the revetment structures and North East Breakwater have been constructed. Mechanical dredging equipment will be used to relocate approximately 3.6 million m^3 of material. A large backhoe dredger is proposed to excavate the material and place in hopper barges. The hopper barges will transport the material to be mechanically placed in the reclamation area using conventional earthmoving plant. It is expected that the dredging operation for the basin areas will be undertaken as a continuous process of nearly 3.5 years. However it is also possible to dredge the requirements for each berth as separate dredging campaigns.

Development of Berths 14, 15 and 16 could be undertaken in one or more stages according to demand for facilities or to achieve efficiency of a continuous construction program. The berths will be located in a basin with breakwater protection from waves which will enable them to be developed to suit all cargo types. Development of the land for port operations, including the installation of services, will be undertaken in a similar manner to that described in the EIS (refer to Chapter A.3.5).

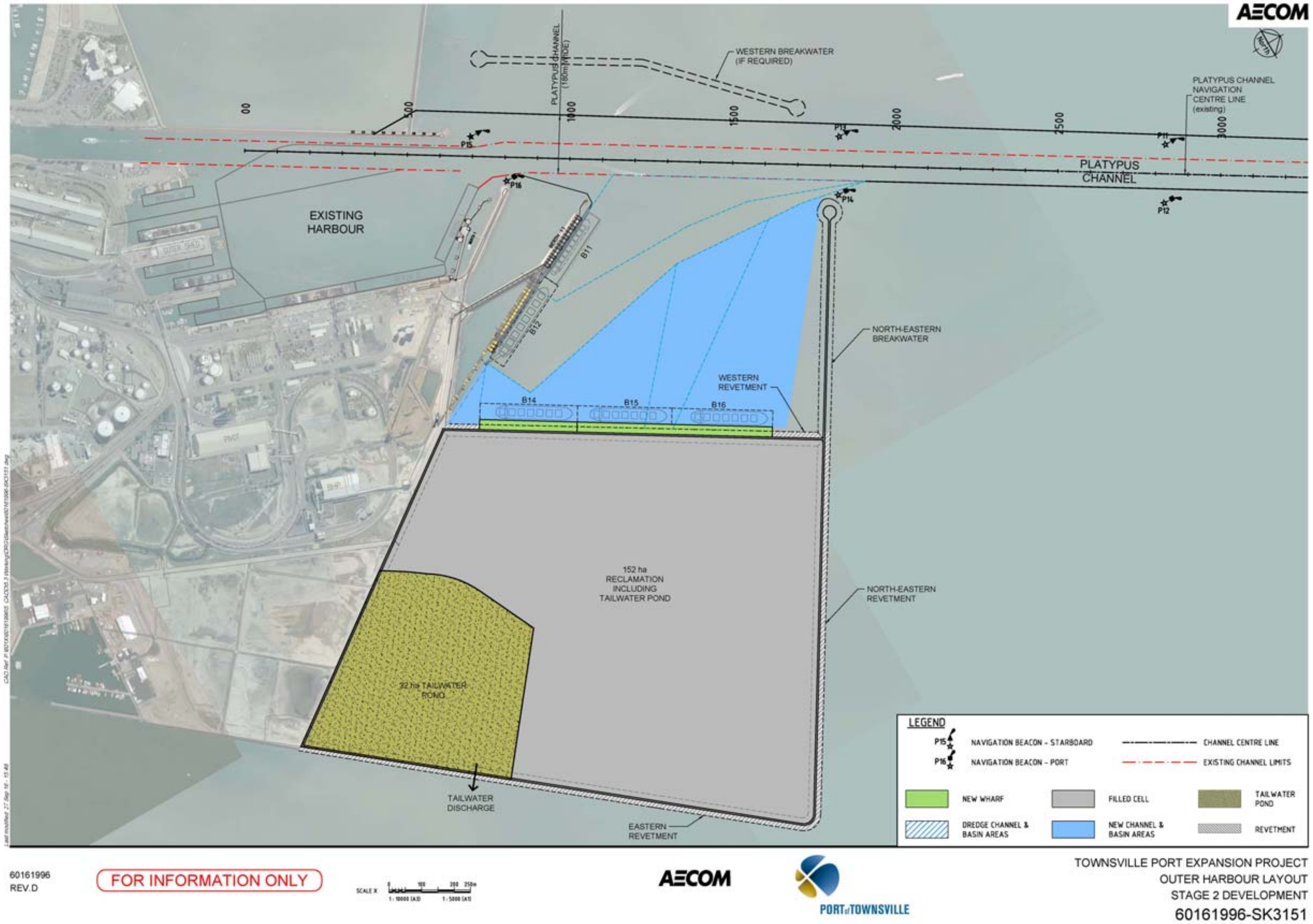

Figure 2.4 PEP AEIS Stage 2 Development

2.4.4 Stage 3

By the time that Stage 3 commences, the outer harbour perimeter revetments and North Eastern Breakwater will be established. Stage 3 development (refer to Figure 2.5) involves:

- deepening of the Platypus and Sea Channels
- development of Berth 17 and Berth 18 (including dredging of berth pockets) and associated landside infrastructure.

Stage 3 development is not constrained as the perimeter revetments and the North Eastern Breakwater will be in place and the entire outer harbour basin will have been dredged during Stage 2.

The Platypus and Sea Channels will be deepened to a navigation design depth of -12.8 m LAT using a TSHD and a mechanical dredger (backhoe and/or grab dredgers). All dredged material from the channel deepening will be placed in the reclamation area. The channel deepening will result in the Sea Channel being lengthened approximately 1 km seaward, rather than the 2.7 km lengthening proposed in the EIS.

The TSHD will be targeted to material types that are suitable to be pumped ashore. The material dredged using the TSHD will be approximately 0.7 million m^3 and typically comprise soft marine sediments and the clayey sands. A small TSHD (hopper capacity of approximately 3,000 m^3) is proposed to appropriately manage the turbidity from dredging operations. Material will be transferred to the reclamation area by pumping in a slurry form through floating and fixed pipelines. The resultant tailwater will be treated in a tailwater pond prior to releasing it to the sea at a location on the eastern revetment. The duration of this work will be approximately 8 weeks.

The mechanical dredger will be used to relocate approximately 1.3 million m^3. A large backhoe dredger is proposed to excavate and place material in hopper barges. The hopper barges will transport the material to the outer harbour where they will be mechanically unloaded into the reclamation using conventional earthmoving plant. The duration of the mechanical dredging operation is estimated to be approximately 2.2 years.

Development of Berth 17 and Berth 18 could be undertaken in one or two stages according to demand for facilities or to achieve efficiency of a continuous construction program. Dredging of the berth pockets will involve mechanical dredging of approximately 0.08 Million m^3 of material which will be relocated to the reclamation area. The berths will be located in a harbour basin with breakwater protection from waves which will enable them to be developed to suit operations that do not require land immediately behind the berths. Development of the land for port operations, including the installation of services, will be undertaken in a similar manner to that described in the EIS (refer to Chapter A.3.5).

2.4.5 Dredge Volume Overview

The following provides a summary of the above dredging volumes by stage and dredge type. These volumes are approximate based on current design and presented as million m^3.

- Stage 1
  - Revetment structures dredging with mechanical dredger – 0.3.
  - Widening of Platypus and Sea Channels with TSHD – 1.5.
  - Widening of Platypus and Sea Channels with mechanical dredger – 2.4.
  - Berth 12 basin and pocket dredging with mechanical dredger – 1.4.
- Stage 2
  - Revetment and breakwater structures dredging with mechanical dredger – 0.2.
  - Berth 14, 15 and 16 basin and pocket dredging with mechanical dredger – 3.6.
- Stage 3
  - Deepening of Platypus and Sea Channels with TSHD – 0.7.
  - Deepening of Platypus and Sea Channels with mechanical dredger – 1.3.
  - Berth 17 and 18 pocket dredging with mechanical dredger – 0.08.

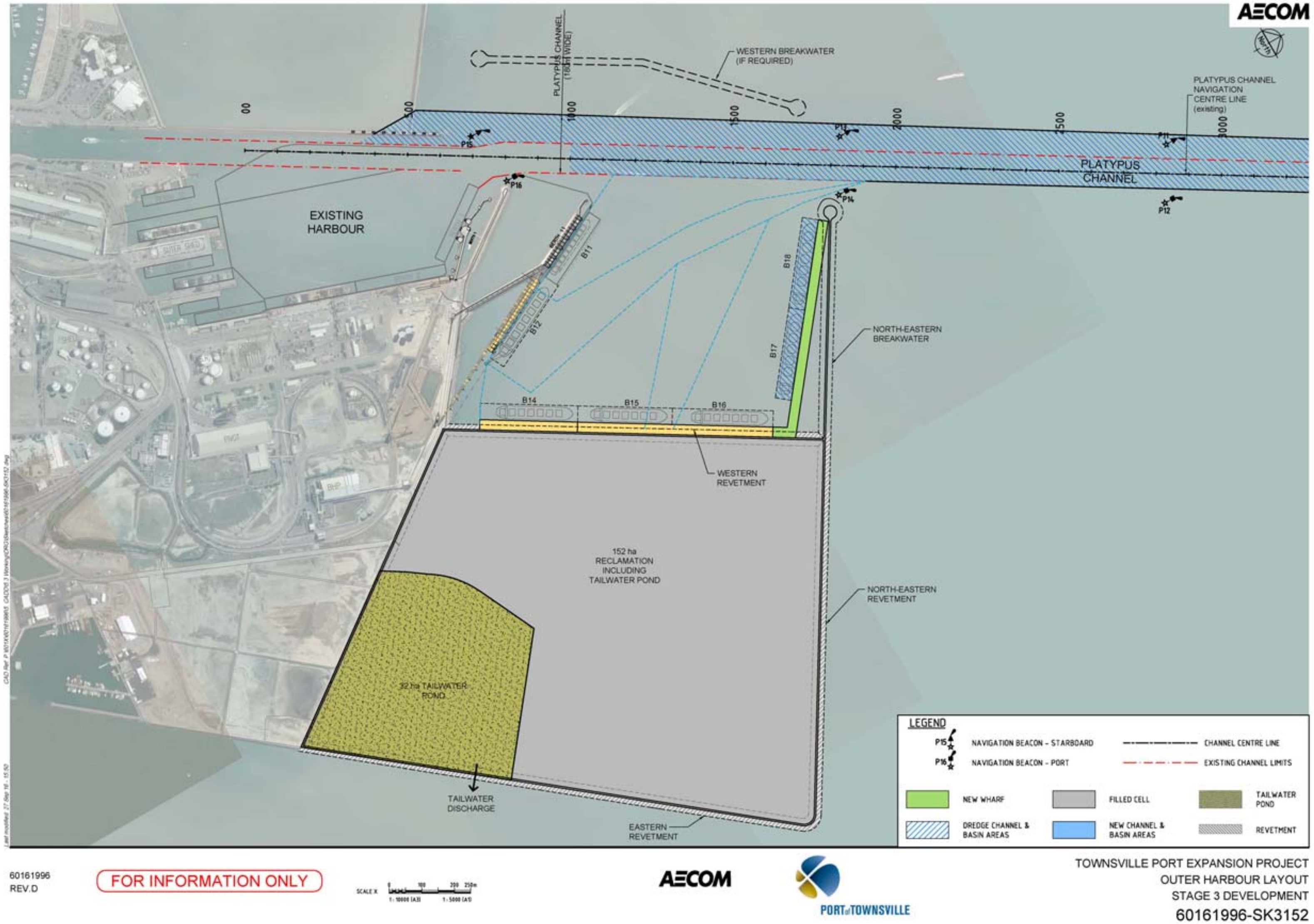

Figure 2.5 PEP AEIS Stage 3 Development

2.4.6 Project Program

The AEIS construction program recognises that the timing of the new berths and associated infrastructure is dependent on trade growth and available port capacity. Other considerations including the long lead time in obtaining approvals, procuring contractors, construction timing and duration require that the proposed sequence and timing of development will be regularly reviewed and adjusted to reflect the actual demand for cargo handling capacity and shipping requirements.

The construction timing for the revised design is provided in Table 2.2. This indicative program forms the basis of assessment in the AEIS and is dependent upon assessment and approval timeframes.

Table 2.2 Indicative PEP staging program

Stage	Start construction*	Total duration*	Indicative duration of main construction activities***
Stage 1	2017	4.5 years	
Reclamation perimeter structures (Initial)	2017 (Q1)**	12 months	Construction of temporary revetment structure to capture soft material from under perimeter revetment bunds over approximately 12 months (Q1 2017 to Q4 2017). Construction of bunds over 12 months (Q1 2017 to Q4 2017).
Channel widening	2018 (Q1)	2.3 years	Dredging to widen Sea and Platypus Channels over 2.3 years (Q1 2018 to Q1 2020).
Berth 12	2020 (Q2)	15 months	Deepening of the existing outer harbour basin and dredging of basin area and pocket for Berth 12 over 15 months Q2 2020 to Q2 2021. Concurrent construction of wharf over 12 months. Construction of landside infrastructure over 9 to 12 months.
Stage 2	2023	4.5 years	
Reclamation perimeter structures (ultimate) & North Eastern Breakwater	2023 (Q1)	12 months	Dredging of material under perimeter revetment bunds and North Eastern Breakwater over 12 months (Q1 2023 to Q4 2023). Construction of bunds over 12 months (Q1 2023 to Q4 2023) overlapping with dredging activity.
Berth 14	2024 (Q1)	17 months	Dredging of basin area for Berth 14 over 14 months Q1 2024 to Q1 2025, including 3 weeks to dredge the Berth 14 pocket.. Construction of wharf over 12 months. Construction of landside infrastructure over 9 to 12 months.
Berth 15	2025 (Q2)	13 months	Dredging of basin area for Berth 15 over 10 months Q2 2025 to Q4 2025 including 3 weeks to dredge the Berth 15 pocket. Construction of wharf over 12 months. Construction of landside infrastructure over 9 to 12 months.
Berth 16	2026 (Q1)	20 months	Dredging of basin area for Berth 16 over approximately 17 months Q1 2026 to Q2 2027 including 3 weeks to dredge the Berth 16 pocket. Construction of wharf over 12 months. Construction of landside infrastructure over 9 to 12 months.
Stage 3	2030	2.5 years	
Berth 17 & Berth 18	2030	19 months	Dredging of berth pockets for Berth 17 and Berth 18 over 5 weeks. Construction of wharves over 18 months. Construction of landside infrastructure over 16 to 19 months.
Channel deepening	2030	2.2 years	Dredging to deepen Sea and Platypus Channels.

* This program is indicative based on preliminary PEP design and subject to all relevant assessments being undertaken and approvals being obtained. Some overlap exists between the construction components.
** Q1 – Quarter 1, Q2 – Quarter 2
*** Refer to Figures 2.2 to 2.5 for a visual representation of dredge areas for each stage

2.4.7 Project Design Summary

Table 2.3 summarises the design refinement outcomes and represents the updated PEP Design parameters which are the subject of this AEIS. The dredge depths are presented as Average Dredge Depth at Lowest Astronomical Tide (LAT).

Table 2.3 Design Elements and Average Dredge Depth

Design Element	Stage 1	Stage 2	Stage 3
Channel Characteristics			
Channel widening	Platypus Channel: 180 m at harbour, tapering to 135 m at sea channel. Sea Channel: tapering from 135 m to 120 m at outer end.	-	-
Channel deepening	-	-	Both channels to an average dredge depth of -13.6 m LAT
Enclosed reclamation area	110 ha	152 ha	Placed in Stage 2 area
Berth staging	12	14, 15 and 16	17 and 18
Average Dredge Depth*			
Berth 12	-15.5 m LAT		
Berth 14		-15.5 m LAT	
Berth 15		-15.5 m LAT	
Berth 16		-15.5 m LAT	
Berth 17			-15.5 m LAT
Berth 18			-15.5 m LAT
Outer harbour	-13.1 m LAT	-13.1 m LAT	-13.1 m LAT
Channel			-13.6 m LAT

* A Navigation Design Depth has been used to describe the channel depth during the design process in the EIS and AEIS. The Navigation Design Depth includes allowances for underkeel clearance, and other tolerances which are applied for safe vessel navigation. Navigational Design Depth of -12.8 m LAT in the channel translates to an Average Design Depth of – 13.6 m LAT.