SOUTHERN PORTS
ALBANY BUNBURY ESPERANCE

Port of Esperance

Port Master Plan

Foreword

Southern Ports has developed a Port Master Plan (PMP) for the Port of Esperance. The Plan has assessed potential trade for a 30-year planning period, considering current and future trade opportunities and how this could influence development within the Port.

Concept development items have been produced for short-, medium- and long-term horizons within the thirty-year planning timeframe, with the process to reach these development items outlined.

The Port Master Plan for the Port of Esperance seeks to set out how particular areas can (as opposed to will) develop and redevelop into the future. The document is not considered to be a statutory planning document, but rather is available as a strategic tool to support development and investment decisions within the Port.

This plan was endorsed by the Board of Southern Ports on 16 March 2023.

SOUTHERN PORTS
ALBANY BUNBURY ESPERANCE

Section 1: Introduction and Background

This section summarises the strategic Port Master Plan objectives, outlining what a Master Plan is and what benefits it can offer. Southern Ports' values and the sustainability considerations imbedded into the Port Master Plan are described.

A snapshot of the Port through time is also provided, demonstrating how the Port of Esperance came to be and illustrating historical trade throughput.

Section 2: Port Master Planning Process

The process undertaken to produce the Port Master Plan is outlined in this section, providing an overview of the stages and methodology.

Stakeholder engagement is a key part of the Master Planning process. As such, a summary of some of the key outcomes from engagement activities is provided, leading into a summary of the opportunities and constrains specific to the Port of Esperance.

Section 3: Trade Forecast Scenarios and Infrastructure Needs

Trade is one of the core influences behind the Port Master Plan. This section outlines how differing trade scenarios were developed and how these influence infrastructure and land requirements within the Port.

Section 4: Esperance Port Master Plan

This section defines the Port Master Plan development items, outlining how the Port could look in the future considering short-,medium-, and long-term infrastructure and development solutions. A breakdown of each item is provided describing the scope of each item.

A brief discussion around the future of Ports and a document conclusion is also provided in this section.

01.

Introduction and Background

The Port of Esperance is the most south-easterly Port in Western Australia, supporting the greater Goldfields-Esperance region. The wider harbour has been in operation in some form since the late 1800s, with land backed wharfs brought into operation in the 1960s. Southern Ports is responsible for managing the Port of Esperance facilities (along with the Ports of Albany and Bunbury).

Strategic Port Master Plan Objectives

Port Master Plan Objectives

The Port of Esperance PMP aims to:

- Clarify and further define Southern Ports' strategic planning for the Port over a 30-year horizon
- Guide and facilitate future developments, including infrastructure developments
- Reserve Port and other land for future developments, if required
- Align with the overarching development plans prepared for Esperance, the Goldfields-Esperance region and wider Western Australia
- Consider opportunities, constraints and risks from various perspectives such as trade, maintenance and port expansion, environmental, and social aspects
- Be flexible to allow updating in future, with ever changing planning parameters

What is a Port Master Plan?

A Port Master Plan is a document which describes a high level development concept for a Port, seeking to:

- Set out how a particular area can (as opposed to will) develop and redevelop in future.
- Set out objectives and strategies to manage development and change over time.
- Define what is important about a place and how its character and quality can be conserved, improved and enhanced.

What are the benefits of a Port Master Plan?

An effective Port Master Plan will:

- Create additional economic value via increased industry and investment confidence.
- Assist in overall supply chain management by integrating the Port into broader network considerations, and ensuring that vital infrastructure is delivered when and where it is needed (via well-considered staging options).
- Maximise significant economic and productivity improvements through efficient management of critical infrastructure delivery and protection.
- Provide increased environmental protection by identification of critical environmental values early in the design process.
- Help to inform Port users, employees and local communities as to how they can expect to see the Port develop into the future.

The Port Master Plan is used to coordinate the preparation of more detailed plans, and guide the Port development planning process in the short to longer term (30 years).

Southern Ports Values

Southern Ports is focussed on creating optimum value for all stakeholders that includes for best practise sustainability principles.

Our Vision

Strong regional ports, strong regions.

Our Values

- Safety: Demonstrating an uncompromising commitment to safety at all times
- Integrity: Holding high standards of conduct and decision-making to ensure confidence and trust
- Teamwork: Working as one team to achieve a common goal
- Future focus: Building a sustainable future aligned with our vision, while representing our history.
- Accountability: Empowering people to perform well, demonstrating initiative and acting responsibly

Southern Ports has adopted and operates to fulfill the roles of port set out in Figure 1.1 that relate to the key overarching themes of Prosperity, Environment and People and Partnerships.

Figure 1.1
Roles of Ports
Source: SP SDP 21-30

Sustainability

Sustainability Considerations & Alignment

Sustainability has been a key consideration during the PMP process. 'Core Sustainability Principles' were established and considered during the PMP project – seen below in Table 1.1.

Consideration and alignment between items below is set out in Table 1.2 :

- Key 'Options Analysis' considerations
- Southern Ports Sustainability Themes
- Key 'Materiality Issues' (identified during the project stakeholder survey) and the relevant UN Sustainable Development Goals.

The preferred PMP solution has included consideration of these matters - ensuring an enduring, sustainable 'plan' which meets the expectations of Southern Ports and the wider community.

'Core Sustainability Principles' to meet:	Achieved in PMP?
Drives Land Use Efficiency	✓
Facilitates Economic Growth	✓
Ensures Resilient & Adaptive Infrastructure	✓
Manages the 'Port-City' Interface	✓
Included Early Consideration (& subsequent protection) of Environmental Values	✓
Identifies & Protects of Critical Supply Chains	✓
Included Stakeholder Engagement, Inclusiveness & Transparency	✓
Maintains Port Safety & Security	✓

Table 1.1 Core PMP Sustainability Principles
Source: Sprott Planning & Environment

Sustainability Alignment

Sustainability Theme	PMP Materiality Issues	United Nations SDGs	PMP 'Options Analysis Considerations'
Prosperity	• Facilitating/Supporting Trade Growth & Diversity • Supporting & Activating Shire, Regional and WA Economic Activity • Providing Confidence for Investment within the region	8	Enabling infrastructure and regional development
Partnerships Prosperity	• Driving Port Efficiency • Clarifying the 'Vision' for the Port of Esperance • Exploring joint venture partnerships/opportunities for future development	9, 11, 15, 17	Planning & Delivery
Planet Prosperity	• Focusing on Safe and Clean Shipping • Driving Port Efficiency • Clarifying Dredging/Sediment Management projects	14, 17	Navigation
Planet Prosperity	• Driving Port Efficiency • Clarifying Dredging/Sediment Management projects	12, 14	Operability - Berth
Prosperity	• Driving Port Efficiency	8, 9, 11, 13	Ensures Resilient & Adaptive Infrastructure
Prosperity Partnerships	• Ensuring Efficient and Protected Supply Chains and Corridors (Road, Rail & Sea) • Driving Port Efficiency	9, 17	Operability - Land - Materials Handling Corridors (Supply Chains etc)
Prosperity Partnerships	• Driving Port Efficiency	9, 17	Operability - Land - Road Interface
Prosperity	• Ensuring Business Flexibility, Resilience & Adaptation	8, 9, 11	Scalability
Prosperity	• Investigating Local Supply Opportunities • Ensuring Business Flexibility, Resilience & Adaptation	9, 11	Construction Fronts / Schedule
Partnerships	• Ensuring safety & security of people at and around the port • Openness & Transparency with the Township • Investigating Local Supply Opportunities • Clarifying the 'Vision' for the Port of Esperance	3, 8, 11, 17	Social Impacts
Planet Partnerships	• Managing potential Port Impacts (eg. Air, Noise, Stormwater) • Managing & Preserving Biodiversity around Port Precinct - in partnership with Shire of Esperance • Management of Separation Distances (ie. Port Buffers) • Ensuring 'Sustainability' informs decision-making • Addressing Climate Change Resilience & Adaptation	6, 7, 13, 14, 15	Impacts on the Environmental Aspects
Prosperity	• Providing Confidence for Investment within the region	8, 11	Financial Aspects

Table 1.2 Sustainability Alignment
Source: GHD/Sprott Planning & Environment

Esperance Port Layout and Security Zones

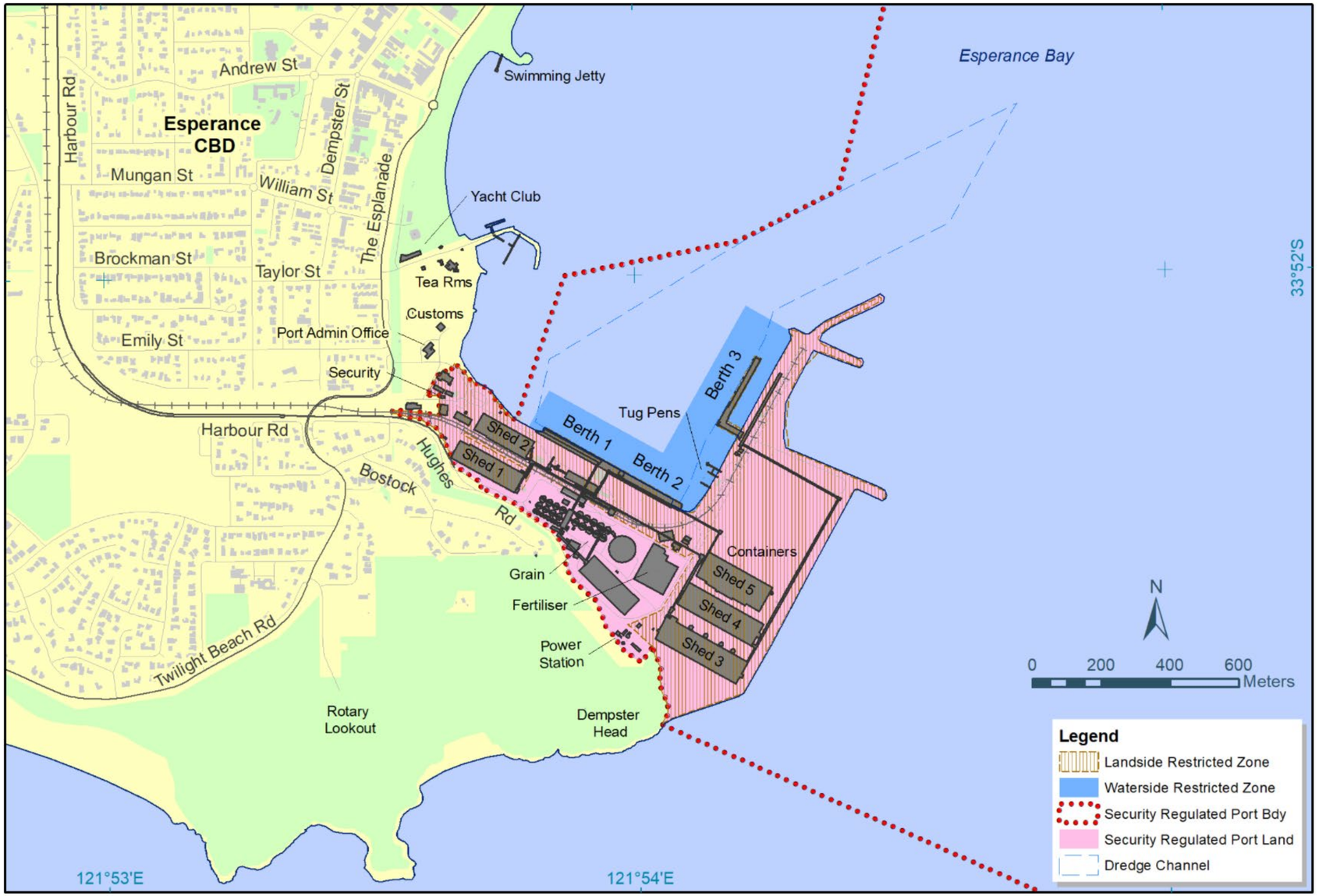


Figure 1.2
Port of Esperance layout and Security Zones
Source: Southern Ports Authority

History

The Port of Esperance has been in operation in various forms since the formation of Esperance townsite in the late 19th century. The Port has undergone many changes since then to evolve to the current configuration as the gateway for trade. Southern Port is currently responsible for managing the Port of Esperance, and is governed under the Port Authorities Act 1999.

The Port's main trades are iron ore, nickel and grain, while also supporting spodumene, containers, fuel, cruise tourism and other trades.

The Port of Esperance has played a vital role in the development of Esperance and the surrounding region. The Port has been expanding since the 1960s, following a development journey described in the adjacent timeline.

Port of Esperance

1863-93

- The Dempster Brothers begin farming in the Esperance region
- Small regular shipping service established
- Small jetty / landing built near Dempster Head for wool export
- Esperance townsite declared

1894

- Newtown Jetty was constructed
- Port of Entry proclaimed

1902

- Esperance Bay Jetty tendered for lease

1925

- Rail connection to Esperance

1934-35

- Construction of Esperance Deepwater Jetty at Hartnett's Point – 8m maximum depth

1956-60

- Pipeline installed on Deepwater Jetty for Shell
- Vacuum Oil (Mobilgas) built adjacent Deepwater Jetty

1962

- First vessel loads wheat in bulk on Deepwater Jetty
- Fertilizer commences manufacturing at Esperance
- Harbour works contracts awarded

History continued

Port Master Plan Pathway

The Port has operated for a long time, experiencing many changes to evolve to the current configuration.

The Port supports, and is critical to, the Esperance and Goldfields region and the local Esperance community.

Potential future growth in trade could exceed the current 60 year old basin capacity – requiring upgraded and new port infrastructure to accommodate the long term growth potential for the Goldfields-Esperance region.

1963-69

Dredging works for new harbour undertaken

Breakwater (1044 m long) is constructed

90 hectares of land reclaimed

Landbacked Berth 1 is constructed

Stage 1 of the CBH Grain Terminal (8 silos)

Esperance Port Authority Act 1968 assented

Dredging of harbour basin used for beach nourishment

1970-1990

Deepwater Jetty renamed Tanker Jetty

Berth 2 opened

Esperance Port Authority Lands Act 1979

Bandy Creek Boat Harbour opens

Dredging undertaken to deepen harbour and widen channel. Spur groyne constructed

1990 -2000

Esperance Shire assumes control of the Tanker Jetty

Iron ore mined at Koolyanobbing – export commenced

New bulk minerals loader on Berth 2 constructed to handle nickel concentrate

CBH committed to major upgrade of their grain export terminal

1.8 billion m3 of spoil in harbour basin deepening

2000-2020

Cape class capability provided at Berth 3, including reclamation of 23 hectares of land, two 300,000 tonne storage sheds, rail upgrades, installation of travelling ship-loader

Sulphur storage and handling facility constructed (120,000t capacity)

Multi-purpose rail mounted shore-based gantry crane installed

Design depth of Berths 1 & 2 is 14.6m CD, Berth 3 and the inner channel are 19.1m CD, middle channel is 19.5m CD, outer channel is 19.9m CD

NOW

SHORT-TERM
<5 years

MEDIUM-TERM
6-10 years

LONG-TERM
11-30+ years

Historical Port Throughput

Historical Port throughput is dominated by iron ore and grain products. In the 2020/21 financial year, commodity throughput included:

Exports

Commodity	Throughput
Iron ore	10.2 mtpa^
Grain	2.3 mtpa
Spodumene	0.7 mtpa
Woodchips	0.13 mtpa
Copper/Nickel products	0.19 mtpa

Imports

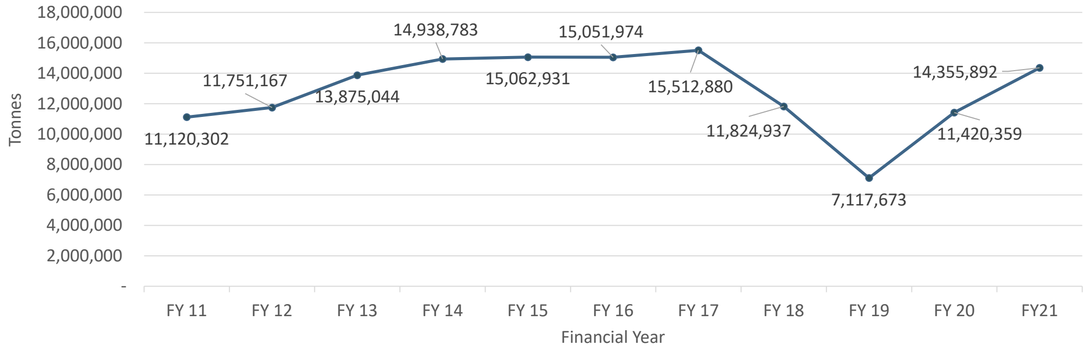
Commodity	Throughput
Oil/Petroleum products	0.35 mtpa
Fertilizer	0.19 mtpa
Sulphur	0.27 mtpa

Over the last five years total cargo trade volumes have fluctuated in a range between 7 to 15.5 mtpa, with imports of under 1 mtpa and exports accounting for the remainder. The fluctuation during this period was caused by the cessation of a number of iron ore exports as global iron ore prices became uneconomic for a number of mining projects, however strong growth has increased iron ore export volumes across the 2020/21 financial year period.

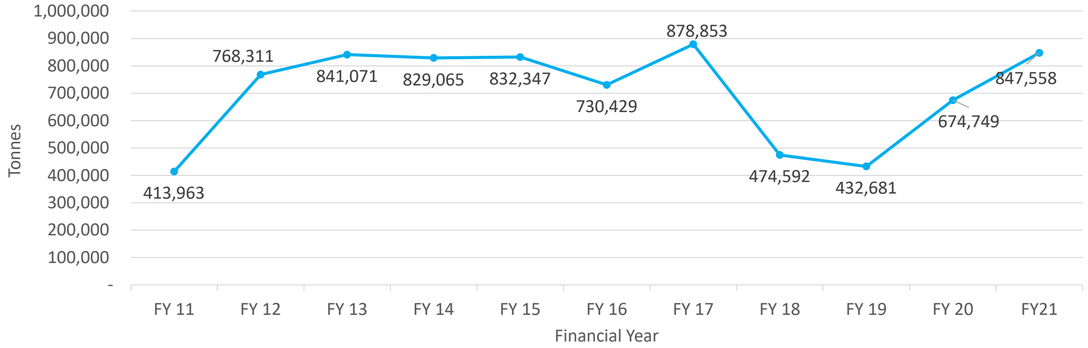
The adjacent figures provide an overview of the historical Port throughput for key commodities.

^ mtpa = Million Tonnes per Annum

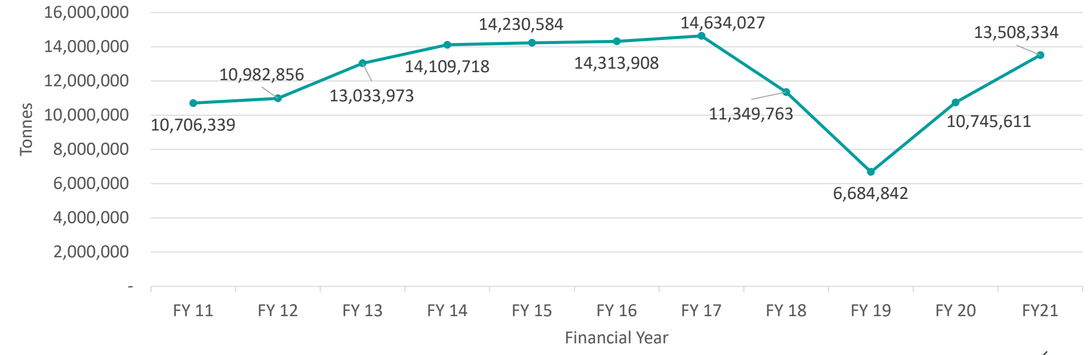
Historical Port throughput (FY11-21)



Historical Port Imports (FY11-21)



Historical Port Exports (FY11-21)



Transport Connectivity

Port throughput is limited to the efficiency of the Goldfields-Esperance regional transport corridors that support the transfer of goods between the port and this hinterland.

The PMP seeks to provide a forward development path that can be integrated within the greater regional transport network planning.

The primary transport corridors that support the Port of Esperance are the Goldfields - Esperance rail system and the local and regional road network made up predominantly of Harbour Road and the South Coast, Goldfields, Coolgardie Esperance and Great Eastern Highways.

The rail system outside the port boundary between Kalgoorlie and Esperance is approximately 383 kilometres in length with seven passing loops and a 23 tonne axle capacity. This rail has approximate capacity to accommodate 11.5 mtpa and consideration of new rail loops and / or other measures will be required to increase throughput capacity in future.

The current rail system in the port requires that train lengths be limited due to physical rail length beyond the rail car dumper. Opportunities to increase train lengths provide operational and capacity efficiencies but will also require consideration of impacts on other areas such as public vehicle interactions at level crossings (e.g. Pink Lake Road intersection). This will require consideration by relevant Local Government, road and rail authorities in future planning.

The regional road networks are mostly certified to accommodate RAV 7 (36.5m long, 123.5 tonne maximum) vehicles but there is an ever increasing trend towards larger vehicles to increase freight cost efficiency. Currently PBS 3B vehicles (42m long, 153 tonne maximum) have access to the port from all major road links.

Safety, quality and maintenance concerns, especially on roads designed and constructed in the 1960's remains a concern. Future planning, funding and capacity increases within the road networks will be required to match growth in hinterland commodity growth.

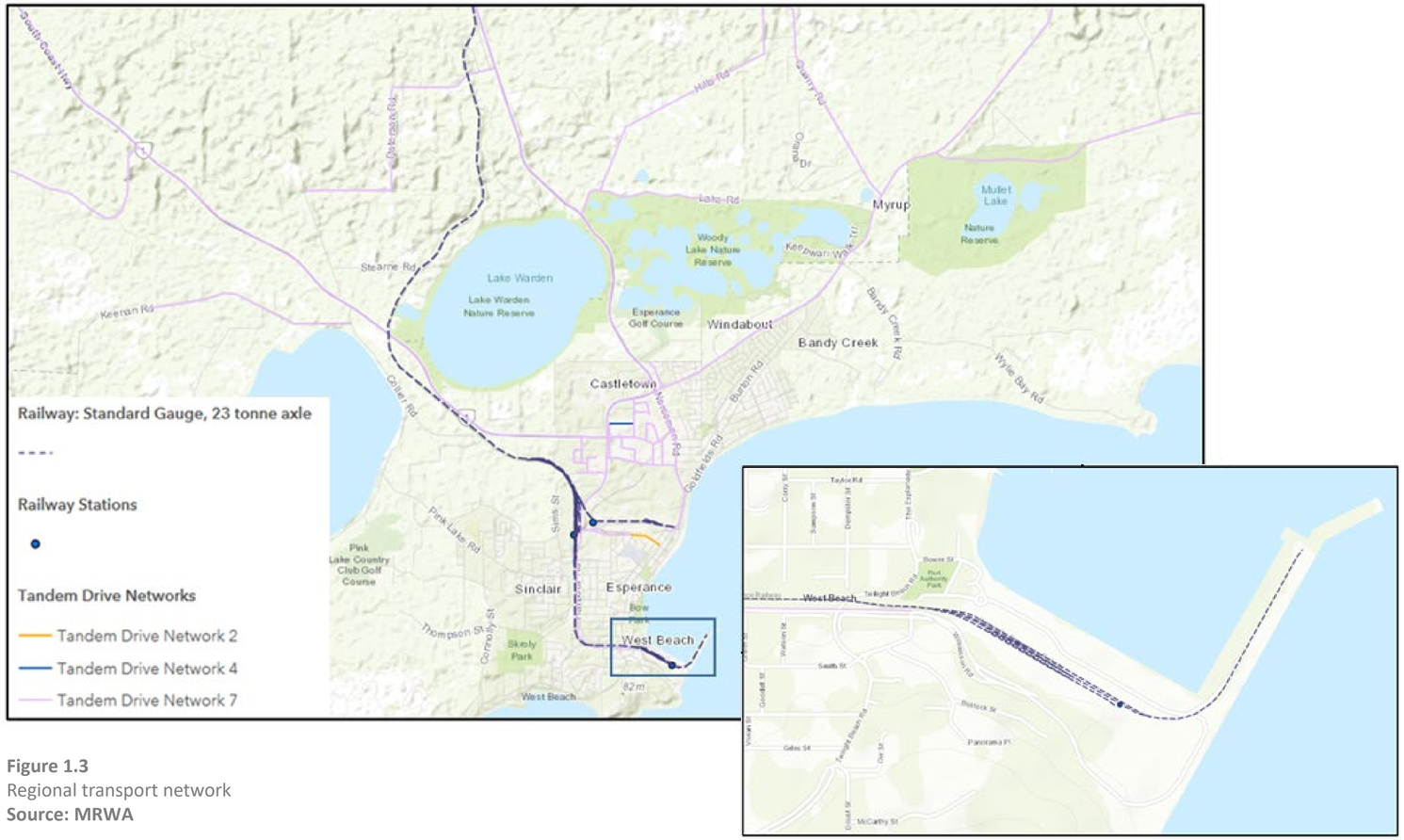


Figure 1.3
Regional transport network
Source: MRWA

02.

Port Master Planning Process

The process undertaken to produce the Port Master Plan is outlined in this section, providing an overview of the stages and methodology.

Process and Methodology

The process adopted for Esperance Master Plan closely aligns with International Port Planning and Ports Australia Guidelines for port development and has followed a series of stages tailored to suit the unique requirements of the Port of Esperance.

The process comprises 3 key steps:

- Baseline Establishment
- Option Development
- Preferred Plan Development

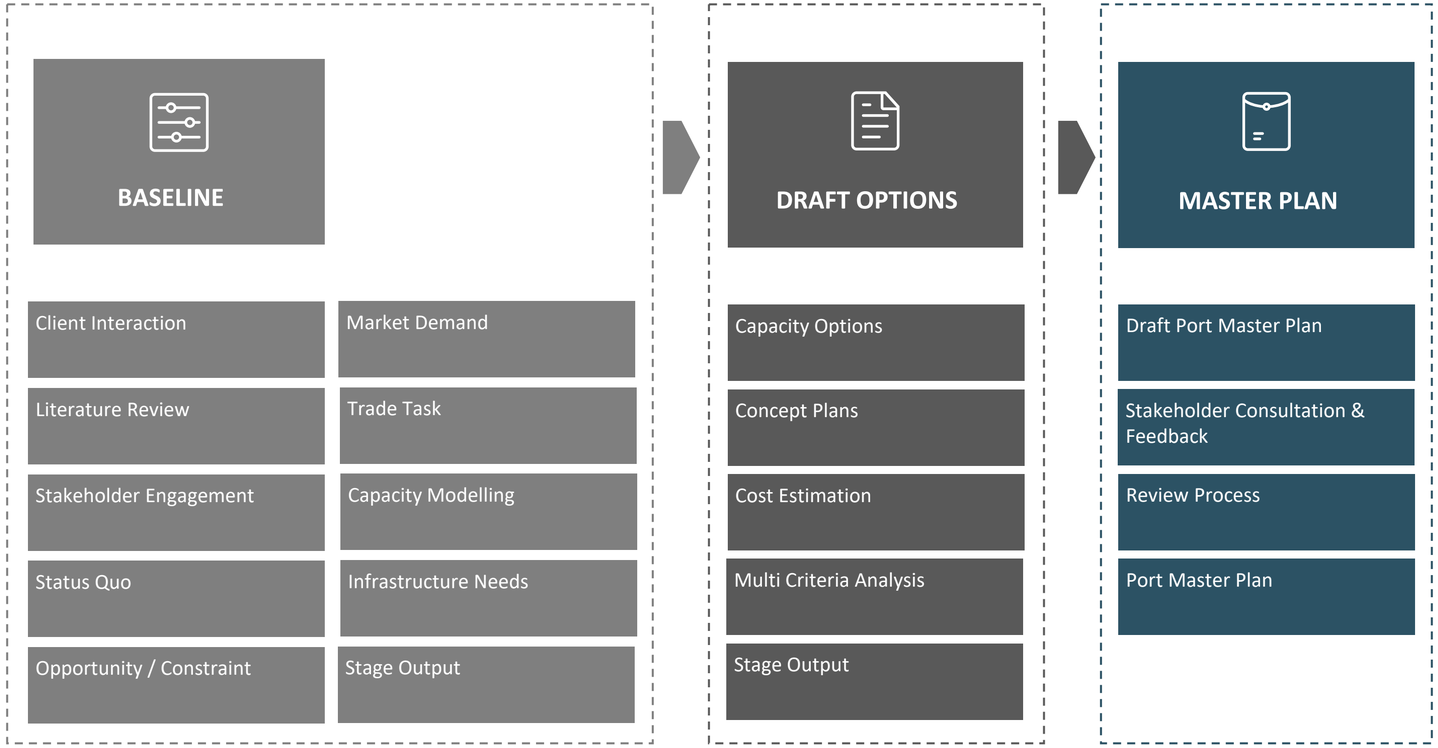


Figure 2.1
PMP study process
Source: GHD

Engagement Process and Outcomes

Efficient communication, consultation and engagement of stakeholders and potential proponents are critical steps toward achieving a comprehensive PMP. This creates an effective balance between the various and sometimes conflicting interests, concerns and considerations of key stakeholders. Stakeholder consultation was aimed primarily to achieve the following goals:

- To identify and classify external stakeholders based on their interests, involvement and concerns in the future development of the port
- To obtain vital input from stakeholders, where applicable, about their future trade, operational procedure, vessel sizes, project timing and other critical data which may dictate modification to the default master planning assumptions
- To obtain stakeholder views including governmental and community-based groups on how the port development is to be planned, funded and managed into the future

An overview of the overall stakeholder consultation process is provided below.

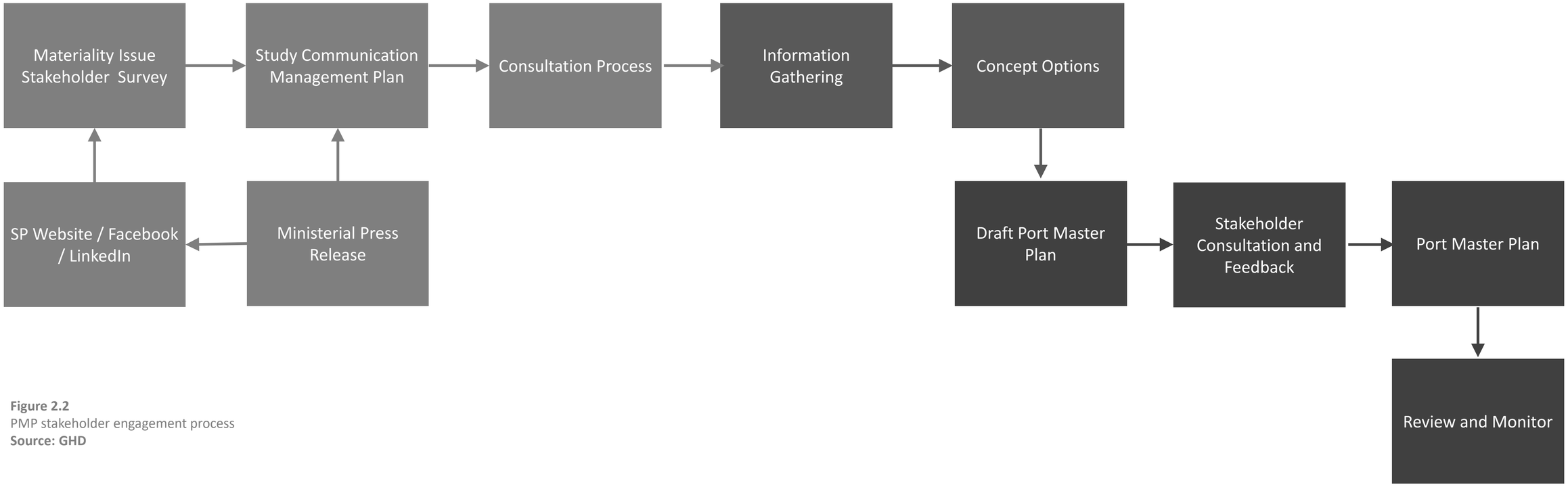


Figure 2.2
PMP stakeholder engagement process
Source: GHD

Public Pre-Planning Survey

A public pre-planning survey was undertaken, intended to provide Port stakeholders, staff, and the wider community the opportunity to give their view on issues they thought important for the master planning process.

Survey requested ranking of important issues within three key themes, namely, People & Partnerships, Environment and Prosperity.

Respondents were asked to rate material issues in terms of importance, with the results summarised in Table 2.1 and Figure 2.3.

Item	Theme	Important Issues
1	People & Partnerships	Ensuring safety & security of people at and around the port
2	People & Partnerships	Clarifying the 'Vision' for the Port of Esperance
3	People & Partnerships	Openness & Transparency with the Esperance Township
4	People & Partnerships	Management of Separation Distances (ie. Port Buffers)
5	People & Partnerships	Exploring joint venture partnerships/opportunities for future development
6	People & Partnerships	Ensuring strong engagement with all stakeholders during the Master Planning process
7	People & Partnerships	Investigating Local Supply Opportunities
8	Environment	Managing potential Port Impacts (eg. Air, Noise, Stormwater)
9	Environment	Ensuring 'Sustainability' informs decision-making
10	Environment	Focussing on Safe and Clean Shipping
11	Environment	Addressing Climate Change Resilience & Adaptation
12	Environment	Clarifying Dredging/Sediment Management projects
13	Environment	Managing & Preserving Biodiversity around Port Precinct - in partnership with the Shire of Esperance
14	Prosperity	Supporting & Activating Shire, Regional and WA Economic Activity
15	Prosperity	Facilitating/Supporting Trade Growth & Diversity
16	Prosperity	Driving Port Efficiency
17	Prosperity	Ensuring Business Flexibility, Resilience & Adaptation
18	Prosperity	Ensuring Efficient and Protected Supply Chains and Corridors (Road, Rail & Sea)
19	Prosperity	Providing Confidence for Investment within the region
20	Prosperity	Exploring New Technologies/Digitalisation in Operations

Table 2.1
Pre-Planning Survey Result
Source: GHD/Sprott Planning & Environment

Community Feedback

The survey received 135 responses over the time period, with the respondents representing a wide range of stakeholders.

All the materiality issues are considered to be of key importance (rank above 7.5) with the top four highest ranking issues being:

1. Ensuring safety & security of people at and around the port
10. Focussing on Safe and Clean Shipping
3. Openness & Transparency with the Esperance Township
15. Facilitating/Supporting Trade Growth & Diversity

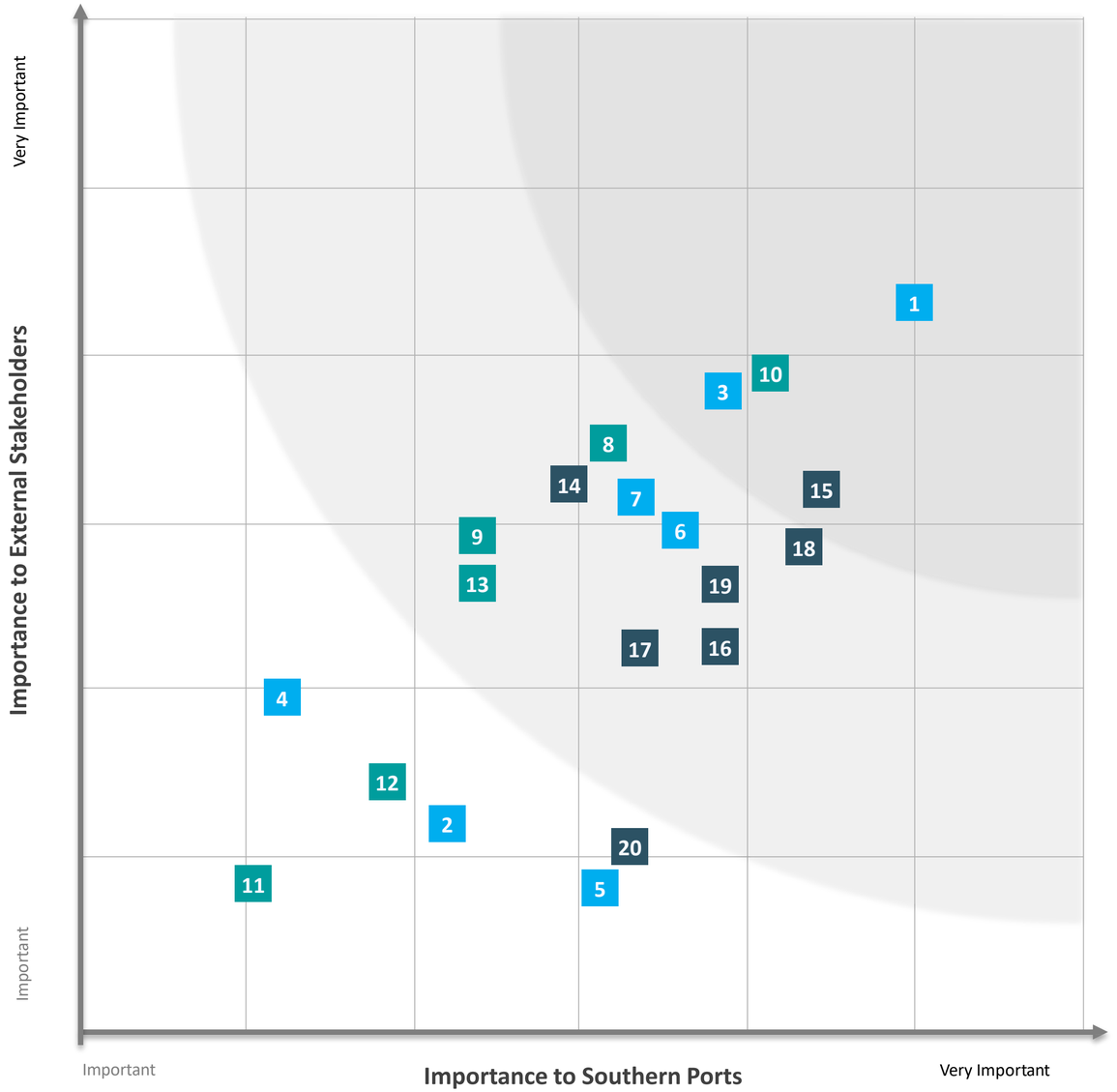


Figure 2.3
Pre-Planning Survey Result
Source: GHD/Sprott Planning & Environment

Industry Consultation

Twenty seven stakeholder groups of varying backgrounds and operations were consulted, seeking their input to the Port Master Plan process. A summary of some of the stakeholder groups engaged is provided in the adjacent figure.

The meeting and interview discussions were often broad in nature covering current and future operations.

The key themes were extracted and informed the identification of opportunities and potential constraints for the Port to consider in the master planning process.

27
stakeholder groups

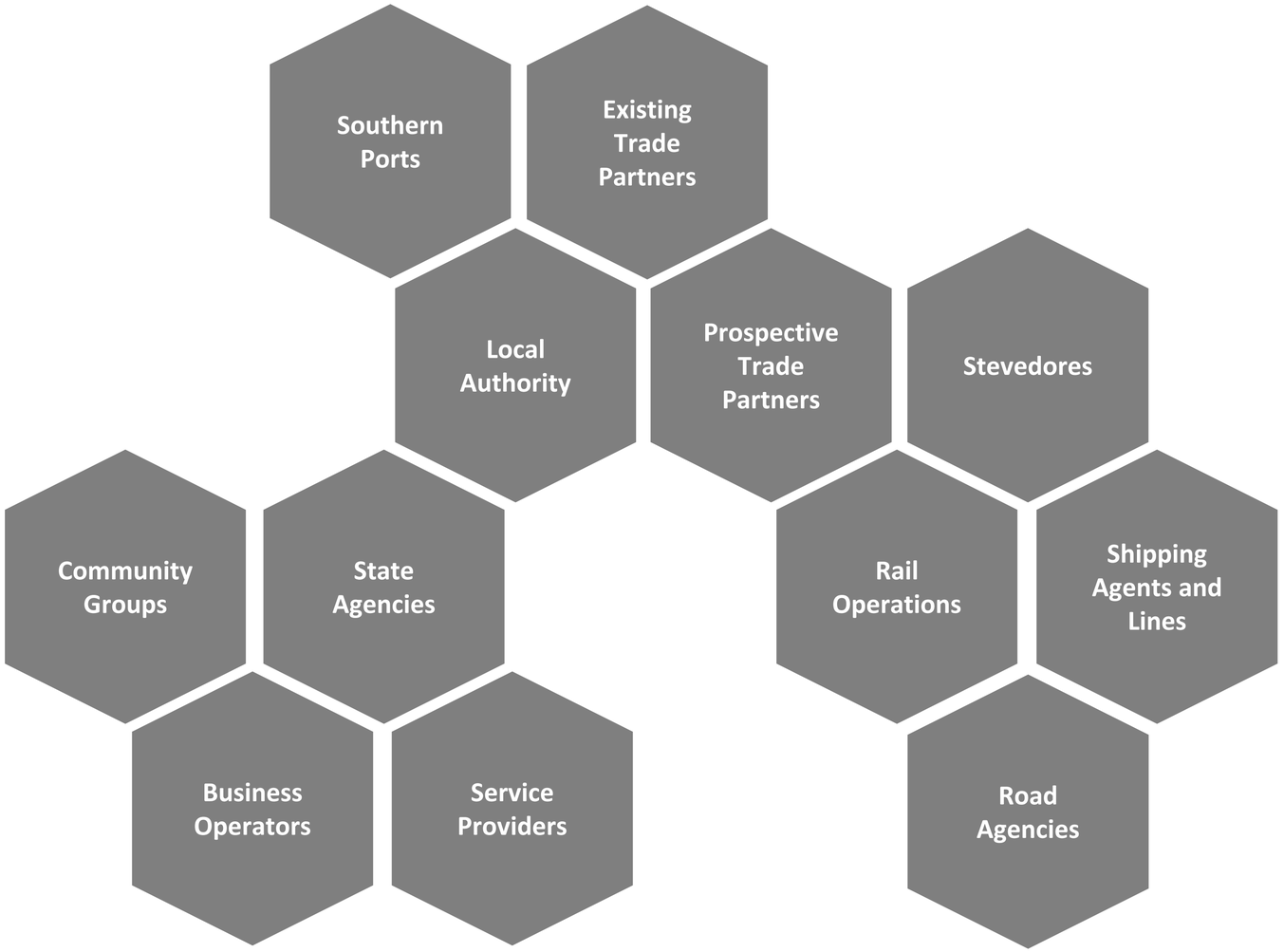
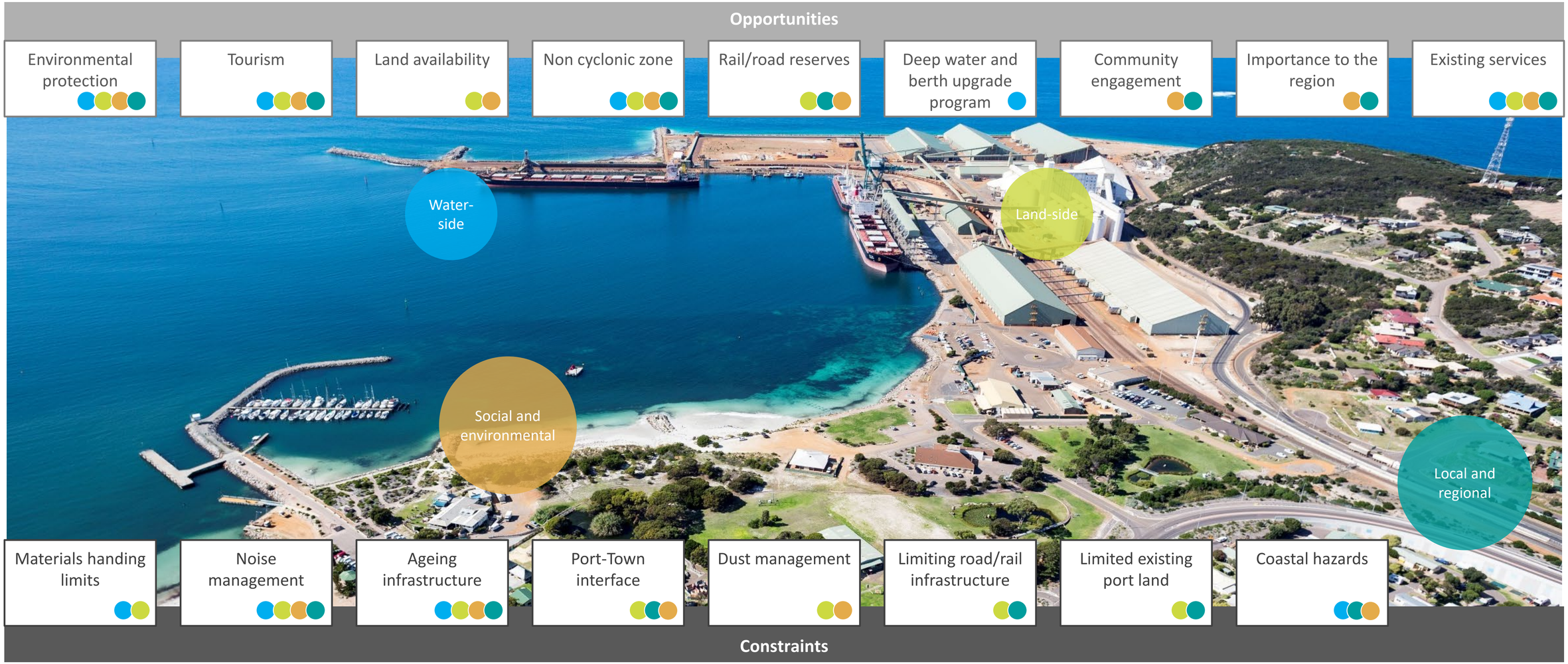


Figure 2.4
Industry Consultation Groups
Source: GHD

Opportunities and Constraints

The following items represent the key opportunities and potential constraint themes identified in the baseline phase of the port master planning process. The opportunities and constraints are factored into the development of the Port Master Plan options.

Water-side | Land-side | Social and environmental | Local and regional



03.

Trade Forecast Scenarios and Infrastructure Needs

Trade is one of the core influences behind the Port Master Plan. This section outlines how differing trade scenarios were developed and how these influence infrastructure and land requirements within the Port.

Trade Forecast Scenarios

The general approach used for development of the trade forecast scenarios comprised:

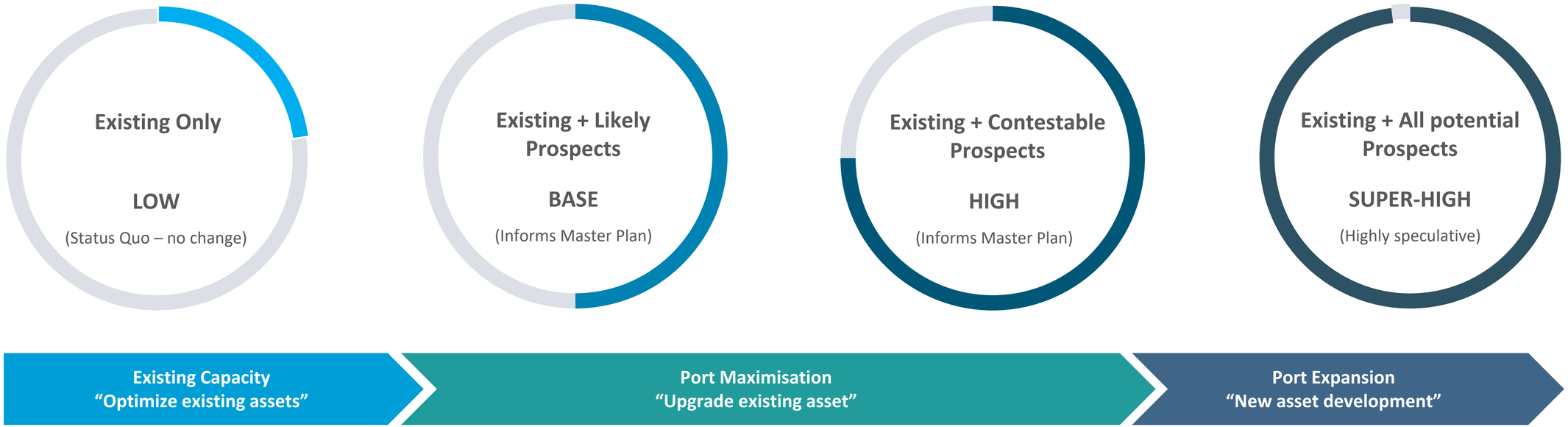
- Feedback from stakeholder consultation;
- Incorporation of the recent business opportunity review work by Southern Ports;
- Granular, bottom-up analysis using actual cargo throughputs and a list of prospects at a project level with defined assumptions; and
- Latest thinking, research and study outcomes of government agencies (WA and federal) on the possible future development of cities, populations, trade sectors and relevant innovations within the Port of Esperance catchment area.

The trade forecasting time-frame reflects the Port Master Planning of up to 30 years.

Range of Scenarios

For each market sector, a range of four trade volume scenarios (Low / Base / High / Super-High) have been considered to test the scale of possible future infrastructure needs.

The Base and High Scenarios are considered most important and relevant for the purposes of master planning work as Super-High is mainly speculative, and Low (with no new business) is not considered an issue for existing infrastructure capability. The High scenario is utilised to inform the potential infrastructure requirements within the development of the port master plan options.



Commodity Forecast Scenarios

The trade forecast for each of the Low, Base, High and Super-High scenarios has been provided in the adjacent table for key commodities.

The High forecast scenario is used for the basis of future planning within the Port Master Plan.

As outlined in the table, trade in the Port of Esperance is forecast to continue to be driven by iron ore. Grain also continues to be a significant trade in each of the scenarios with some increase in other dry and liquid bulk cargo.

Commodity	2020/21 Throughput	Low Forecast	Base Forecast	High Forecast	Super-High Forecast
Iron ore	10.19 Mtpa	4.8 – 9.5 Mtpa	Up to 10.9 Mtpa	11.5 – 18.4 Mtpa	12.7 – 40.4 Mtpa
Grains	2.25 Mtpa	Up to 2.3 Mtpa	Up to 2.3 Mtpa	3.8 Mtpa	4.2 Mtpa
Spodumene	0.73 Mtpa	0.5 Mtpa	0.7 Mtpa	0.8 Mtpa	0.9 Mtpa
Minerals Concentrates	0.19 Mtpa	Up to 0.2 Mtpa	Up to 0.2 Mtpa	Up to 0.2 Mtpa	Up to 0.2 Mtpa
Dry Bulk – Other	0.58 Mtpa	Up to 1.0 Mtpa	Up to 1.3 Mtpa	Up to 2.8 Mtpa	Up to 6.8 Mtpa
Liquid Bulk	0.35 Mtpa	0.5 Mtpa	0.5 Mtpa	0.5 Mtpa	0.7 Mtpa
Break Bulk	0.002 Mtpa	-	0.01 Mtpa	0.01 Mtpa	0.01 Mtpa
Containers	10,028 TEU	17,200 TEU	25,900 TEU	30,100 TEU	39,000 TEU
Summary	**14.4 Mtpa**	**14 Mtpa**	**15.1 Mtpa**	**19.6-26.5 Mtpa**	**53.2 Mtpa**

Table 3.1
Trade forecast scenario summary
Source: GHD

Emerging Markets

Globally, reduction in fossil fuel use and developing sustainable energy security through the emergence of renewable based energy sources with a focus to achieve high density and zero emissions fuel is a priority.

Australia has excellent natural resources to develop economically viable hydrogen and has developed a national Hydrogen Strategy to set a vision for the near and longer term development of a clean, innovative, safe and competitive hydrogen industry.

Western Australia has developed a Renewable Hydrogen Strategy that clearly sets out a vision of “WA will be a significant producer, exporter and user of renewable hydrogen”. The strategy sets out four key strategic focus areas, namely:

Export – securing global market share and exporting renewable hydrogen products

Remote applications – reducing reliance on diesel in remotely located industries and communities

Hydrogen blending in natural gas networks – blending hydrogen int natural gas networks

Transport – hydrogen utilisation for mobility and freight transport opportunities

The strategy sets out goals to achieve in the short (by 2022) and medium (by 2030) term timeframes. Notably, sustainable and economically viable renewable hydrogen production is dependent on large scale development of wind turbine and solar photo voltaic energy infrastructure components.

Ports are critical nodes in the supply chain that support the emerging renewable energy market. Initially, ports provide points of intermodal interface that allow the handling of project cargo (e.g. wind turbine structures, electrolyser components) to construct and maintain the renewable hydrogen production facilities. Once renewable hydrogen production is online the export of hydrogen based products will require port facilities to safely facilitate product transport, storage, loading and wharf operations.

The production of hydrogen using renewable energy sources, especially at large scale, is not a mature technology and still subject to extensive research and testing. Currently there are several industry initiatives that are focussing on the development of initial small scale developments with a view to grow into longer term export scale production. It is recognised that ports will support the development of the renewable hydrogen industry however the quantification of land and berth requirements within the port systems cannot accurately be assessed at this early stage.

The Port of Esperance can support the initial project development phase that incorporates the import of modular project and containerised cargo while the longer term requirement for bulk hydrogen export potential will be quantified and accommodated in future iterations of the port master plan.

Ports are critical enablers to develop and maintain the future production and export of renewable energy resources.

Infrastructure Requirements

The assessment of port infrastructure capacity is a complex task due to the large number of variables and influencing factors.

To understand the existing capacity, and therefore the need for increased capacity to meet future demand, aspects such as historical trade, the vessel fleet, commodity parcel sizes, maximum operational rates and effective berth capacity were considered.

The assessment was separated into three components, being water-side (marine) infrastructure, land infrastructure and land area. Each was assessed to determine the additional requirements needed to meet the forecast trade through the Port of Esperance, noting the determined requirements were based on current Port operations and throughput methodology.

Waterside Infrastructure Needs

A capacity model was used to develop the water-side infrastructure needs, where vessel berth occupancy and load rates at the wharf were compared to forecast demand, allowing shortfall to be identified. The model also supported testing of various factors linked to latent capacity (e.g. change in wharf length, cargo load rates, and service hours, etc.).

Assumptions such as commodity allocation, berth outages, diverse commodity parcels and load rates where considered, with Base, High and Super-High scenario outcomes produced.

Based on current commodity throughput achievable per berth (utilising existing materials handling infrastructure and rates), the quantum of berth infrastructure required to meet forecast scenarios was estimated as summarised in the Berth Requirements table provided.

Waterside infrastructure capacity modelling considered various factors including berth occupancy of vessels, commodity load rates, and how commodities are currently distributed throughout the Port.

Land Infrastructure Needs

To determine how much land needs to be earmarked to support various types of trade and the associated throughputs, existing land availability was compared to the forecast land requirements in line with the Base, High and Super-High trade scenarios. The outcomes of the assessment were used to develop a Port landside concept sufficient to meet forecast demand.

The key in determining land requirements is maintaining maximum infrastructure flexibility so that the Port Master Plan will meet future demand even if things change over time.

Road and Rail Infrastructure

Similar to the berth capacity modelling, a truck generation model was developed. The model assessed inward and outward cargo movement via road, considering payload size, traffic count data at local intersections and trade forecast data to calculate truck volumes. The truck traffic forecast was then added to intersection road models to establish the impact on the Level of Service as defined by Main Roads WA.

The assessment indicated that all roads remained within the acceptable Level of Service, with only internal port road upgrades to be considered further.

Rail capacity and demand was also assessed, were it was identified that the existing configuration of rail within the port is near capacity with little scope for easy improvement. The rail requirements table provided summarises the results of the rail assessment, where the existing rail capacity has been compared to the Base, High and Super-High forecasts for the rail commodities.

Infrastructure Requirements

Land Area Requirements

As for water-side and land infrastructure, land area requirements were assessed, comparing the existing land capacity of the Port to forecast trade requirements.

As part of the assessment, efficiencies within the Port were determined such as grouping major and ‘like’ trade commodities, maintaining proximity to the appropriate berth, minimising changes to existing lease areas and minimising wholesale changes to land use.

The total area requirements to meet the High and Super-High Scenario trade forecasts are provided in the Land Area Requirements table. Due to the similarity of the current throughput to the Low and Base trade scenarios the land area requirement for these scenarios has not been considered.

Note that grain land requirements are not considered to increase due to the large facilities at the Port and the ability to develop further offsite storage as currently utilised. Similarly, dry fertilizer growth is limited as liquid fertilizer tankage area has been considered as an industry preference.

Land for container operations can be particularly important in Ports, as area can be needed for import (full), export (empty) or even refrigerated containers. Proximity to the berth is also a key factor, as heavy machinery is required for container transport.

Infrastructure Requirements

Berth, rail and land area requirements are summarised in tables below. Due to the existing throughput and Low trade forecast scenario being similar in tonnage and profile the infrastructure requirements for this scenario is not listed.

Berth Requirements

Berth	Product	Existing Capacity [1]	Berth Requirements (#)		
			Base Forecast	High Forecast	Super-High Forecast
Berth 1	Grain, woodchip, fuel	3.9 – 4.4 Mtpa	Berth 1 + 0 new berths	Berth 1 + 0 new berths	Berth 1 + 0 new berths
Berth 2	Containers, Spodumene, Nickel/Copper concentrates, Sulphur, fuel, fertilizer	2.5 – 2.9 Mtpa	Berth 2 + 0 new berths	Berth 2 + 1 new berth[2]	Berth 2 + 1 new berth
Berth 3	Iron ore, spodumene	10.4 – 11.8 Mtpa	Berth 3 + 0 new berths	Berth 3 + 1 new berth	Berth 3 + 2 new berths

1. Capacity based on current and predicted commodity profile and current operational load rates with average tonnage range related to Berth Commitment thresholds at 75% and 85%
2. Berth capacity improvement required in 5-10 year timeframe

Table 3.2
Berth infrastructure requirements
Source: GHD

Rail Requirements

Existing Capacity [3]	Existing Throughput	Rail Throughput (mtpa / # trains)		
		Base Forecast	High Forecast	Super High Forecast
1,100 trains / annum (based on max Rail Car Dumper capacity)	901 trains / annum (based on 2020/21 iron ore throughput)	10.9 mtpa (965 trains)	18.4 mtpa (1,630 trains)	40.4 mtpa (3,575 trains)

3. Approximate capacity based on full length Kalgoorlie - Esperance train (59 wagon, 11,300 tonne iron ore load) at 11.5 mtpa

Table 3.3
Rail infrastructure requirements
Source: GHD

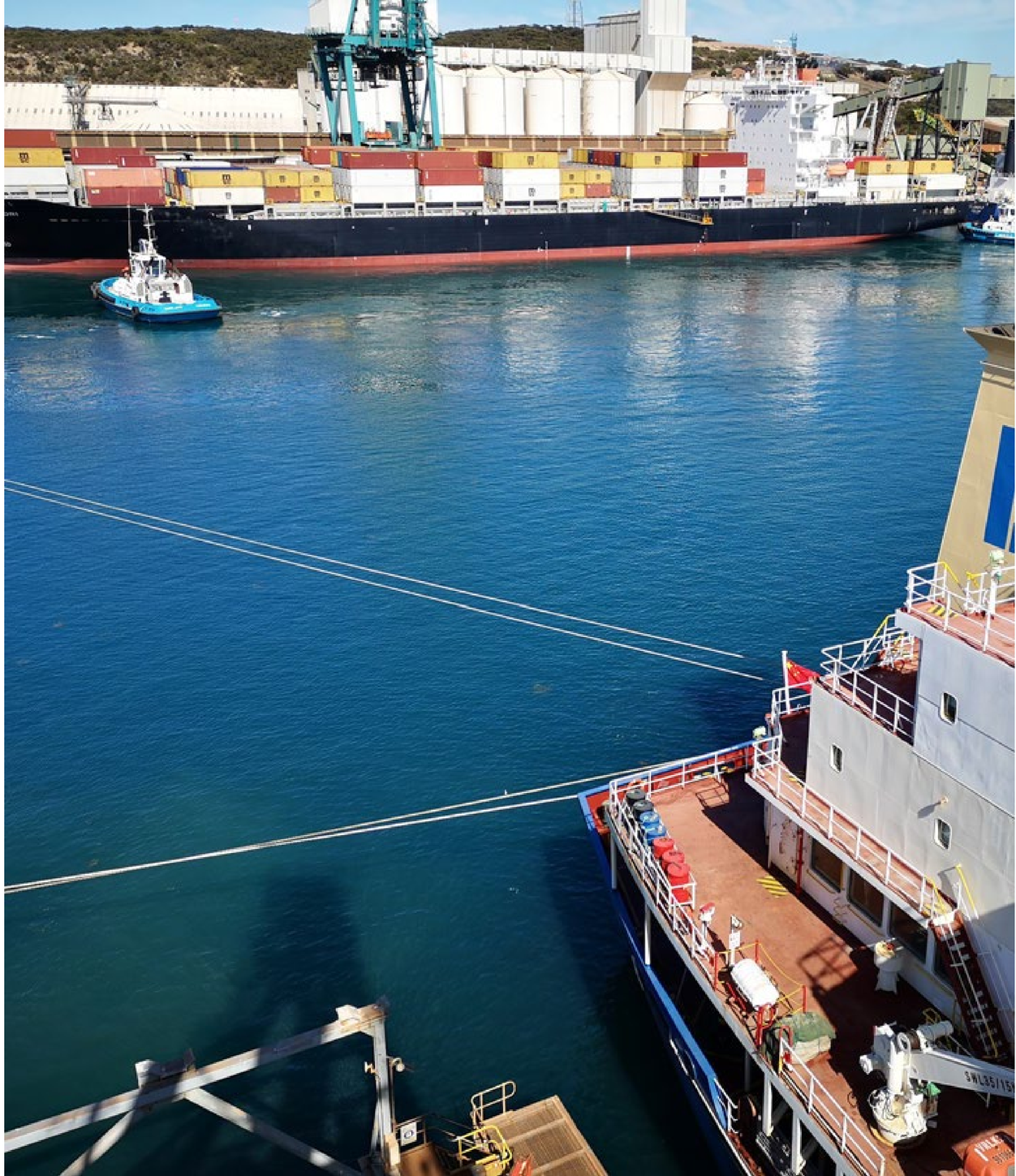
Infrastructure Requirements

Local Area Requirements

Product	Total Area Requirements (m^2)		
	Current	High Forecast	Super-High Forecast
Iron ore	40,300	82,200	180,600
Spodumene	22,700	32,000	36,000
Sulphur	18,900	30,000	30,000
Dry fertilizer	14,100	14,100	14,100
Liquid fertilizer	0	5,400	5,400
Grain	78,000	78,000	78,000
Minerals / other	-	20,000	20,000
Containers	17,800	17,100	21,400
Total	177,700	278,800	385,500
Additional Storage Area Required	0	101,100[4]	207,300

4. Current vacant land and reclaim area within Port of Esperance is approximately 100,000m^2. This excludes land holdings at Shark Lakes industrial area.

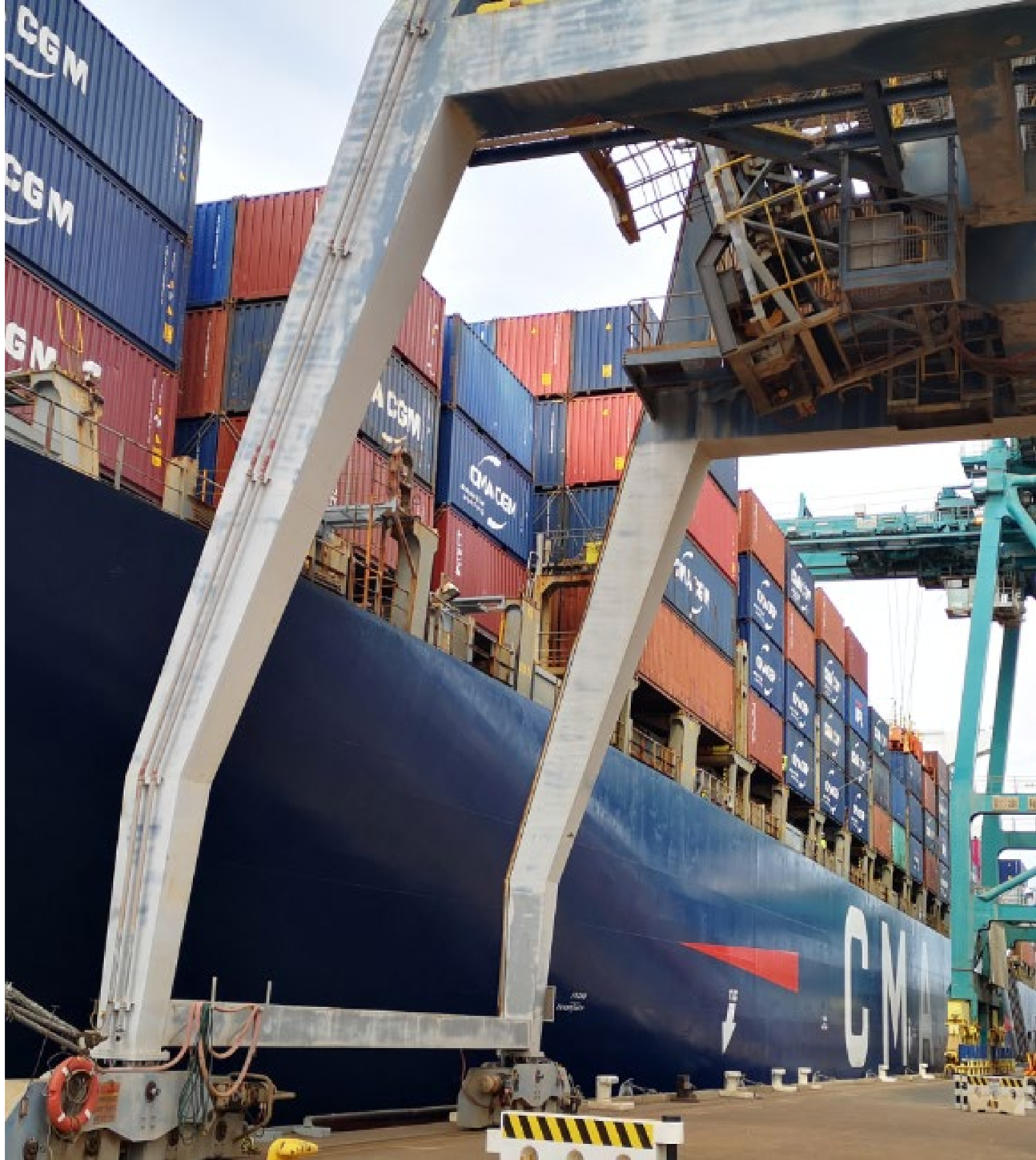
Table 3.4
Land area requirements
Source: GHD



04.

Esperance Port Master Plan

This section defines the Port Master Plan development items, outlining how the Port could look in the future considering short-,medium-, and long-term infrastructure and development solutions.



Port Master Plan Overview

The Port Master Plan at the highest level has three principle focus areas, namely:

Maximisation

Seeks to maximise the efficiency and development opportunity that exists within the existing port area (limited changes to the surrounding port environment).

Integration

Focuses on identification, planning alignment and development of undeveloped or surrounding port area adjacent to the port boundary (reserve or protect land area critical to sustainable port operations and continued economic benefit to the region).

Expansion

The planning and development of future port infrastructure in the form of new land and wharves (as required) to support long term growth forecasts.

The Maximisation, Integration and Expansion principles (as illustrated in the provided figure) each lend themselves to a natural development horizon. Initially, within the short to medium term (0 -15 year timeframe) the focus is on the Maximisation and Integration opportunities. The development opportunities contained within the Expansion phase are linked to longer term development horizons (e.g. 15-30 year period and beyond).

The Maximisation, Integration and Expansion planning principles culminate in an overarching preferred Port development option, as outlined in the following sections.

It should also be noted that the development of the Port Master Plan seeks to align at all times with Southern Ports principles such as sustainability, safety, and economic opportunity.

Ports, due to their function as nexus for trade and intermodal logistics are extremely dynamic environments. This version of the Port Master Plan with its specific opportunities and constraints represents the preferred port development option presently. However, as time progresses and new market dynamics come to play this could very well change. This is especially relevant to the longer term opportunities forming part of the Expansion phase. It is good to consider short term opportunities as having a higher probability of occurring than the longer term options, which have some inherent flexibility due to the time scale of the forecasts driving demand for this infrastructure.

Ongoing review of economic factors and comparison of the actual port trade throughput compared to forecast will allow Southern Ports to monitor and assess the requirement for and schedule capacity driven port development.

The schedule for port development projects, when linked to capacity requirement, is presently based on the High case trade forecast scenario. Development schedules linked to safety, efficiency and opportunity are driven by Southern Ports', and the business sector's, appetite for investment.

Port Development Projects for Key Commodities

Some specific overarching development strategies for key Port commodities are summarised as follows, outlining how the Port Master Plan seeks to secure these trades now and into the future, and to facilitate growth.

Iron Ore

Berth 3 upgrade, including ship loader load increase and significant reconfiguration of the rail system within the Port to support improved throughput capacity.

Future option for expansion of Berth 3 to support additional vessel alongside.

Multi-User (including Containers)

Berth 2 extension and upgrade, including container / bulk crane and materials handling upgrades to support larger container vessels and other bulk throughputs.

Complementary upgrade of Berth 1 to support longer vessels, and dredging works to allow for deeper draft vessels in the inner basin.

Grain

Berth 1 extension and upgrade, including materials handing upgrades to support larger grain vessels.

Complementary upgrade of Berth 2 to support longer vessels, and dredging works to allow for deeper draft vessels in the inner basin.

Additional to the identified Port Development Projects, Southern Ports is in process of implementing a sophisticated asset management system to gain better understanding of the required renewals, maintenance and life cycle gaps to substantiate future work requirements on the existing asset base.

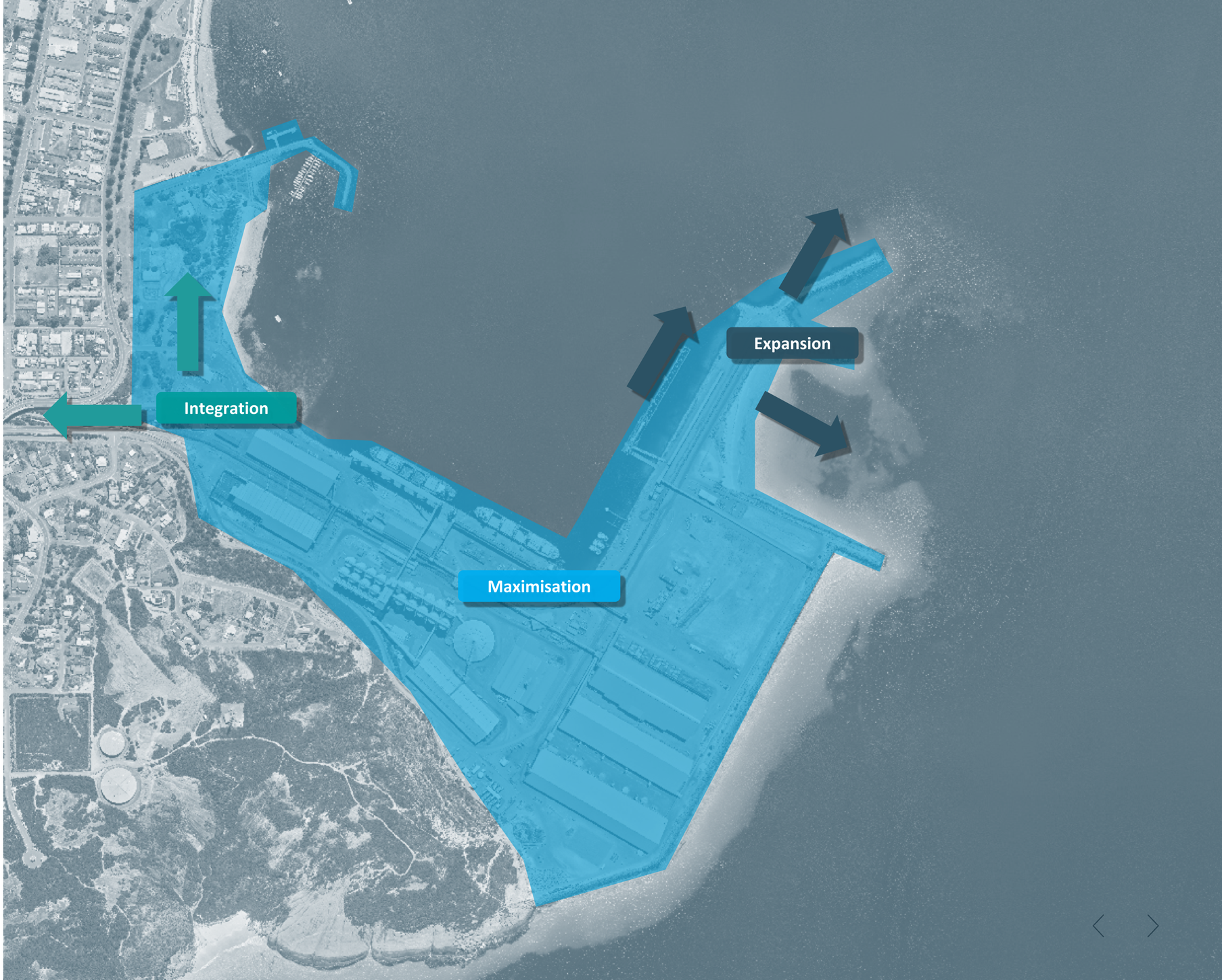


Figure 4.1
Maximisation, integration and expansion port development principles
Source: GHD

Port Master Plan Development Items

The Port Master Plan development items in the short, medium and long term (up to 30 years) are summarised in the adjacent figure and the tables provided on the following pages. The tables provide additional details regarding the individual items, nominated timeframes and how the items align with themes considered during the stakeholder engagement phase.

New reclaim area to accommodate the rail balloon loop is indicative and subject to further technical study regarding appropriate rail loop radius.

Longer term (30 years plus) items are more flexible in terms of implementation timing and are dealt with in the Future Port Expansion Potential section.

Figure 4.2
Short and medium term port development items
Source: GHD

Port Master Plan Development Items

Item		Scope	Trade / Sector	Timeframe	Materiality Survey Theme
1) Stormwater management		Upgrade of the stormwater management infrastructure and systems	Operational Area	Short term	Environment
2) Berth 2 hardstand development		Berth 2 hardstand renewal			
3) Power station		Decommission existing power station			
4) Fire water		Repair and upgrade of fire water systems			People and Partnerships
5) New Operations Centre	5a) Stage 1	New consolidated operations and administration offices			
	5b) Stage 2	Consolidation of site workshops (welding, mechanical, electrical and stores)		Medium term	
6) Remove remaining nickel circuit infrastructure		Removal of shed 6 and remainder of associated materials handling circuit			Prosperity
7) Heavy vehicle entrance		Upgrade heavy vehicle entrance and renewal of Hughes Road pavement	Port Access Corridor	Short term	Prosperity
8) Transport Corridor		Create new transport corridor at Port entrance for future road access / rail duplication		Long term	
9) Taylor Street Jetty		Develop and implement Taylor Street Jetty asset strategy	Other	Short term	People and Partnerships
10) Tug / Pilot boat pen upgrade		Renewal of tug/pilot boat pens			Prosperity
11) Relocate CBH offices		Relocate CBH offices	Agribulk	Long term	Prosperity
12) Berth 1	12a) Extension	Berth 1 extension and associated wharf strengthening works to support design vessel			
	12b) Dredge pocket deepening	Berth 1 dredge pocket deepening in line with item 12a			
	12c) Loading gantry	Extension of Berth 1 loading gantry in line with item 12a			
	12d) Fender augmentation	Berth 1 fender augmentation to support design vessel in line with item 12a			
13) Berth 2	13a) Berth 2 mobile crane	Provision of mobile crane (within existing wharf load capacity) to work in conjunction with B2 gantry crane	**Multi-User / Containers**	**Short term**	**Prosperity**
	13b) Berth 2 extension	Berth 2 extension, strengthening and other associated works to support design vessels		Long term	
	13c) Berth 2 container/bulk hybrid crane	Provision of new container/bulk hybrid crane to replace existing asset due to condition (safety and load rate improvements)			
14) Rail container facility		New rail load/unload container facility	**Multi-User / Containers**	Long term	**Prosperity**
15) Liquid Fertiliser storage		Liquid fertiliser storage facility	**Liquid Bulk**	Short term	**Prosperity**

Port Master Plan Development Items

Item		Scope	Trade / Sector	Timeframe	Materiality Survey Theme
16) Rail loop (including storage, materials handing, road and Berth 3 upgrades)	16a) Rail loop	Rail loop and associated reclamation	**Iron Ore / Mineral Bulk**	Short term	**Prosperity**
	16b) New road	New road development around rail loop – link to item 16a			
	16c) Container hardstand	Relocate container hardstand area			
	16d) Berth 3 materials handling circuit	Adapt Berth 3 materials handling circuit for rail loop and road development			
	16e) Workshop relocation	Relocate existing workshop for new rail loop alignment			
	16f) Additional storage	Additional new storage shed developments to support 9.8 mtpa >18 mtpa storage requirement (market dependant)			
	16g) Light vehicle access (rail loop)	Horseshoe bridge to provide light vehicle access into new rail loop			
	16h) New train unloader	New multi-user train unloader (existing RCD to be replaced in approx. 2032, market dependant)			
	16i) Materials handling infrastructure	New materials handling infrastructure to tie into existing and new storage and outload circuits			
	16j) Berth 3 ship loader upgrade	Berth 3 ship loader upgrade to increase load rate (replacement required by 2026)		Medium term	
	16k) Berth 3 upgrade for ship loader	Upgrade berth 3 to accommodate upgrade ship loader.			
	16l) Noise management infrastructure	Noise management infrastructure		Short term	**Environment**
17) Multi User truck unloading		Provision of a truck unloading facility to maximise storage loading efficiency	Mineral Bulk	Short term	Prosperity
18) Berth 3	18a) Mooring upgrade	Berth 3 mooring system upgrade	Iron Ore	Short term	Prosperity
	18b) Berth-side walkway	Berth 3 walkway to be made independent of main structure and Berthing Dolphin (BD) 3 to be structurally connected to BD2 and BD4 to stop pile fatigue from long period waves.			
	18c) Breakwater extension	Extension of the Berth 3 breakwater for mooring stability and siltation outcomes		Medium term	
19) Reclad Sheds 2 and 4		Recladding of Shed 2 and Shed 4			
20) Shed 1 / 2 Trade Optimisation		Reconfigure Shed 1/2 to accept road based products in the event additional Iron Ore storage sheds constructed out on reclaim as per 16f		Medium term	Prosperity

Future Port Expansion Potential

The Port Master Plan outlines the expected trade scenarios for the next thirty years, providing infrastructure solutions to meet this forecast trade.

However, there is an inherent level of uncertainty within these forecasts. As experienced in recent times in Australia, unexpected events can lead to significant changes in what and how Ports trade, but can also open up new opportunities.

It is therefore important to build flexibility into the Esperance Port Master Plan, but to also look towards and past the thirty-year horizon to consider long-term possibilities, even if these are not completely understood or even expected in the present day.

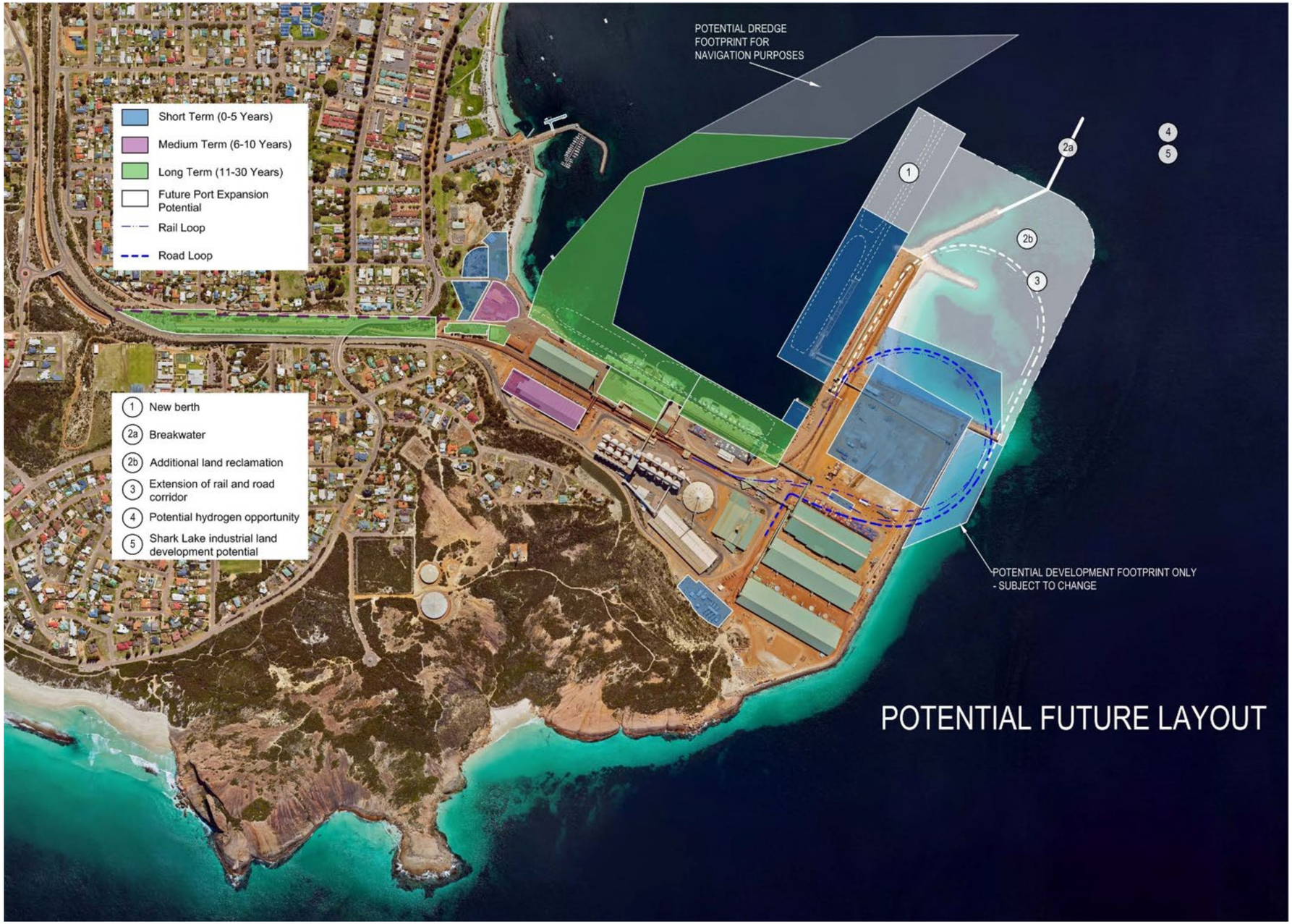
Understanding how the Port Master Plan could lead into future expansion opportunities is a key part of the process, as a Port Master Plan seeks that you not do today what you must undo tomorrow.

The figure provided demonstrates how the Port could possibly expand in the thirty year plus timeframe past the present Port Master Plan assessment period.

It also demonstrates that the Port is able to support increased existing, new or unexpected trades if required in the shorter term through expansion opportunities.

Future expansion opportunities could include additional land through reclaim activity, new rail infrastructure, new wharf infrastructure, or a combination of all three depending on the type and quantum of future trade opportunities.

Port land holdings at Shark Lake industrial area could be utilised to optimise industry development and trade supply chains.



Port Master Plan Potential Expansion Development Items

In addition to the Port development options, additional items that potentially extend beyond the 30 year timeframe have been identified, forming part of the Esperance Port Master Plan and summarised below.

Item	Scope / Additional information	Materiality Survey Theme
1) New berth	Additional bulk mineral or hydrogen-based products could necessitate potential wharf expansion to accommodate growth in export products.	Prosperity
2a) Breakwater expansion	Increased wharf infrastructure could require expansion of breakwater structures based on operability requirements.	Prosperity
2b) Land reclamation	Increased export product could require additional port land to accommodate storage and material handling infrastructure requirements.	Prosperity
3) Extension of road and rail corridor	Potential extension and development of additional road, rail and pipeline infrastructure to accommodate export product growth.	Prosperity
4) Potential hydrogen opportunity	Due to emerging market potential and growth in the renewable energy sector the requirement to safely store and export Green Hydrogen based products could require development of additional dedicated liquid bulk facilities.	Environmental
5) Shark Lake Industrial Land development potential	Port land holdings at Shark Lake industrial area could be utilised to optimise industry development and trade supply chains.	People and Partnerships

Sea Level Rise

Port Land and the berths are protected from wave influence from the south and east by rock protection structures. These structures, consisting of a rock walls, spurs and breakwaters, protect the reclaimed Port land also act as a sediment trap to limit littoral drift into the navigation channel and basin. These rock structures are the first line of defence protecting Port infrastructure and require continual monitoring and maintenance due to exposure to the Great Australian Bight and the varying ages and methods of construction of the revetments. Some form of the breakwater has been in place since the mid-1960s, with the newest rock walls constructed in 2002 with the reclamation area.

The Western Australian Government has outlined Sea Level Rise (SLR) predictions till 2100, aiming to inform current and future developments as to the potential impacts of climate change along the coastline. In 2010 the WA Planning Commission specified that SLR should be taken as +0.9m by 2100.

A high level review of the Port's wharf infrastructure compares the relative level of Port assets to Highest Astronomical Tide + SLR predictions for 2050 and 2100. The review indicates there is in excess of 1m between the highest predicted tide in 2100 and current infrastructure levels. The rear of wharf levels also suggest that the current land levels of the Port are sufficient to reduce the risk of future SLR inundation events. Recent assessment for the nearby Tanker Jetty identified a possible surge of 0.3m (200 year ARI) which still maintains over 0.5m of clearance to wharf deck levels. Given the relatively protected nature of the Port, the impacts due to storm waves is considered negligible.

The Coastal Hazard Risk Management & Adaptation Planning (CHRMAP) study for the region predicts coastal hazards from erosion and inundation over 100-year planning timeframe. The Shire of Esperance has released their CHRMAP for Esperance, which does not cover the Port, however extends to the northern boundary.

Erosion hazard lines show that the land immediately north of the Port is at risk in the short to medium term, which is supported by reports that Esperance Beach is prone to erosion.

Inundation hazard mapping to the north of the Port show inundation expected to be a growing hazard to the Port over the next 100-years, mainly due to sea level rise. Sea level rise for 2070 is set to 0.5m in the CHRMAP process.

The general coastal adaptation strategy for erosion and inundation in the CHRMAP for the Town Centre and Foreshore is a future **Protect** option.

Removing inundation pathways can also assist in reducing the risk to the Port, particularly when surrounding land lay may be lower that the wharves. Based on the CHRMAP inundation mapping, the foreshore to the north of the Port is likely to see inundation and therefore presents the greatest longer term future risk to operations. Raising land levels along this northern boundary or use of protection structures such as bund walls could be considered in the future to remove the inundation pathway.

Future of Ports

As Ports move forward into the future, there is a shift occurring in how Ports operate, whether it be a change in the type of commodity throughputs, how Ports are run from a carbon footprint perspective, or the ever increasing impact of digital technologies in the Port environment.

The influence of renewable energy sources in the Esperance region opens up an opportunity for new trade throughputs, where the resources and infrastructure to support renewable energy generation may pass through the Port. The Port of Esperance itself can also make use of this renewable energy to minimise environmental impacts moving forward.

‘The Western Australian Climate Policy sets out the State Government’s plan for a climate-resilient community and a prosperous low-carbon future.’

The Western Australian Government has recently outlined their aspiration of achieving net-zero emissions by 2050 in its climate policy. As Port Authorities operate under the jurisdiction of the WA State Government, the Port of Esperance is just one of the operations seeking to achieve this goal.

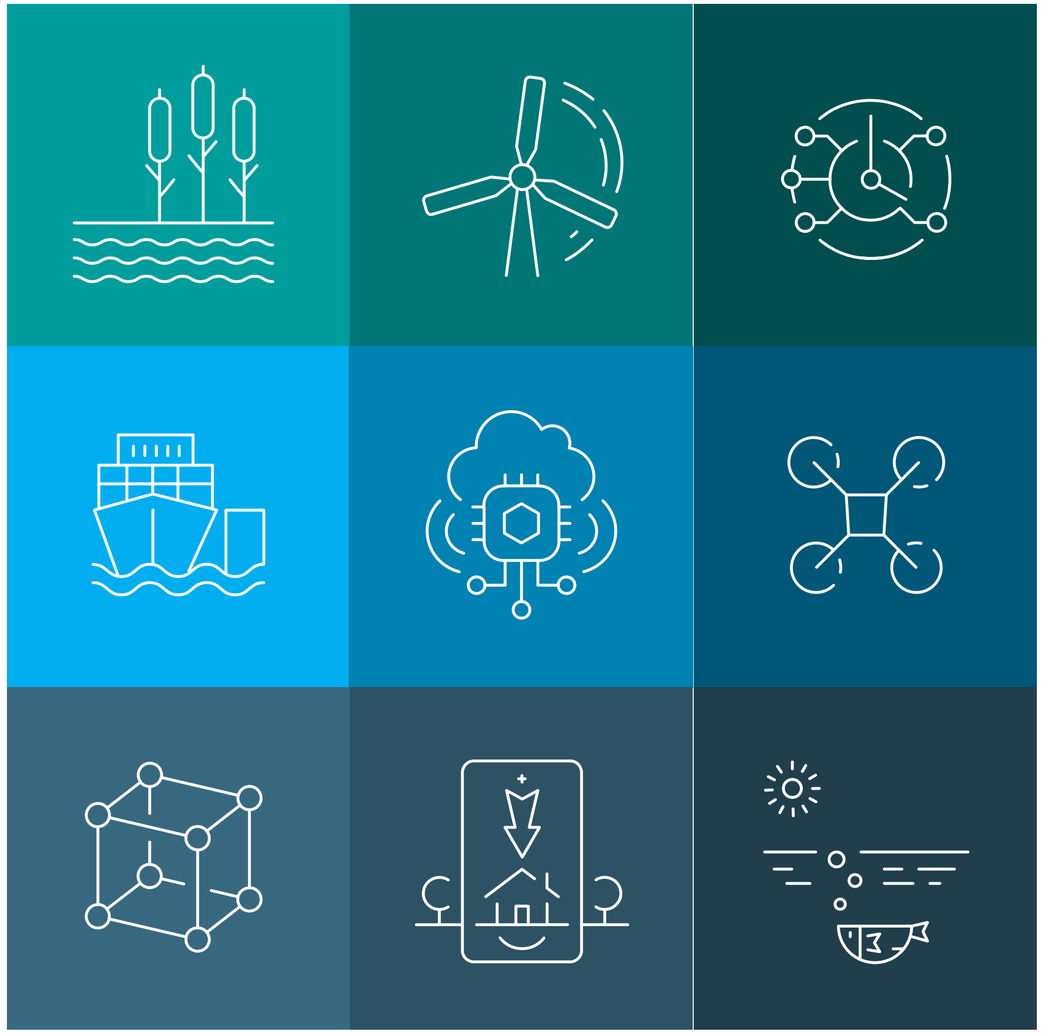
The influence of digital technology is another example of how the Port environment may change into the future.

Digital technology is driving how people, businesses and governments think and operate.

Digital innovation has the potential to influence all aspects of Port operations, with the ability to improve connectivity and scheduling, and to create and improve the efficiency of operational methods. Digital technologies also have the ability to change how a Port views, measures, and reports various aspects across trade, infrastructure and the environment, with space for continuous improvement and innovation.

Examples of digital technologies within the Port environment include the use of smart asset management systems, increased automation, drone technology, digital twinning and improved digital interfaces.

Another aspect to be considered in the changing Port space is the increased weight being given to environmental, social and governance (ESG) metrics. These metrics, which aim to understand and integrate the value of intangible assets and influences into business decisions, allow a more well-rounded decision making process. ESG influences are some of the key drivers in the Port Master Planning process, and are becoming increasingly integrated into day-to-day decision making in the Port environment.



Conclusion

Moving Forward

Southern Ports' vision is "Strong regional ports, strong regions" and the Port Master Plan seeks to practically demonstrate the port development pathway that supports the development of a strong regional port.

This Port Master Plan is considered a living document that forms the basis for the articulation of Southern Ports' vision for the future.

Through promoting greater understanding of Port needs, the Port Master Plan allows the integration of the Port into a broader network consideration with local, regional and state planning agencies and port related businesses.

Continued discussions with a broad range of Esperance Port interested and affected stakeholders and frequent presentation of the plan will allow Southern Ports to capture commentary that allows the necessary testing, review and future updating of the plan.

The Port of Esperance Master Plan demonstrates that the Port has significant growth opportunity across most of the commodities that currently move through the Port. Iron ore is a key component of the potential increase in trade, with a upgraded berth 3 included as a short term development item to meet the increased iron ore throughput. Containerised cargo throughput is predicted to increase notably, which in conjunction with increased grain opportunities, are supported by an extension of the Berth 1 and 2 quayline to allow larger ships to access to the inner areas of the Port.

The Port Master Plan is built on the foundation of the market demand assessment. Review of the actual trade volumes compared to the market demand forecast volumes, and also the continuous testing and review of the assumptions that drive the market demand forecast is necessary. As such, regular review of the Port Master Plan, in the context of dynamic strategy, policy, trade, economics and stakeholder needs environment is encouraged, allowing for the plan revision to be rigorously undertaken from the ground up.

This Port Master Plan seeks to highlight the current and future opportunities presented by the Port of Esperance, outlining a strategy to meet forecast trade which has been informed by a wide variety of stakeholders, regional economics and relevant Port policies at a local through state and national level.

In combination, these elements make up the key drivers of the Esperance Port Master Plan.

Source: Infrastructure Australia, 2013

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