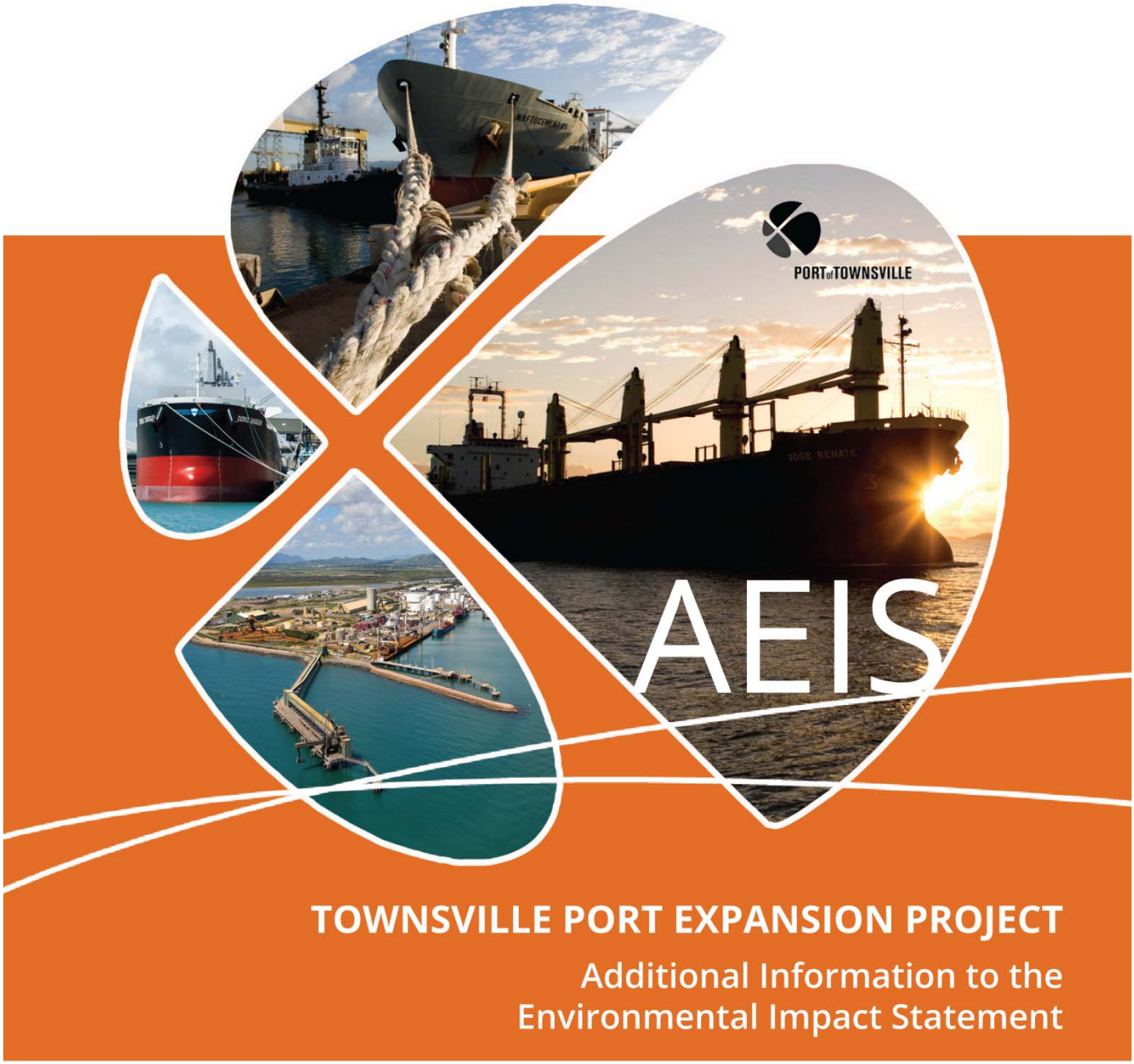

TOWNSVILLE PORT EXPANSION PROJECT

Additional Information to the Environmental Impact Statement

TOWNSVILLE PORT EXPANSION PROJECT

SECTION 21

Economic Development

AECOM BMT WBM

21.0 Economic Development

21.1 Introduction

The economic environment and the economic impact from the development of the Port Expansion Project (PEP) are discussed in Chapter B.19 (Economic Development) of the Environmental Impact Statement (EIS). The economic assessment discussed the existing and future demand for Port capacity. The assessment defined and assessed a base case against the expected developed port to identify any positive or negative impacts during the construction and operation phases. The estimated economic benefit (in present values), of the Project was estimated to be of around $1,500 million. Socio-economic impacts were also assessed, including housing, commercial fishing, labour markets and employment.

This section provides responses to submissions from public consultation and the results of new analysis that identifies the economic role of the Port in the region, and regional risks resulting from capacity constraints of the Port. This chapter section is not intended to represent a business case for the PEP, or an update on an existing business case for the PEP, however the information presented here is required under the Terms of Reference to provide context for economic impacts.

Key matters raised within the submission process include:

- justification of the need to expand the Port of Townsville in context of present berth utilisation
- the role of the port in the economic stability, sustainability and development of North Queensland and the risks and flow-on effects of removing this capacity
- consideration of using alternative ports to cater for increased demand, especially any future coal exports
- the need to accommodate larger vessels
- coal exports through the Port of Townsville
- economic impacts of the Port Expansion Project to tourism, especially on Magnetic Island
- greater economic impacts to Great Barrier Reef (GBR) Outstanding Universal Value (OUV)
- changes to base data demographics.

21.2 Response to Submissions

21.2.1 Justification for the need to expand the Port of Townsville in context of present berth utilisation

There were 26 submitters who identified that global economic conditions have changed since the EIS was produced and raised that the PEP might not be required. Submissions cited the current port capacity and speculated that sufficient space exists without further expansion. The Department of State Development, Infrastructure and Planning also identified the need to consider opportunities for improved efficiencies as an alternative to accommodating some of the growth at the port. Submitters mostly used historical berth utilisation statistics as an indicator of port capacity and therefore used historical berth utilisation rates to question the need for future expansion.

While the historical berth utilisation figures may suggest additional capacity is available, berth utilisation is only part of the picture. Rather, it is port performance, reliability and economic throughput that are most suitable indicators of port capacity and therefore basis for increased capacity rather than historical berth utilisation statistics.

Port capacity can be defined as the maximum traffic a port terminal can handle (Martin Soberon, 2012). Port capacity is therefore effectively a function of the reliability and economic performance that are determined by factors such as the level of traffic and the commercial activity occurring at each individual port, channel infrastructure and materials handling equipment.

Due to the differences between individual ports, measuring and defining port performance is not standardised (Fourgeaud, 2000). However, a number of key performance indicators (KPIs) may be used for measuring port performance. For example, berth occupancy, ship dwell time, cargo handling performance and utilisation of materials handling equipment are commonly used.

Operational port performance, which can be measured in terms of output, productivity and utilisation, is also a reflection of port capacity. Output is the volume or tonnage of cargo a terminal handles over a period of time, productivity is the work rate of the resources of a terminal, and utilisation is the ratio of time a resource is used over the total time it is available.

When considering the marine part of operations, optimal capacity for a port (in terms of berth numbers) is a balance between berth utilisation and ship waiting time. When berth utilisation is high this leads to low operational costs at the expense of high ship waiting time (anchorage delays). Conversely, for a port with a high number of berths (and hence lower berth utilisation), there will be low ship waiting times but high operating costs (De Weille & Ray, 1974).

Therefore considering historical berth utilisation alone is not a good indicator of either port capacity or future need. Berth utilisation is also impacted by the availability of the resources required for loading/unloading vessels, shipping mix, ship scheduling policies, terminal layout, channel access (including waiting for tide conditions and under keel clearance (UKC) and availability of product.

Furthermore, when considering berth utilisation, it is important to remember that it is not possible to fully utilise a berth at all times. That is, 100% utilisation is never achievable. The time required to pilot vessels between the inner harbour and berth, the process of mooring and clearing the berth and harbour and delays waiting for correct tide and under-keel clearance, as well as maintenance windows, must all be taken into consideration. In addition POTL has been undertaking a range of improvements of existing infrastructure which have progressively had one or more berths being unavailable during these works. For the existing berths at Townsville, other factors such as proximity to other berths and associated access restrictions are also applicable. According to BITRE (2013) a berth utilisation at or exceeding 80 per cent is an indication of a berth close to, or at, full capacity. Depending upon the physical arrangement of the berths, and other factors, the full capacity figure may be much lower. Berths operating at 80 per cent utilisation are somewhat unusual and often restricted to either single high demand product berths, or bulk port single cargo berths. It can often be the case that when the berth utilisation is high, the overall port efficiency is low, as high berth utilisation generally implies that a number of vessels will be at anchor. Hence the utilisation figure at maximum capacity is not the same at every port.

Since the publication of the EIS, Queensland Nickel imports have ceased due to the current liquidation of the company. There are a range of commercial issues still to be resolved. Queensland Nickel asserts that a reopening of the refinery is possible; this would clearly require the use of Berth 2. Should the refinery not resume operations, Berth 2 has a number of physical limitations (primarily draft and wharf structural strength) which would restrict its' use for a range of other cargoes. In the case of Berth 2 becoming available, it is not a viable substitute for the vessel types being catered for by PEP and therefore has no significant impact on the need for PEP.

21.2.2 Current Berth Occupancy at Port of Townsville

Berth occupancy (utilisation) and total tonnage for the Port of Townsville from 1997 to 2014 is shown in Figure 21.1 below. There is a general upward trend in utilisation of berths since 1997 and a substantial variation across individual berths. In Figure 21.1, optimum berth capacity is shown for each berth in the right hand column. These figures were estimated in 2007 prior to various capacity improvements which POTL has commenced in parallel to this PEP.

There is substantial variation in the optimum utilisation for the various berths at Port of Townsville. For example, for Berth 8, optimum utilisation is as low as 35% whereas for Berth 2 it is 65%. This variability is due to many factors including the berth arrangement and access restrictions as a result of berth arrangement, specific onshore cargo handling infrastructure, channel capacity including dimensions and any associated tidal or draft restrictions, and the overall efficiency of the general terminal layout. In the case of Berth 8, the 35% optimum utilisation is primarily the result of access restrictions that are in place for Berth 8 as a result of the proximity of Berth 7. Historically, access to Berth 8 is not available to vessels over a certain beam when there is a vessel in Berth 7. When works at Berth 8 are complete and Berth 7 is completely demolished, the optimum utilisation at Berth 8 will increase.

The optimum utilisation value of 65% for Berth 2 is the highest of all the berths in the Port. It is noteworthy that this berth is used for single cargo by a single operator who is able to schedule their vessel arrival time. It has the capability to share cargo handling cranes with the adjacent Berth 3 and illustrates the optimal utilisation that could be expected in a fully optimised port without the physical constraints of the existing breakwaters, berth arrangement and channel restrictions.

In addition, due to ongoing upgrades, Berth 7 has been under demolition, and Berth 10 has not been operational for periods in the 2011/12, 2012/13, 2013/14 Berth 8 has also been unavailable for operations for many months over recent years as a result of port works. These outages are reflected in the lower utilisation figures for these berths over recent years. Once the upgrades are completed it will improve the optimum utilisation figures.

Port of Townsville Limited

Berth Occupancy 1997/1998 to 17 October 2014

Includes Cargo, Navy, Passenger & Other vessels

Berth Occupancy Berth	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	Optimum Berth Occupancy
Berth 1	20.39%	16.38%	23.02%	20.96%	16.59%	16.58%	17.48%	21.19%	21.50%	20.68%	24.03%	22.98%	20.95%	22.44%	31.56%	31.70%	26.54%	25.26%	60%
Berth 2	55.41%	58.20%	54.89%	51.11%	49.63%	59.12%	58.23%	56.57%	54.13%	52.97%	60.62%	52.72%	62.73%	62.89%	68.06%	76.10%	55.40%	56.51%	65%
Berth 3	40.10%	40.60%	52.08%	49.35%	46.61%	49.54%	46.93%	49.44%	50.61%	51.53%	55.90%	58.83%	62.26%	70.77%	80.20%	87.81%	81.46%	77.87%	50%
Berth 4	43.63%	31.65%	28.17%	30.38%	28.86%	30.55%	30.72%	32.56%	32.46%	44.16%	46.82%	42.90%	35.71%	35.07%	63.00%	71.53%	53.12%	50.39%	40%
Berth 7	35.36%	27.02%	24.26%	40.41%	32.53%	35.60%	29.48%	35.66%	40.85%	39.45%	42.29%	40.58%	45.21%	51.54%	72.15%	56.50%	39.64%	40.95%	50%
Berth 8	46.11%	28.27%	43.00%	35.29%	31.22%	37.10%	40.99%	29.77%	27.46%	30.55%	32.70%	26.34%	27.10%	35.19%	6.58%	0.13%	0.65%	7.79%	35%
Berth 9	40.57%	28.94%	39.86%	42.14%	27.09%	33.01%	33.72%	30.67%	37.79%	39.46%	44.65%	35.38%	36.40%	39.55%	66.74%	58.57%	40.34%	40.04%	55%
Berth 10	34.99%	22.51%	27.26%	29.75%	25.88%	30.58%	25.15%	18.42%	27.11%	25.19%	40.82%	29.40%	28.09%	22.89%	17.57%	1.05%	39.33%	53.85%	45%
Berth 11	8.96%	13.42%	12.94%	13.75%	14.56%	11.98%	14.14%	14.54%	13.60%	12.18%	18.59%	19.40%	19.49%	25.84%	30.27%	23.32%	15.81%	9.16%	55%
Total	**36.17%**	**29.67%**	**33.94%**	**34.79%**	**30.33%**	**33.79%**	**32.98%**	**32.09%**	**33.95%**	**35.13%**	**40.71%**	**36.50%**	**37.55%**	**40.69%**	**48.46%**	**45.19%**	**39.14%**	**40.20%**	

Includes Cargo, Navy, Passenger & Other vessels

Berth utilisation for berth 8 & 10 not adjusted and excluding PB Towage tugs & Maintenance visists

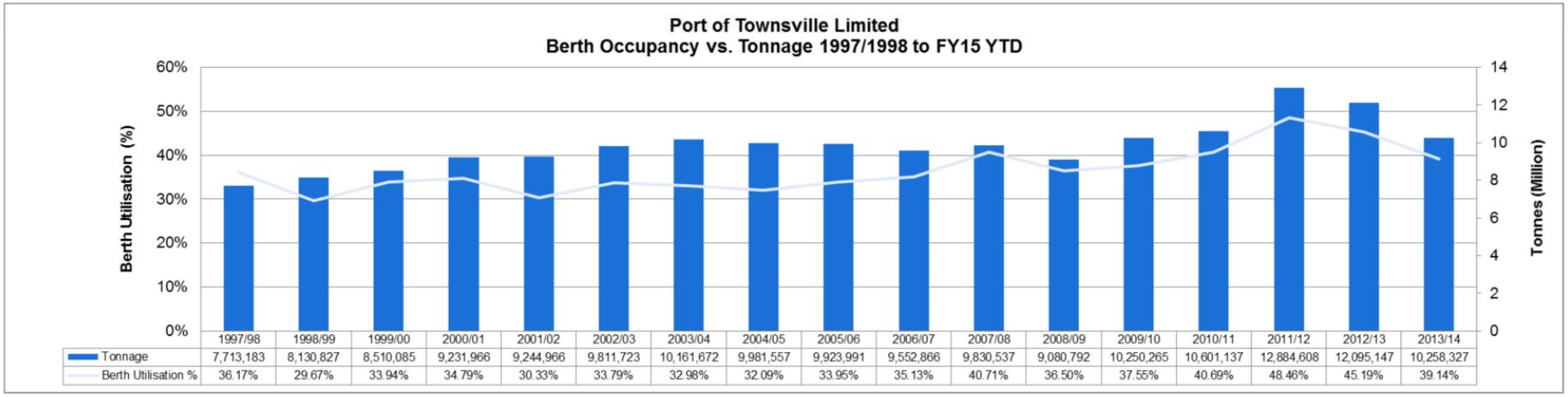

Figure 21.1 Berth Occupancy (1997-2015) and Tonnage Port of Townsville 11997-2014)

21.2.2.1 Comparison of Port of Townsville Berth Utilisation with other ports

Some examples of port expansion projects that have occurred in a port with "low" historical berth utilisation rates are provided below to illustrate how berth utilisation varies across ports.

To compare Port of Townsville Berth Utilisation with other ports, the table below illustrates berth utilisation for Victorian ports for the years ending 30 June 2006 – 2010 (Essential Services commission 2011). Table 21.1 illustrates how berth utilisation varies across ports. It is also important to note that despite these relatively low berth utilisation rates, major port expansions are underway in Victoria.

Table 21.1 Berth utilisation (%) for Victorian Ports, 2006 - 2010

Port	2006	2007	2008	2009	2010
Melbourne	29.5	31.2	30.9	29.0	28.1
Geelong	36.0	37.0	34.0	41.0	32.0
Portland	45.8	30.0	32.4	27.8	28.6
Hastings	20.2	19.7	20.4	14.8	7.7

The Victorian ports listed above have recent utilisations below 50 percent, however have developed or are implementing expansion strategies to accommodate growth in future trade. Individual approaches differ according to existing land usage and infrastructure. For example, Portland and Hastings port expansions focus on land use planning to gain efficiencies in cargo handling. Expansions at Port of Melbourne include channel deepening, and a new container terminal at Webb Dock to take port traffic off local roads.

The expansion strategy for Port of Geelong addresses land and sea transport infrastructure requirements that will take into consideration larger vessels, larger trucks and new commodities. For the marine side, the larger vessels will require increased channel dimensions (including at the berth) to maintain safe passage of vessels. A historical and future change to the global vessel fleet, particularly the shift towards larger vessels, was a major driver for the expansion of infrastructure in the Port of Geelong.

Therefore use of only historical berth utilisation statistics is an inadequate tool to assess if further port expansion is necessary and is inconsistent with best-management port practices. Whilst POTL continuously seeks to improve efficiencies and work within the existing port, to minimise capital costs, the proposed expansion to the Port of Townsville is required to accommodate medium and long-term future growth in trade volume over a planning horizon to 2040 and beyond. Additional berths, land reclamation, and modifications to improve accessibility for vessels will ensure the port remains attractive to shippers and allow for increased shipping movements and access, decrease in ships at anchor and remove current constraints on growth. The staged future planning is also considered to be consistent with the *Sustainable Ports Development Act 2015*.

21.2.3 The role of the port in the economic stability, sustainability and development of North Queensland and the risks and flow-on effects of removing this capacity

There were 230 submissions (includes form letter submissions) which questioned the role of the port in the region.

The Port of Townsville is the gateway to the region for a range of imports including general cargo, construction material and motor vehicles. The Port facilities have critical infrastructure for the central, western and northern Queensland region and support the region in a number of sectors: defence; oil, gas and fuel; mining and metals; agriculture; and tourism.

The Port of Townsville is critical to the ongoing survival of regional industries including Queensland Sugar Limited, and global companies including but not limited to, Glencore, South 32, and Incitec Pivot.

The value of cargo which transits the wharves in the Port is estimated to be in excess of $8 billion per year.

In terms of the above sectors the port's role at present and in the future are summarised as follows.

21.2.3.1 Defence

Townsville has a longstanding history hosting The Australian Defence Force. Townsville presently hosts Lavarack Barracks, RAAF Base Townsville, Mount Stuart Training Area and Townsville Field Training Area. These are critical frontline ready-deployment capabilities for the Australian Defence Force.

The Port of Townsville was identified in the 2009 *Defence White Paper* as a critical component of Australia's defence force operations. Recent infrastructure upgrades to the Port support Defence capability include the development of the Landing Helicopter Dock vessel at the new multi-user terminal at Berth 10.

The 2016 Australian Defence White Paper identifies investment in national defence infrastructure – including the Army, Navy and Air Force bases in northern Australia, including Townsville as a focus of the White Paper. The White

Paper acknowledges the Defence fuel installations as critical enablers for the generation of Defence capability. The government will continue to improve Defence's fuel resilience and capacity to transport bulk fuel to support of bases and operations. This will include upgrades to existing Defence fuel infrastructure as well as improvements to Defence ability to utilise commercial fuel supplies. The Port has a bulk fuel line to Berth 9 to provide a high flow rate supply of diesel fuel for defence and other vessels.

The Port also caters for other cargo supporting Defence assets in Townsville which include Lavarack Barracks, RAAF Base Townsville and the Townsville High Range Training Area.

21.2.3.2 Tourism

The new multi-user facility at Berth 10 includes a cruise ship terminal which provides cruise liners with a dedicated berth containing a commercial hub. This facility has the capacity to allow home porting of cruise vessels in the future and proposed improvements to the channel included in PEP will increase the certainty of access for a number of cruise vessels.

The communities of Magnetic Island and Palm Island are serviced from the Ross Creek precinct that lies within the boundaries of the Port. Ferry services are presently supplied by SeaLink Queensland that operates 4 vessels and employs around 70 staff in the region, as well as Fantasea which is predominately a car ferry service but also includes passengers. Multiple tourism operators on these islands are also underpinned by the facilities at the Port facility so that visitors can be supplied whilst on Magnetic Island.

Future development projects such as Townsville Waterfront Priority Development Area, will provide an improved experience of the waterfront area that showcases Townsville, the port and the CBD. There will potentially be a variety of public open spaces and a mixed use development to showcase the relaxed lifestyle of Townsville and the CBD.

The Port also maintains the navigational channel that allows safe passage for tourism vessels to the Great Barrier Reef.

21.2.3.3 Fuel and fuel products

North Queensland is reliant upon the import of fuel, bitumen, oil and gas. The Port hosts four fuel terminals that contain storage tanks and road / rail load-out facilities.

ATOM operates one terminal on behalf of BP, while Viva Energy operates two terminals on behalf of themselves and Caltex. Puma Energy operates two terminals (one bitumen, one fuel) on behalf of themselves.

Further to the fuel facilities, there are also two bitumen import and storage facilities, located in the Viva Energy terminal and a second one located at the rear of Berth 2 operated by Puma Energy. These facilities are critical for maintaining road infrastructure in North Queensland, underlined by Viva Energy currently progressing with a major upgrade to their facility.

Petroleum products for all companies are imported through a multi-user facility at a dedicated Bulk Liquids Berth (Berth 1). Approximately 1 million tonnes of oil, gas, acid and petroleum products are imported annually through berth 1. This generally comprises around 900,000 tonnes of fuels:

- around 540,000 tonnes or 635 million litres of diesel
- around 180,000 tonnes or 228 million litres of Jet A1
- around 180,000 tonnes or 250 million litres of gasoline products including Unleaded Petrol blends and Avgas
- around 180,000 tonnes of heavy Fuel Oil (for Queensland Nickel)
- bitumen products (including finished bitumen and bitumen feed stock).

The Townsville terminals supply customers directly by road tankers, road trains and limited rail tankers. The B-double configured road tankers have a capacity of approximately 52,000 litres. The road trains have a capacity of 105,000 litres. The local semis have a capacity of 35,000 – 40,000 litres. Customers supplied in this way include retail sites (petrol stations), transport companies, mining companies and regional distributors. Major users, such as the cane farmers of the region, are supplied through regional distributors.

Locally, Townsville airport and Department of Defence is supplied with Jet A1 from the Townsville terminal. Major airlines such as Qantas and Virgin Australia refuel every 737 flight at Townsville with this Jet A1 fuel, using in the order of 15 million litres each month.

Further afield, Cloncurry and Mount Isa depots are supplied by road train and rail tankers from Townsville. Notably, Aurizon which operates on the Mount Isa to Townsville rail line is itself a major customer of the terminal, with the diesel for the locomotives being imported through the Terminal. Townsville is the only port in Queensland that can load rail wagons directly with fuel.

It is believed that the majority of mine sites in the north-west, who together represent a significant diesel user, generally carry approximately 8 days' supply on their own sites, while there is generally 2 to 3 weeks supply in the supply chain for domestic customers of both diesel and gasoline (including LPG).

Other major diesel users include the transport companies which support the banana growers around Tully, and the cane farmers in both the Herbert and Burdekin districts.

The users of Avgas include the general aviation sector, and specialist services such as the rescue helicopter.

The sulphuric acid terminal provides storage facilities for the import and export of acid for the industrial and mining activities for North Queensland. Acid is a byproduct of zinc refining, and is also a major component in the manufacturing of fertiliser and other industrial activities.

21.2.3.4 Individual facilities reliant upon the port

The North West Queensland Mineral Province, located in Mount Isa represents a large proportion of minerals in Australia. Minerals mined from this region are exported as refined product or as mineral concentrates through the Port of Townsville. Key mineral exports include refined copper and copper concentrate, silver, lead ingots and lead concentrates, zinc metal and zinc concentrates and magnetite on occasion. Hence the Port serves as critical infrastructure for the minerals exported from central and Northern Queensland.

Summary descriptions of these major exporters' operations are provided in Table 21.2 below.

Table 21.2 Summary of operations of Major Uses

Major Users	Description of Port operations
Defence	The Port has been designated as critical defence infrastructure.
Glencore	Glencore own and operate multiple mines in the Mount Isa and Cloncurry area, including the Ernest Henry Mine which produces and processes copper, gold and magnetite (production of magnetite is presently not underway). In 2011 this mine produced around 100,000 tonnes of copper in concentrate and 130,000 ounces of gold in concentrate. Along with the Enterprise, X41, and George Fisher underground mines, and the Black Star and Handlebar Hill open-pit zinc mines, the Glencore portfolio represents a global-scale mining operation in central and northern Queensland, with the majority of the produced minerals and concentrates exported through the Port of Townsville.
Incitec Pivot	Incitec Pivot Limited (IPL) produces ammonium phosphate fertilisers from a combined mine and ore processing facility at Phosphate Hill, located around 150 kilometres south of Mount Isa. The annual production is around 975,000 tonnes, the majority of which was historically exported through Berth 8 at the Port of Townsville. This operation will move to the upgraded Berth 8 in early 2015.
Queensland Nickel	Queensland Nickel at the Yabulu refinery uses around 4 million tonnes of nickel and cobalt bearing laterite ores, imported through Berth 2, along with around 180,000 tonnes of Heavy Fuel Oil (HFO), imported through Berth 1. The refinery also uses electricity from the grid and LNG piped from Moranbah as energy sources to refine the ore into nickel and cobalt products. Some of these products are then exported through Berth 3 at the port. Queensland Nickel's ore represents the single largest product handled through the port.
Queensland Sugar Limited	The Townsville Sugar Terminal is located behind Berth 9 at the Port of Townsville. This terminal is operated by Queensland Sugar Limited (QSL). QSL manages around 70% of raw sugar exports in Australia through six bulk terminals in Queensland. Sugar for the Townsville Sugar Terminal is sourced from the Burdekin growing area which is the largest sugar producing region in Australia. The four Burdekin mills produce around 1.2 to 1.5 million tonnes of raw sugar annually. The Townsville bulk sugar terminal was established in 1950 and has a present storage capacity of 760,000 tonnes. The storage capacity is such that timely export of sugar is required each season to ensure the mills are able to remain operational. QSL also operate the Molasses Terminal behind Berth 4 on behalf of Wilmar Sugar.
South 32	The largest single global producer of lead and silver is the Cannington mine, located 200 km south-east of Mount Isa. This underground mine, owned by South 32, also hosts a metallurgical processing facility. The concentrate is transported by rail to dedicated storage and ship-loading facilities at the Port of Townsville, and exported through Berth 11.

21.2.3.5 Current Port trades

Figure 21.2 shows the port throughput since 2002/03. A list of the specific cargoes are provided in Table 21.3.

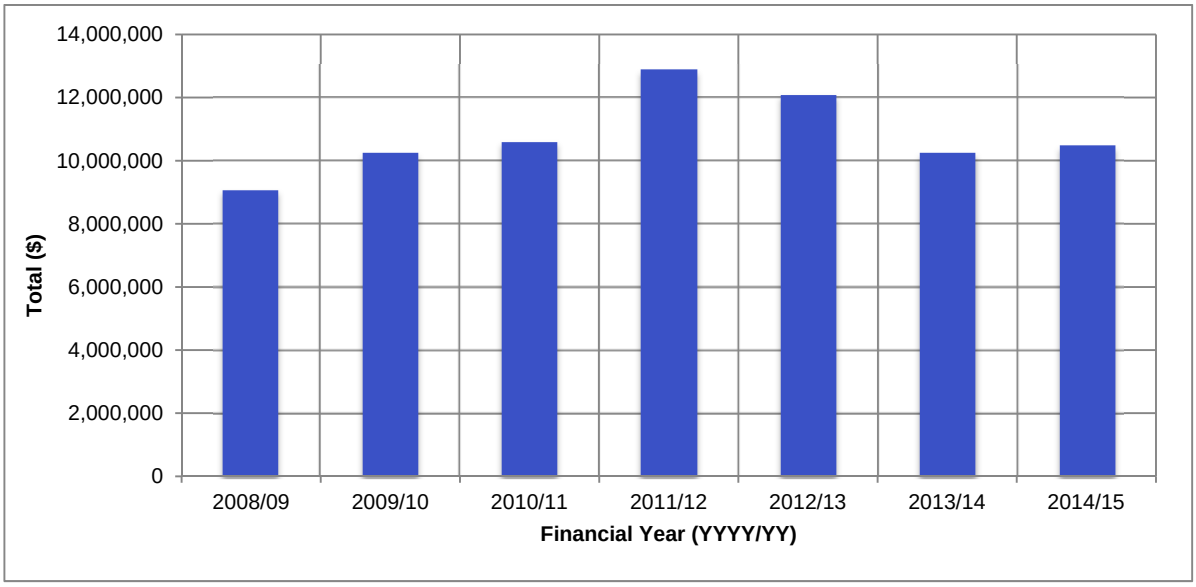

Figure 21.2 Port of Townsville Trade Statistics - Townsville Throughput

Following a peak in 2011/12, total throughput has reduced over the last two years. However, as demonstrated in the analysis of berth utilisation, a short term reduction in throughput whilst partly a result of weakening global and regional economic conditions, importantly also demonstrates that changes in the global and regional shipping fleet, and other bottlenecks in the port supply chain are restricting the port throughput. In other words, rather than simply concluding that the role or demand for port services is waning, it demonstrates that the capacity and configuration of the port needs to be updated to reflect regional external changes in the shipping fleet and behaviour of shippers. This is further discussed in the following section.

Table 21.3 Trade throughput summary (tonnes) (POTL, 2008 - 2013)

Trade	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
Import							
Cement	460,538	453,124	466,668	482,254	540,158	503,908	414,645
Fertiliser	91,600	113,691	87,775	96,817	118,814	157,962	114,356
General Cargo	152,086	188,726	211,621	300,493	265,215	254,596	263,869
Concentrates Nickel	41,439	0	13,311	52,714	16,283	69,132	63,063
Concentrates Zinc	228,476	158,341	258,309	250,230	322,078	251,841	282,856
Metals - Copper Anode	31,655	98,964	30,630	73,564	97,968	77,055	47,005
Mixed Hydroxide Percipate	0	0	0	0	0	0	8,117
Motor Vehicles	15,500	28,166	19,329	27,092	24,224	19,150	22,819
Nickel Ore	2,618,563	3,680,603	3,719,507	3,978,616	3,958,967	3,160,244	2,926,579
Petroleum Products	987,897	1,016,206	941,103	1,111,296	1,112,244	1,087,606	939,699
Sulphur	101,703	103,812	103,746	112,733	102,460	52,909	79,210
Sulphuric Acid	37,578	0	24,067	63,396	112,980	22,398	26,517
Import Total	**4,767,034**	**5,841,634**	**5,876,067**	**6,549,205**	**6,671,391**	**5,656,801**	**5,188,733**
Export							
Fertiliser	773,619	779,810	828,105	866,066	810,338	637,203	923,987
General Cargo	150,018	150,126	145,404	191,633	163,846	171,126	219,604
Livestock - Cattle	76,204	45,031	23,888	10,863	2,072	100,905	152,890
Magnetite	0	0	278,476	846,523	773,177	386,662	153,095
Meat & By-Products	6,832	15,129	27,188	21,288	13,014	5,633	8,427
Metal Cons - Copper	454,050	302,138	213,874	180,492	276,305	227,734	136,615
Metal Cons - Lead	325,585	401,910	381,792	373,058	354,773	387,697	369,176
Metal Cons - Lead/Silver	42,330	64,960	14,257	0	1,705	31,755	10,176
Metal Cons - Zinc	544,104	695,858	776,315	808,480	889,953	755,588	1,117,553

Trade	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
Metal Cons - Zinc Ferrites	67,218	56,726	154,328	210,651	210,175	252,513	226,857
Metals - Refined Copper	205,500	201,358	228,520	272,221	198,633	257,536	314,855
Metals - Refined Nickel	1,146	11,548	17,733	27,967	16,998	17,773	14,863
Metals - Refined Zinc	158,945	137,143	289,014	156,889	139,109	175,451	155,567
Metals - Smelted Lead	153,192	152,029	113,658	164,430	129,623	132,563	109,201
Metals - Zinc Oxide	0	0	24,339	0	0	0	0
Molasses	244,463	185,237	233,710	381,782	254,731	271,032	247,856
Motor Vehicles	0	0	0	0	0	0	50
Petroleum – Contaminated Oil	5,566	1,667	3,259	8,628	6,978	5,955	0
Sand/Gravel/Coke	0	8,181	0	0	0	0	0
Sugar	1,078,520	1,190,898	958,720	1,490,541	1,091,626	784,400	1,140,806
Sulphuric Acid	30,497	11,432	12,488	5,502	0	0	0
Timber	0	0	0	318,696	90,700	0	0
Export Total	**4,317,787**	**4,411,181**	**4,725,069**	**6,335,708**	**5,423,756**	**4,601,526**	**5,301,578**
Grand Total	**9,084,821**	**10,252,815**	**10,601,137**	**12,884,913**	**12,095,147**	**10,258,327**	**10,490,311**

Note:
- Sugar figures for Lucinda included for 2012/13 so totals agree with published totals from POTL Annual Report.
- While 2012/13 data is included in Table 3, the data wasn't available in time to be included in the analysis.

21.2.3.6 Impact of not having sufficient port capacity

The information presented above describes the pivotal role the port plays in supporting North Queensland communities and industry sectors. An economic input-output model was developed to understand the economic impacts to North Queensland industries and communities of current constraints at the port. The model investigated hypothetical disruption scenarios where specific vessels would be unable to gain access to the port as a result of hypothetical reductions in available channel depth. The model was constructed using measured historical data and considered real impacts that would occur to real trades should the disruption become real. By implication, the impacts of not having future trades occur can be inferred.

The current Port of Townsville access channel is maintained at a declared depth of -11.7 m LAT, which provides all tide access for Handymax size cargo vessels (40 000 – 50 000 DWT) and limited tidally assisted access for Panamax class vessels (65 000 – 80 000 DWT).

Handymax size cargo vessels, generally 150-200 metres in length, are the most common vessel presently used for general cargo operations in the shallower ports such as Townsville. These vessels typically have a loaded draft of around 11.0 m and needs 12.3 m of water depth in the channel and swing basin to allow these vessels to access the port. The mean low water spring (MLWS) level in Townsville is +0.77 m LAT, so there is sufficient water depth for Handymax shipping to transit the channel during most tides.

Trading ships, such as Panamax class type vessels, are built longer and/or wider than Handymax cargo vessels in order to access a trade through the Panama Canal. The common Panamax size vessel is generally 32.3 m wide, 225 m long and with a laden draft of up to 14.5 m. As a result of the available dredged depth in the Port's access channels, these vessels can only transit the Port of Townsville during short high tide windows when they are fully laden.

The Panama Canal is presently being widened under the Panama Canal Expansion project (due for imminent completion). This will allow post-Panamax Plus or new Panamax ships to traverse the canal and this is incentivising a global change in the mean beam or width of vessels. The Port Expansion Project will provide enhanced access for Panamax and unrestricted access for Handimax vessels. However, the following discussion relates to the present shipping which accesses the port through the existing channels, but is applicable to all future channels.

The following three scenarios were considered and described in Table 21.4:

1. All tide access restricted to Handysize vessels (40,000 deadweight tonnage)
2. All tide access restricted to small Handysize vessels (25,000 deadweight tonnage)
3. All tide access restricted to small Handysize vessels (10,000 deadweight tonnage).

Port data were combined with supply-chain analysis information to quantify the key supply chain interdependencies. Table 21.4 shows an example of these inter-dependencies.

Table 21.4 Scenarios considered for vessel access

Scenario	Largest vessel that can sail loaded in channel		% Vessels unable to sail loaded in channel	
	All tides	High tides	All tides	High tides
1	Handysize (30,000 deadweight tonnage)	Handysize (40,000 deadweight tonnage)	29%	16%
2	Small Handysize (20,000 deadweight tonnage)	Handysize (25,000 deadweight tonnage)	70%	50%
3	Small Handysize (10,000 deadweight tonnage)	Small Handysize (12,000 deadweight tonnage)	87%	78%

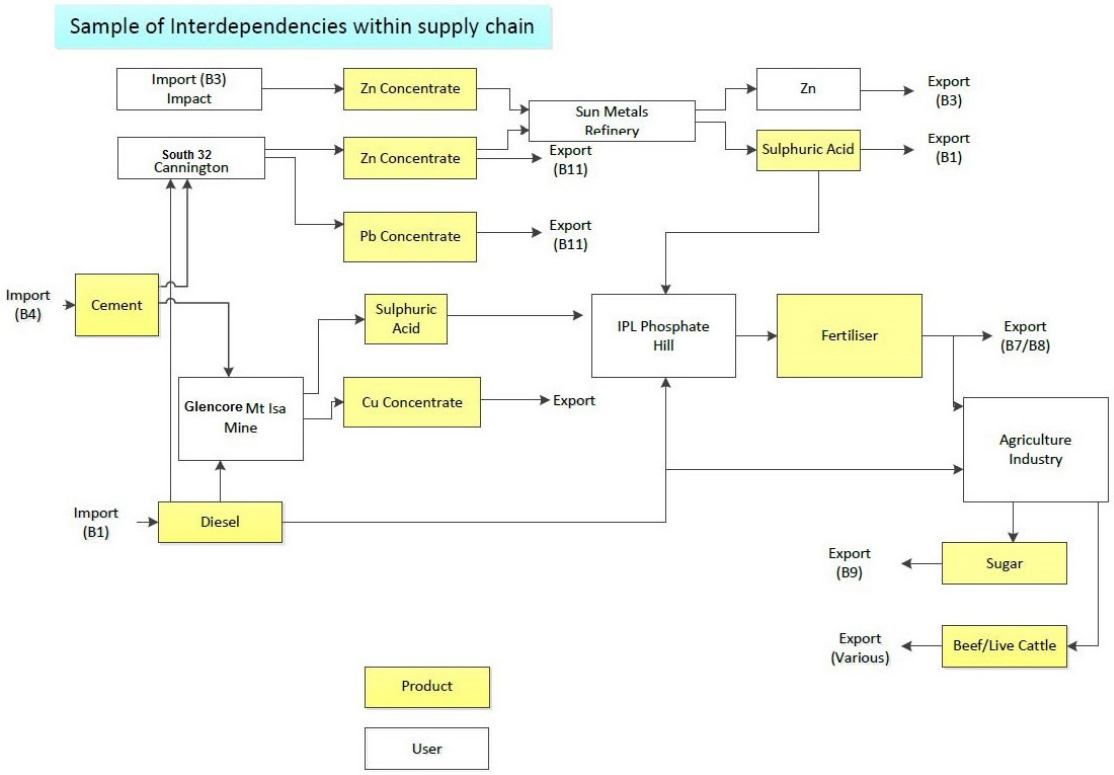

Figure 21.3 Sample of Interdependencies within Supply Chain

The economic impacts were estimated using regional multipliers calculated from a State-level Input-Output table (Australian Bureau of Statistics, 2012b). This table was derived using the latest national Input-Output table (2008-09) prepared by the Australian Bureau of Statistics as part of the Australian National Accounts (Australian Bureau of Statistics, 2012a), and adjusted by AECOM to reflect Queensland inter-industry transactions and final demand flows. The adjustments were based on information and data at the State-level within the Australian National Accounting System and on Census data.

The Queensland Office of Economic and Statistical Research have developed regional Input-Output tables, the most recent being for 1996-97. It is important that the relationships between the regions and the State underlying these earlier tables are recognised. This is not because industries in a particular region will necessarily have different production methods to those in the rest of Queensland, but because the import-intensity at a regional level could be significantly different than would be found in the State-level table.

The table for Northern Queensland (which mainly captures Townsville activities) has been used as a reference source to compare the regional multipliers to the State level multipliers for that year. The resulting ratios were applied to the multipliers derived from the latest State level Input-Output table to impute regional multipliers for the latest year. These multipliers were then reviewed to take account leakages of expenditures and factor incomes from the region.

To measure economic impact, four multipliers are used:

- output (gross revenue or turnover)
- value added (which can be directly compared to gross State product and gross regional product)

- household income
- employment.

Two types of multipliers can be calculated.

- Type 1 multipliers - measure the direct and production-induced impacts of a stimulus or activity. The latter impacts refer to the subsequent rounds of purchases of inputs by businesses supplying the direct suppliers of the stimulus or activity (industrial flow-on effects).
- Type 2 multipliers - capture the Type 1 effects and also measure the consumption-induced effects that flow from the expenditure of income that is earned from the production of additional output.

Previous port impact studies have used Type 2 multipliers because of the labour intensity of port operations and their importance as places of employment to the communities in which they are located (Bureau of Transport Economics (2000; 2001a; 2001b), Econsearch (2009).

Multipliers are usually presented in terms of '$ per unit of output'. However, employment multipliers are expressed in terms of jobs (full-time equivalent positions, or full time equivalents) per million dollars of output. The multiplier values used to calculate the impact on the regional economy of the disruption of vessel access to the Port of Townsville are presented in Table 21.5.

Table 21.5 Type 2 multipliers (Northern Statistical Division) for transport support services and storage industry

Measure	Direct effects [a,b]	Flow-on effects	Total impact [c]
Output [d]	1.37	2.24	3.62
Value added [d]	0.57	1.06	1.63
Household income [d]	0.26	0.49	0.76
Employment [e]	3.7	8.0	11.7

Notes:

(a) From Queensland Input-Output Table 2008/09, 111 industries, imputed by AECOM from Australian Bureau of Statistics National Input-Output tables. This industry classification includes port-related activities.

(b) The effects of the change in output in the transport support services and storage industry including the purchases of inputs required from other industries in order to produce the change in output in the transport support services and storage industry.

(c) Totals may not sum exactly due to rounding.

(d) Dollar impact per $1.00 of output change in the transport support services and storage industry.

(e) Number of full time equivalent jobs per $1 million of output in the transport support services and storage industry. The values derived from the 2008/09 Input-Output table have been reduced to allow for increases in the general price level since then (the implicit price deflator for State Final Demand for Queensland has been used).

21.2.3.7 Assessment Results

Table 21.6 sets out the derivation of the change in final annual demand for port-related output for each scenario. The calculations are for an average year over the four-year period 2008/09 to 2011/12.

The derived change in final demand suggests a linear relationship exists between changes in tonnage and changes in port-related output (this implicitly assumes that the different types of cargo affected have the same cargo handling requirements and support service requirements in the Port). However, in reality there will be differences in factors such as profitability, capital intensity, average income and labour intensity.

The change in final annual demand for port-related output in dollar terms has been estimated by assuming that the value of POTL output (i.e. the value of services provided by POTL) accounts for about 17 percent of total port-related output (the value of services provided by all port-related firms and organisations). This is the average of the corresponding percentages for the ports of Gladstone (19 percent), Mackay (23 percent) and Port Kembla (9 percent) (Bureau of Transport Economics (2001a; 2001b), Econsearch (2009)). Based on information collected from port users during this study, POTL accounts for about 15 percent of total port-related employment.

Table 21.6 Derivation of change on final demand for port-related output

Disruption scenario	Estimated reduction in port throughput (tonnes) [b]	As % of total port throughput [c]	Annual change in final demand for port-related output [d]
1	5,525,515	47%	$215 million
2	7,693,222	65%	$300 million
3	10,137,177	86%	$395 million

Notes:

(b) Calculated as average parcel size x number of ships impacted per outage. Average of four financial years from 2008/09 to 2011/12.

(c) Total port throughput over the four-year period averaged 12.1 million tonnes. For the purpose of the analysis, this was adjusted to 11.8 million tonnes to allow for cargoes for which information is unavailable on average parcel size and therefore on estimated trips per year.

(d) Assuming that POTL accounts for about 17 percent of total port-related output (value of services).

The regional economic impacts associated with 3 disruption scenarios are shown below.

21.2.3.8 Scenario 1 - All tide access restricted to Handysize vessels (40,000 deadweight tonnage)

The regional economic impacts associated with Scenario 1 are shown Table 21.7. These figures are based on the multiplier values in Table 21.5 and the change in final demand for port-related output in Table 21.6.

Table 21.7 Regional economic impacts of disruption to vessel access to Port of Townsville - Scenario 1

Measure	Direct effects	Flow-on effects	Total impact [b]
Lost output ($ mill)	296	483	779
Lost value added ($ mill)	123	227	350
Lost household income ($ mill)	57	106	163
Employment reduction (FTE) [a]	803	1,726	2,529

Notes:

(a) Number of jobs (full-time equivalent positions).

(b) Totals may not sum exactly due to rounding.

Table 21.7 shows the following in Scenario 1.

- The direct effects of disruption to vessel access to the Port are estimated to be $296 million in lost output while the total impact, after allowing for flow-on effects, is estimated to be $779 million in lost output for the region.
- In terms of lost value added, the direct effects are estimated to be $123 million while the total impact, after allowing for flow-on effects, is estimated to be $227 million. The estimated loss of contribution to Gross Regional Product is equivalent to about 2.9 percent for the region and 3.3 percent for Townsville Local Government Area.
- In terms of lost household income, the direct effects are estimated to be $57 million while the total impact, after allowing for flow-on effects, is estimated to be $163 million.
- In terms of employment, the direct effects are a loss of 803 full time equivalent positions while the total impact, after allowing for flow-on effects, is a loss of 2,529 full time equivalent positions. This is equivalent to about 2.9 percent of total employment in the region and 3.5 percent for Townsville Local Government Area.

21.2.3.9 Scenario 2 - All tide access restricted to small Handysize vessels (25,000 deadweight tonnage)

The regional economic impacts associated with Scenario 2 are shown in Table 21.8. The figures are based on the multiplier values in Table 21.5 and the change in final demand for port-related output in Table 21.6.

Table 21.8 Regional economic impacts of disruption to vessel access to Port of Townsville - Scenario 2

Measure	Direct effects	Flow-on effects	Total impact [c]
Lost output ($ mill)	412	673	1,085
Lost value added ($ mill)	171	317	488
Lost household income ($ mill)	79	148	227
Employment reduction FTE) [b]	1,117	2,403	3,521

Notes:

(a) Based on multipliers in Table 21.5 and change in final demand for port-related output in Table 21.6.

(b) Number of jobs (full-time equivalent positions).

(c) Totals may not sum exactly due to rounding.

Table 21.8 shows the following in Scenario 2.

- The direct effects of disruption to vessel access to the Port are estimated to be $412 million in lost output while the total impact, after allowing for flow-on effects, is estimated to be $1,085 million in lost output.
- In terms of lost value added, the direct effects are estimated to be $171 million while the total impact, after allowing for flow-on effects, is estimated to be $488 million. The estimated loss of contribution to Gross Regional Product is equivalent to about 4.1 percent for the region and 4.6 percent for Townsville Local Government Area.
- In terms of lost household income, the direct effects are estimated to be $79 million while the total impact, after allowing for flow-on effects, is estimated to be $227 million.
- In terms of employment, the direct effects are a loss of 1,117 full time equivalent positions while the total impact, after allowing for flow-on effects, is a loss of 3,521 full time equivalent positions. This is equivalent to about 4.0 percent of total employment in the region and 4.9 percent for Townsville Local Government Area.

21.2.3.10 Scenario 3 – All tide access restricted to small Handysize vessels (10,000 deadweight tonnage)

The regional economic impacts associated with Scenario 3 are shown in Table 21.9. These figures are based on the multiplier values in Table 21.5 and the change in final demand for port-related output in Table 21.6.

Table 21.9 Regional economic impacts of disruption to vessel access to Port of Townsville - Scenario 3

Measure	Direct effects	Flow-on effects	Total impact [c]
Lost output ($ mill)	543	887	1,429
Lost value added ($ mill)	226	417	643
Lost household income ($ mill)	104	195	299
Employment reduction (FTE) [b]	1,472	3,167	4,639

Notes:

(a) Based on multipliers in Table 21.5 and change in final demand for port-related output in Table 21.6.

(b) Number of jobs (full-time equivalent positions).

(c) Totals may not sum exactly due to rounding.

Table 21.9 shows the following in Scenario 3.

- The direct effects of disruption to vessel access to the Port are estimated to be $543 million in lost output while the total impact, after allowing for flow-on effects, is estimated to be $1,429 million in lost output.
- In terms of lost value added, the direct effects are estimated to be $226 million while the total impact, after allowing for flow-on effects, is estimated to be $643 million. The estimated loss of contribution to Gross Regional Product is equivalent to about 5.4 percent for the region and 6.0 percent for Townsville Local Government Area.
- In terms of lost household income, the direct effects are estimated to be $104 million while the total impact, after allowing for flow-on effects, is estimated to be $299 million.
- In terms of employment, the direct effects are a loss of 1,472 full time equivalent positions while the total impact, after allowing for flow-on effects, is a loss of 4,639 full time equivalent positions. This is equivalent to about 5.3 percent of total employment in the region and 6.5 percent for Townsville Local Government Area.

The results of the Economic Impact Assessment are shown in Table 21.10.

Table 21.10 Summary of Economic Impact Assessment Results

Scenario	Total Impact			
	Lost Output ($ million)	Lost Value Added ($ million)	Lost Household Income ($ million)	Employment Reduction (FTE)
1	779	350	163	2,529
2	1,085	488	227	3,521
3	1,429	643	299	4,639

An economic disruption model that describes the impacts of channel restrictions on economic activity was developed. This model was based on actual historical trades and hence considered the impacts of the present channel being restricted. By implication, economic impacts of restricting future trades can be estimated.

In summary, short-term lost output of three access restriction scenarios ranged from $779M to $1,429M. This result suggests that future trades that may be foregone as a result of a lack of sufficient capacity in the port land-based and channel infrastructure could be at least of this magnitude. The model confirms the impact of future trade if the port does not support future expansion.

21.2.4 Consideration of using alternative ports to cater for increased demand, especially any future coal exports

14 submissions suggested that alternative ports should be used to cater for increased demand, especially for any future coal exports. This is a common outcome in communities where a proposed activity may occur as the strong preference is often for this to not to occur near them i.e. Not in my backyard. The possible use of alternative ports is discussed in this section.

The general attributes of other ports along the Queensland coast are detailed in Table 21.11 below. As the gateway for the Mount Isa minerals province, it is not economically feasible to use an alternate Port to Townsville for these products. Nevertheless, a brief discussion of the suitability of other ports for other cargos follows.

Table 21.11 Alternative Ports

Port	Attributes and Suitability as an Alternative
Port of Lucinda	The Port of Lucinda, located around 140 km north of Townsville consists of a single trestle jetty. The port is a dedicated sugar loading port with on-shore handling and storage facilities and the product being transported to the end of jetty ship-loader via conveyer belt. The typical annual throughput is around 350,000 tonnes. During 2011 and 2012 the facility was out of commission as a result of damage suffered during Cyclone Yasi and sugar was trucked to Townsville for export. There is no rail access into Lucinda from the North Coast Line and limited storage space. Without further development, Lucinda does not present an alternative to Townsville for sugar export, or other trade.
Port of Mourilyan	The Port of Mourilyan is located around 270 kilometres north of Townsville. Like the Port of Lucinda, Mourilyan is a sugar export terminal comprising on-shore handling and storage facilities and a single loader mounted on a small wharf. The navigable depth is 10.1 metres below datum. In 2011/2012 the Port of Mourilyan had an annual throughput of around 450,000 tonnes. Without further development, Mourilyan does not present an alternative to Townsville for sugar export, or other trade.
Port of Cairns	The Port of Cairns is the most northern general cargo port on the eastern seaboard; located around 350 kilometres from Townsville. The Port of Cairns is not designated as a priority port; rather it is a small general purpose regional port that can accommodate bulk and general cargo, cruise shipping, fishing fleet, and reef passenger ferries. The Port of Cairns lacks the bulk material handling equipment and storage facilities that are required to process high volumes of bulk materials efficiently. The design depth of the channel is 8.3 metres and during 2011/12 the Port of Cairns had an annual throughput of around 1.0 million tonnes. Without significant development, Cairns is not a suitable alternative port for the bulk exports or imports, or for the volume of most other cargoes which presently use Townsville.
Abbot Point	The Port of Abbot Point is located around 190km south of Townsville just north of Bowen. Abbot Point services central Queensland coal mines and remains primarily a coal port. As a coal port, Abbot Point contains rail in-loading facilities, coal handling and stockpiling areas. A single trestle jetty and conveyor connecting to two offshore berths and two ship loaders extend offshore to a distance of 2.8 kilometres. Abbot Point is a deepwater port with depths at the berths around 17-18 m below LAT. The 2011/12 annual throughput for the Port of Abbot Point was approximately 13.6 million tonnes.

Port	Attributes and Suitability as an Alternative
	With further development, Abbot Point may be suitable for the export of bulk products such as mineral concentrates, magnetite or additional coal. For products other than coal, an upgrade of the facility would be required, and consideration would need to be given to the capacity constraints currently facing Abbot Point port.
Port of Mackay	The Port of Mackay is situated around 390 kilometres south of Townsville. The Port hosts 4 berths for the export of sugar, sugar product and grain, as well as the import of petroleum products and the import and export of break-bulk general cargo. The 4 berths are serviced by three ship loaders and terminal operations include fuel terminals, sugar and grain storage and scrap metal. The design depth of the berths ranges from 10.6 to 13 meters. In 2011/12 the total throughput at the Port was 2.7 million tonnes. In general, some general cargo could be diverted from Townsville to Mackay port. Consideration would need to be given to dealing with capacity constraints at Mackay. Without considerable development, Mackay would be unsuitable for the export of mineral concentrates.
Port of Gladstone	The Port of Gladstone is located 829 kilometres south of Townsville. The port expedites the exports of coal, alumina, aluminium, and cement. The port of Gladstone is a major Australian bulk port, but also processes containerised cargo and general cargo. The annual total throughput for the Port of Gladstone in 2011/12 was 83.8 million tonnes. With further development at Gladstone, some of the general cargo and bulk cargo could be diverted from Townsville to Gladstone.
Port of Brisbane	The Port of Brisbane Queensland's southern-most bulk and cargo port and is located at the mouth of the Brisbane River, which is around 1,400 kilometres south of Townsville. The Port of Brisbane hosts 29 operating berths of there are 7 dedicated container berths, and 11 bulk and general cargo berths for multipurpose, wet and dry bulk commodities and general cargo. The Port of Brisbane had an annual tonnage of 37.2 million in 2011/12. Access to the Port is by Moreton Bay where deep-water channels are a minimum 280m wide and the minimum depth is 15.0m Lowest Astronomical Tide. The Port of Brisbane could handle additional containerised cargo, but would require further development to be able to handle bulk cargo such as mineral concentrates or nickel ore.

21.2.4.1 Assessment of practicality of alternative ports

The Port of Townsville had historically considered the feasibility of an alternative greenfield port site. The process that was undertaken is described in the Project Description (refer Section 2.0 of the AEIS). Importantly, developing a new port on a greenfield site will now be in contradiction to the Queensland Ports Strategy and *Sustainable Ports Development Act 2015*.

The practicality of the using alternative existing ports is governed by the following factors:

- the need for loading infrastructure and a suitable port configuration for the cargoes in question
- the need for capacity in linear infrastructure to alternate ports, i.e. the existence of suitable road and rail access with the capacity to safely transfer the cargo in question in or out of the port
- environmental considerations associated with the use of the alternative port, including the impact of developing suitable infrastructure and supporting infrastructure.

For example, whilst the ports at Mackay and Cairns would presently have berthing capacity that are too shallow, both of these ports are unable to handle mineral concentrates as a result of the existing port configuration and lack of loading infrastructure. The suitable berths in Cairns are not connected to the required rail infrastructure. Cairns port also lacks bottom discharge pits, rotary wagon tippler equipment or a suitable concentrates stockpile area.

Whilst the outer harbour at the Port of Mackay has direct rail access for up to 20 tonne rail axle loads and several balloon loops, all of the rail bottom discharge facilities are designed for food grade export cargoes (sugar and grains). This infrastructure is unsuitable for the present rail wagons used for concentrates in Townsville. Furthermore, the risk of food contamination prevents these facilities, including conveyers and loaders, from being suitable for alternative cargoes.

Abbot Point, a coal terminal, would result in similar issues. Apart from the obvious disruption to the coal handing processes, the lack of a northern access angle from the North Coast Line and tippler infrastructure would need to be resolved.

Alternate ports lack the capacity for road and rail infrastructure. For example, the train sizes required for transportation of some concentrates are much larger than conventional trains. While this is manageable for the

limited number of trains on the Mount Isa rail line, which travels directly to Townsville, it would be unacceptable on the North Coast Rail Line to Cairns or Mackay where train densities are substantially greater.

Using road transport to carry over a million tonnes from Townsville, or direct from the North West Mineral Province, would impose unreasonable demands on the regional and local road networks. The required 30,000 or more movements at 25 tonnes each would require facilities to service a continuous large stream of truck arrivals, for example a single train unloading 4,000 tonnes is equivalent to 160 semi-trailers. Additionally, some of the zinc concentrate produced in the North West is bound for Sun Metals Refinery near Townsville. As a result, a transport supply chain from Mount Isa to Townsville would still need to be maintained. In the case of Cairns, if it was used as an alternative, the most likely scenario is for double handling by truck from Townsville, resulting in additional traffic and costs. Initial calculations suggest that using a closer alternative port such as Cairns may add between 35 to 70 dollars per tonne for transport costs, which would likely be unsustainable for many central and western Queensland mining operations, in addition to adding noticeable and often considerable costs to basic community goods and services in the Townsville region.

21.2.4.2 Other considerations

A key consideration in the investigation of alternatives is the environment impacts of road, rail and shipping. For example, the argument was made by 10 submitters that the port should not have to be expanded as alternative ports could be used to handle future trades; thereby avoiding environmental impacts associated with port expansion. However the environmental impacts of using alternate ports must also be taken into account.

In order for the comparison of alternate ports to be complete, the relative secondary impacts of road or rail transport need to considered to another port by comparison over shipping the same distance. The comparison does not include, for example, impacts associated with international shipping as in the comparison the number of ships entering and leaving Australian territorial waters is the same just entering or departing via different ports.

Energy Use

Not expanding the Port of Townsville and directing shipping through other ports would require cargoes to be then transported to the relevant receiver port by either road or rail. This has consequences for energy use and carbon emissions, and other environmental consequences such as collisions with wildlife.

Table 21.12, extracted from Dekker *et al* (2012) shows a comparison of energy use and emissions of various transport models. The results presented in this table show that per tonne of cargo transported per kilometre, road transport can require an order of magnitude (10 times) more energy by comparison to shipping, and as a result lead to nearly an order of magnitude of more carbon and greenhouse gas emissions.

Similarly, shipping requires around one quarter of the energy by comparison to diesel rail, and produces less than half of the equivalent carbon dioxide emissions. Therefore diverting trades through other ports as a strategy to avoid expanding the Port will lead to additional energy requirements and emissions (up to ten-fold increase).

Table 21.12 Energy use and emissions for typical units of different modes (Dekker *et al*, 2012)

Energy use / emissions g/t/km	1,000 TEU container vessel	6,600 TEU container vessel	Rail-electric	Rail Diesel	Heavy Truck	Boeing 747-400
kWh/t/km	0.014	0.018	0.043	0.067	0.18	2.00
CO_2	7.48	8.36	18	17	50	552
SO_x	0.19	0.21	0.44	0.35	0.31	5.69
NO_x	0.12	0.162	0.10	0.00005	0.00006	0.17
PM_{10}	0.008	0.009	N/A	0.008	0.005	N/A

*Refer to Section 11.0 of the AEIS for details on air quality

21.2.5 The need for accommodating larger vessels

Nine submissions questioned the need for the Port Expansion to cater for larger vessels. Indeed, the need for the dredging of the channel underpinned a number of matters raised in submissions.

Section 21.2.1 above discussed optimum berth utilisation and the trend in berth utilisation at the Port. It highlighted the need for ports to remain internationally competitive by being able to accommodate the medium and longer term changes in global vessel sizes.

Section 21.2.3 investigated the potential economic consequences of port capacity restrictions leading to trades being foregone.

This section discusses:

- how the present capacity of the navigational channel is restricting trade to the Port

- how changes in the global shipping and trade dynamics will lead to pressure for regional ports to be able to accommodate larger vessels.

Entry to the Port is through the Platypus and Sea Channels. The nominal width of these channels is 92 metres and no passing lanes are available. Over recent years around 65 vessels a year (2 million tonnes of cargo) have access restricted by tidal and wind conditions.

Similarly, the Port estimates that up to 10 vessels per month pass Townsville en route to Brisbane, these vessels are unable to enter the port as a result of the capacity of the navigational channel. These vessels unload at Brisbane, and cargo is trucked or railed back to North Queensland. In 2014, of the 186 vessels that berthed at the Port of Brisbane, only 41 of these vessels would be able to berth at the Port of Townsville. The Port estimates that this results in over 100 000 TEU (Twenty foot Equivalent Units) being transported by road or rail, at least half of which could be avoided if these vessels were able to enter Townsville. Furthermore the within-Queensland costs per container could be halved.

The Port Expansion Project, as described in the EIS, included the dredging of the Platypus and Sea Channels to allow all-tides access to the Port for Panamax vessels. Panamax vessels typically have a length in the order of up to 230 m, a beam (width) in the order of 32 m, and a laden draft (depth under water) in the order of 12.5 m. As such, they are presently only able to enter the Port either lightly loaded, or with the additional depth provided by high tide.

In 2016, upgrade works to the Panama Canal will be completed and the historical restriction on Panamax vessel beams of 32 m will be lifted. This restriction has been in place to allow vessels to safely traverse the Panama Canal. The opening of new sections of the Panama Canal, will allow the New Panamax class of vessels to use the Canal. Importantly for Townsville Port, it will also allow the existing 'post Panamax' vessels to use the Canal. Post Panamax vessels have beams in the order of 43 m and include design features that enhance their performance. An increase in beams reduces the need for ballast, which subsequently reduces displacement and drag (WWL, 2014).

Figure 21.4 and Figure 21.5 below provides dimensions of Panamax and Post Panamax vessels in the world fleet. The standardisation of the Panamax vessel beam in the order of 32 m is evident. Typical Panamax vessels which visit Townsville Port are in the 60,000 to 70,000 DWT size range, though as noted above, the larger vessels are often light loaded due to tidal restrictions.

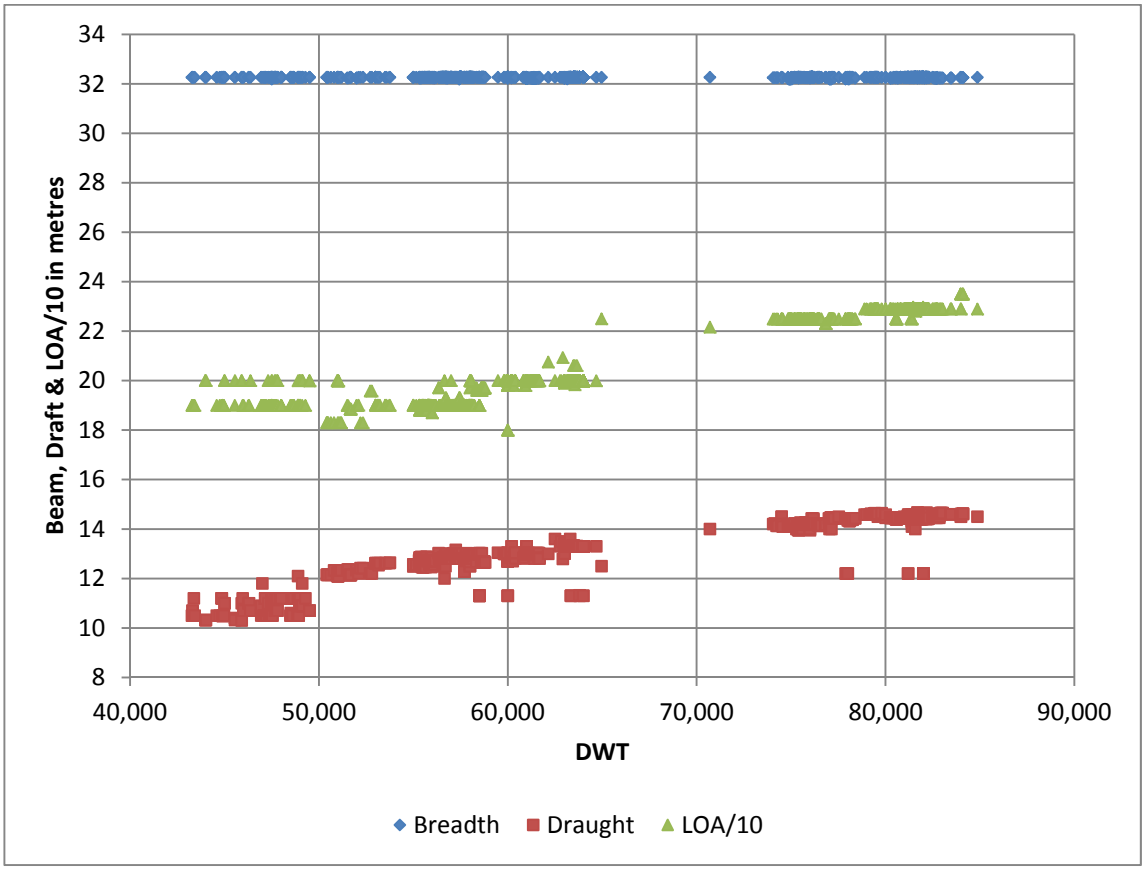

Figure 21.4 Sizes of Panamax Bulk Carriers. The length scale used is the LOA (Overall length) divided by 10 (LOA/10)

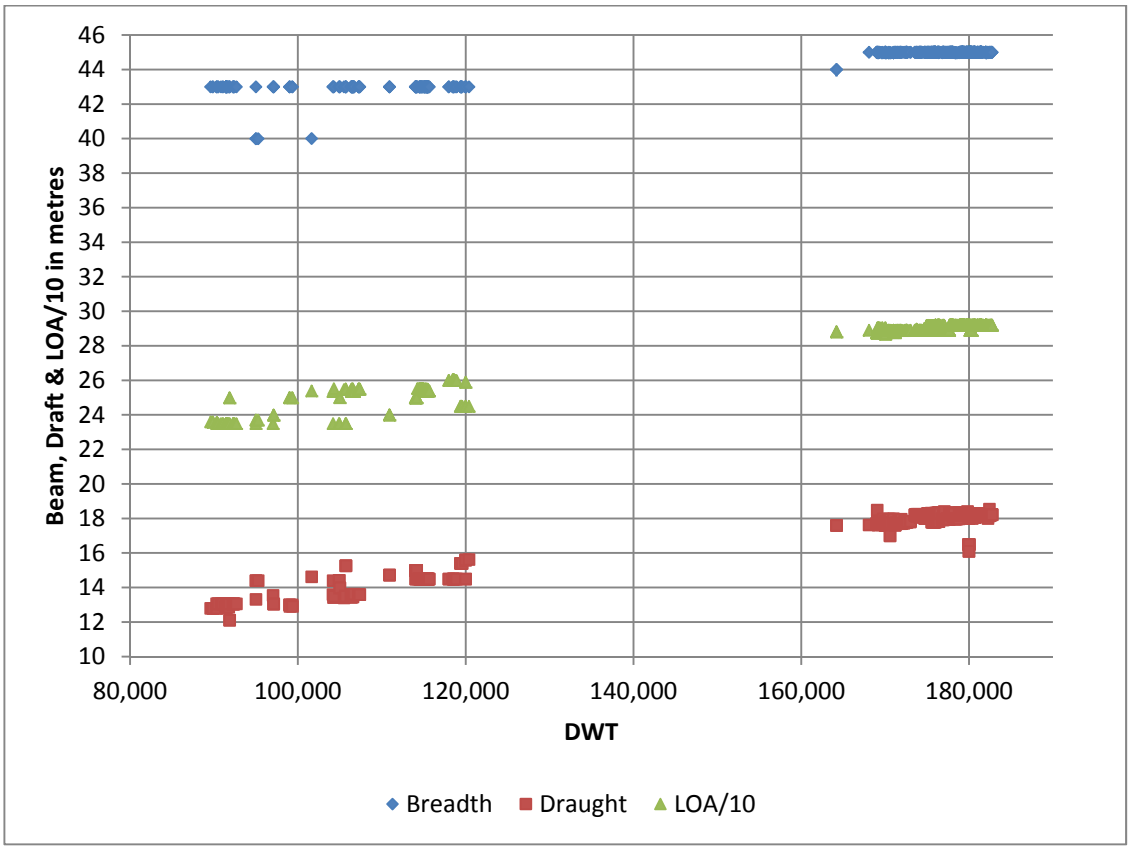

Figure 21.5 Sizes of Post Panamax Bulk Carriers. The length scale used is the LOA (Overall length) divided by 10 (LOA/10)

In lieu of the full deepening existing channels as proposed in the EIS, the design refinement of a widened channel will allow the Post Panamax vessels with a 43m beam access to Townsville. It is anticipated that Post Panamax vessels up to 100,000 DWT will have access to Townsville under the revised case.

In the case of the global container fleet, for example, this benefit is illustrated in Figure 21.6 below. Figure 21.6 also illustrates that the global trend to larger ships is not new. Historically, the 'ideal' size container ship has been fixed due to navigational limitations in regions of the world (for example, the Panama Canal) and to ensure stacking of containers is standardised and efficient (Eurans Ltd, 1998-2014).

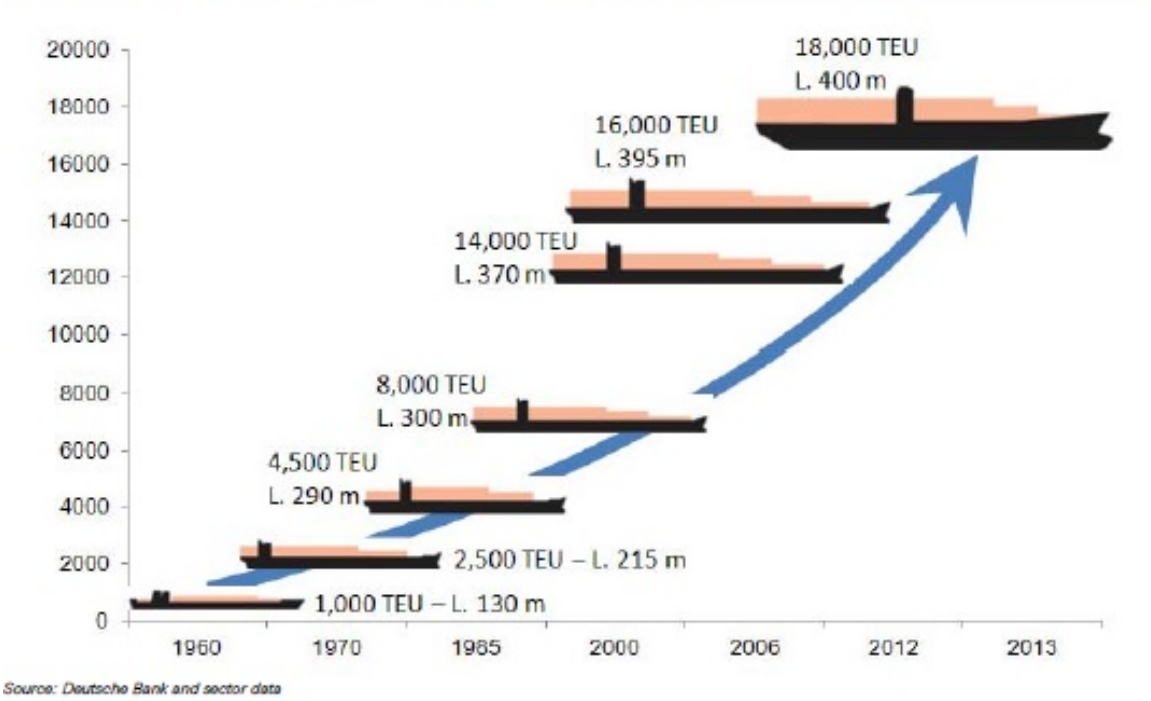

Figure 21.6 Evolution of vessel sizes

The emerging trades that a wider channel at the Port of Townsville will cater for include:

- expansion of the containerised cargo (supported by a larger regional base, as well as expansion in the range of products being containerised)
- fuels (driven by loss of Australian refineries and a need to cater for the longer range vessels i.e. via LR1 and LR2s out of Asia)
- car vessels (loss of Australian manufacturers and increase in population continues to drive an increase in the vehicle imports)
- opportunistic use by the leisure cruise industry.

Townsville port needs to respond not only to the increase in the worlds fleet but also to the vessels currently servicing other ports in Australia, particularly on the east coast, as Townsville will typically be a port of call particularly for container vessels. Ultimately the desired situation is that Port of Townsville is able to accommodate container vessels using the 8000-10000 TEU as a good benchmark (noting that tidal limitations might apply). This is generally the post and new Panamax fleet. Larger vessels with scheduled routes to key southerly ports can dock at Townsville as highlighted above, this results in cheaper products particularly for the regional areas. This allows regional distribution rather than distribution from Brisbane.

The container trade is expected to increase to cater for the following.

- Increased cargo discharge from vessels on route (improved economic return for importers and local businesses).
- Limited capacity on rail and improved economic return for importers and local businesses compared to road transport.
- A trend in increased containerisation of some cargos and or products. For example there is a growing trend in the containerisation of agricultural products in Indonesia and China; increasing demand for the containerisation of smaller volume break-bulk, high value products or bulk products particularly if these are to be transhipped either to smaller ports or on to container based ports.
- An expanding regional population requires additional infrastructure, equipment, products, services and consumable products. A large component of which is handled via the port of Townsville.
- Increase in equipment imports to support a growing population base, and industry in the area be it project cargo e.g. turbines for power plants, pre constructed sections of mining equipment, the mining equipment itself or mining consumables such as tires. Given Townsville's proximity to, and relationship with, the western minerals province it is a natural fit for this project cargo to be handled via Port of Townsville.

In addition to containerised trade, car imports are increasing. This trend is enhanced by the ongoing downsizing of the Australian auto manufacturing sector. Slab-sided car vessels in general have high windage, which means that

can be difficult to navigate in confined areas such as navigation channels, so a narrow channel is challenging for these to navigate. A channel that can cater for a 40-44m beam vessel will allow the flexibility required to service this growing industry as well as cater for the new vessels class (Hero Class).

Import of cars direct from Korea, Thailand and Japan has increased by 30% in the last four years. Car imports are expected to increase by 80% in next five years (based on Townsville trade statistics and discussions with importers). Some of these increases relate to the growth in the market and the availability of a refurbished Berth 10 facility at Port of Townsville, but some changes are in response to the impending cessation in car manufacturing in Australia and changes to trade agreements with Asian countries announced recently. More Ro-Ro (roll-on roll-off) ships can now unload directly at Port of Townsville with vehicles to be distributed throughout North Queensland. Previously some ships bypassed Townsville and unloaded in Brisbane and then the cars were trucked back to North Queensland.

There is an increasing requirement for provision of Fuel (including avgas) for the Townsville Region, the Western mineral province and surrounding areas. As these population centres grow demand for fuel increases this will need to be catered for. As previously outlined the closing of refineries in Australia will result in the need for larger (long range vessels) to be accommodated as this material will now be imported rather than moved via coastal shipping.

Over 1.1 million tonnes of Diesel, Jet A1 fuel, Avgas, oil, petroleum products for domestic use is presently imported annually through the Port of Townsville to supply communities, mines and industries from Townsville to Mount Isa, Cloncurry, as well as to the north and south of Townsville. This trade is based on the needs of these communities and is only just keeping pace with demand at this point in time. The emergence of major export-based refineries in Asia operating on a lower cost base has transformed the industry resulting in the impending closure of the Bulwer Refinery in Brisbane (not an event forecast in the trade scenarios modelled for the EIS), there is an intention by fuel companies to use larger, long range Aframax-sized ships (LR1 and LR2s) to transport fuel from southeast Asia to Australia, including Port of Townsville. These fuel ships are wider and deeper than the forecast bulk trade ships (a beam of up to 44 m and draught of up to 15 m). Access to the Port of Townsville by these ships limited due to tidal restrictions and would still have to be partially loaded. To increase options and improve access to this trade the channel would first have to be widened, then deepened.

The cruise industry along the east coast of Australia and there are presently around 54 vessels active in the region. Presently 26% of these are unable to enter the Port as a result of constraints in the capacity of the navigation channel (Table 21.13).

Table 21.13 Vessel details

Vessel	Cruise Line	Length (m)	Requires PEP to be able to enter the Port
Albatros	Phoenix Reisen	185	
Amadea	Phoenix Reisen	193	
Amsterdam	Holland America Line	238	
Arcadia	P & O	289	Requires PEP
Artania	Phonex-Reisen	231	
Asuka II	Nippon Yusen Kaisha	240	
Aurora	P & O	270	Requires PEP
Astor	Cruise Voyages	176	
Balmoral	Fred Olsen	218	
Black Watch	Fred Olsen	177	
Carnival Spirit	Carnival	294	Requires PEP
Celebrity Century	Celebrity Cruises	248	Potential-subject to weather (RHM approval required)
Celebrity Millennium	Celebrity Cruises	294	Requires PEP
Columbus II	Hapag Lloyd	181	
Crystal Symphony	Crystal Cruises	238	
Crystal Serenity	Crystal Cruises	250	Potential-subject to weather (RHM approval required)
Dawn Princess	Princess Cruise	261	Requires PEP
Sun Princess	Princess Cruise	262	Requires PEP
Diamond Princess	Carnival	290	Requires PEP
Europa	Hapag Lloyd Cruises	197	
Insignia	Oceana Cruises	180	
L'Austral	Ponant Cruises	142	
Legend of the Seas	RCL	264	Requires PEP
Magellan (Cruise)	Cruise and Maritime Voyages	222	

Vessel	Cruise Line	Length (m)	Requires PEP to be able to enter the Port
MSC Orchestra	MSC Cruises	293	Requires PEP
National Geographic	National Geographic	103	
Ocean Princess	Princess Cruises	181	
Oceanic Discover	Coral Princess Cruises	63	
Orion	Linblad Expeditions	104	
Pacific Dawn	P & O	245	Will require RHM (Regional Harbour Master) approval
Pacific Jewel	P & O	247	
Pacific Pearl	P & O	247	
Pacific Princess	Princess Cruises	181	
Paul Gauguin	Paul Gauguin Cruises	157	
Queen Elizabeth	Cunard	294	Requires PEP
Queen Mary 2	Cunard Line	294	Requires PEP
Rhapsody of the Seas	RCL	279	Requires PEP
Radiance of the Seas	RCL	293	Requires PEP
Sea Princess	Princess Cruise	261	Requires PEP
Seabourn Odyssey	Seabourn Cruise Lines	200	
Seabourn Quest	Seabourn Cruise Lines	198	
Seven Seas Mariner	Regent Seven Cruises	204	
Silver Discover	Silversea Cruises	103	
Silver Spirit	Silversea Cruises	196	
Silver Shadow	Silversea Cruises	186	
Silver Whisper	Silversea Cruises	185	
Superstar Gemini	Star Cruises	230	
Superstar Libra	Star Cruises	216	
Superstar Aquarius	Star Cruises	230	
Star Piscies	Star Cruises	177	
The Taipan	Star Cruises	86	
Volendam	Holland America Line	238	
Pacific Eden	P & O	219	
Pacific Aria	P & O	219	

These longer vessels are also generally wider and therefore a wider navigation channel will allow larger cruise vessels to berth at Townsville. This would provide a much-needed boost to Townsville's economy through additional tourism activities generated through passenger visits, including potential befits to Magnetic Island.

21.2.6 Coal exports through the Port of Townsville

18 submissions expressed that coal may be exported from the port in the future. However it is unclear from most of these submissions whether they are in response to a general disagreement with coal mining and burning and therefore the handling of coal by the port, or whether there is a view that coal should be exported through other ports such as Abbot Point.

The impact assessment undertaken through the PEP EIS focuses on altering the land and sea footprint of the port to enable the port to sustain the long term viability of the communities in North Queensland, and as such do not focus on the specific individual cargoes that may be handled in the future.

Whilst the Port presently does not handle coal cargoes, it is possible future trade conditions may deem the handling of some coal desirable from a trade perspective. In such case, the port will need to meet relevant impact assessment and approvals requirements of the time. However, the port is not a dedicated coal port as such, and therefore the rationale for the Project is not underpinned by future coal exports.

Using other ports as an alternative to the Project is addressed in 21.2.4 above.

21.2.7 Economic impacts to tourism on Magnetic Island

261 submissions (includes form letter submissions) sought more information and assessment on the potential and probable impacts to tourism operation on Magnetic Island, in particular vessel-based tourism operations. The following section provides a baseline assessment for the existing tourism derived from available desktop data.

Detailed contemporary tourism data for Magnetic Island are not readily available. Available data sets are often incomplete, not regularly updated and can be difficult to interpret in terms of the causal relationships between

tourism activity and external effects. This may be partly due to the comparatively small scale of the island as a tourist destination in comparison to the much larger tourism markets within the Great Barrier Reef region of Cairns, Port Douglas and the Whitsundays which are located to the north and south respectively.

There is no government policy or standardised industry accepted distinctions to determine the effects of the tourism market on different sectors of the economy. For example, visitors may purchase goods and services such as accommodation, food and drink, car hire, fuel and other retail items which may equally or in greater proportions also apply to local residents. This especially applies to Magnetic Island, which is a developed suburb of the Townsville Local Government Area.

Records obtained from local government and private enterprises on tourism operators that utilise Magnetic Island generally differ in their detail), are incomplete or are likely to be out-of-date making correlation and verification across the different records impractical. Due to the general lack of reliable data, the assessment is primarily qualitative in nature utilising quantitative data where available. The tourism characteristics for Magnetic Island are assessed in terms of the likely effects of the PEP.

Available desktop information that has been used to describe specific characteristics and effects of tourism in the Townsville area include the following:

- The Commonwealth Government "National Long-term Tourism Strategy" (AEC, 2011)
- Great Barrier Reef Marine Park Authority "Great Barrier Reef Region Strategic Assessment Strategic Assessment Report" (GBR Strategic Assessment) (GBRMPA, 2014)
- Townsville Enterprise Limited, "Townsville North Queensland Tourism Opportunity Plan 2009-2019" (AEC Group Limited, 2009)
- Townsville City Council "Economic Development Plan 2013-2017" (Townsville City Council, 2013)
- Townsville North Queensland "Destination Tourism Strategy 2012-2016" (TNQ, 2012)
- Townsville City Council Tourism Data Base
- Townsville Enterprise Tourism Data Base
- Magnetic Island tourist operator brochures
- Australian Bureau of Statistics 2011 Census information
- Office of Economic and Statistical Research information
- Queensland Regional Statistical Information System (QRSIS) (QTT, 2015)
- Sealink Queensland Market Research in conjunction with James Cook University (Sealink Queensland, 2014).

Tourism characteristics of Townsville that were able to be identified from the desktop assessment include:

- the number of tourism operators on Magnetic Island
- the natural assets utilised by tourism operations
- demographic and economic indicators for the contribution that tourism provides to Townsville community and economy, where available.

21.2.7.1 National Long-term Tourism Strategy

The Australian Government, formally Department of Resources, Energy and Tourism, prepared the National Long-term Tourism Strategy in 2009 in partnerships with State governments, management authorities and tourism enterprise representative groups. The National Long-term Tourism Strategy included a profile of tourism experiences and characteristics for the Townsville region based on stakeholder consultation and a tourism product audit (i.e. included Cairns-Townsville Experiences Audit Report which forms a part of the National Long-term Tourism Strategy). The profile provides a summary of tourism assets in the area and identifies potential gaps in the market, based on the results of the survey findings.

Based on the consultation with tourism industry operators and representatives from the Townsville CBD, the study identified the following tourism related characteristics.

- Townsville does not regard itself as a tourist destination and most tourism 'product' has a strong dependence on locals. Much of the accommodation available is also focussed on business visitors or inter-regional visitors.
- Much of Townsville's international visitation is stopovers on east coast road trips.
- International tourists who do stay for significant periods in Townsville report enjoying the feel of a real / authentic Australian town. Many only discover what it has to offer by accident.
- Appeal is as an escape from the tourist trail.

- Townsville is focussed on developing a CBD with infrastructure and events to appeal to locals. Much of this infrastructure and events appeals to tourists.
- International tourists in Townsville still ask primarily for reef experiences (also, to a lesser degree rainforest). There is disappointment that access to the reef from Townsville for tourists is generally unavailable.(other than options for advanced divers such as Yongala).
- Tourists in Townsville participate more into the local lifestyle (particularly in winter), rather than do specific tourist activities.

It is generally accepted that Magnetic Island is the most recognised destination in the Townsville region for international tourists. However, the National Long-term Tourism Strategy found that the Island's recognition and visitation levels are well below other destinations in Far North Queensland. Magnetic Island was found to offer clear experiences based on 'nature in Australia' and 'coastal lifestyle'. The report identifies that Magnetic Island's key experience is 'accommodation', being nestled amongst bush, wildlife and beaches. Other activities and products that the Island has to offer are generally supporting or are a part of the accommodation experience.

21.2.7.2 The Great Barrier Reef Strategic Assessment

Tourism is considered in the Strategic Assessment Report the GBR Strategic Assessment defines tourism as:

> *"…commercial activities that provide transport, accommodation or services to people who are visiting the Region principally for enjoyment".*

Tourism within the GBR Marine Park offers a wide range of tourism experiences, however while visitation does occur across most of the GBR, activity is consistently focused on a small portion of the Marine Park, with more than 85% of all tourism activity management occurring in about 7% of the region (see Figure 21.7).

Figure 21.7 illustrates the distribution of tourism activity in the Great Barrier Reef Marine Park in 2012. Tourism use of the Great Barrier Reef is strongly focused offshore of Cairns, Port Douglas and the Whitsunday Island. The figure accounts for full day visits (more than three hours) and part day visits (less than three hours).

It is evident from the Strategic Assessment that tourism within Townsville and Magnetic Island holds a lesser value than other key areas within the GBRMP area but is comparable to other locations outside of the key tourist areas.

Townsville is included in the Townsville/Whitsunday Management Area of the GBR Marine Park. Specific figures for tourist visitation to Townsville is not available and using aggregate numbers for the management area is heavily skewed by the high figures for the Whitsundays.

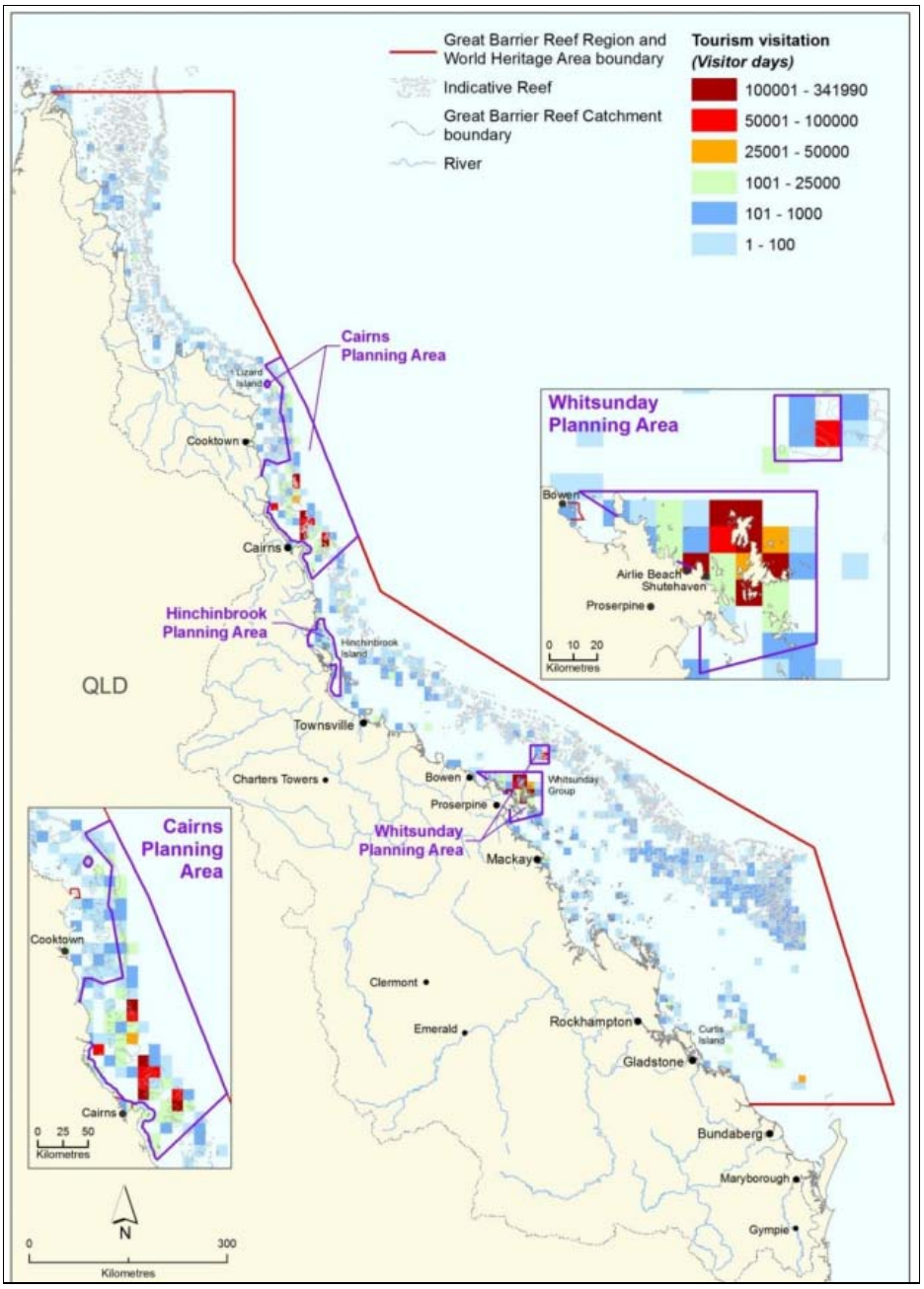

Figure 21.7 Distribution of Tourism activity in the Great Barrier Reef Marine Park

21.2.7.3 Townsville North Queensland Tourism Opportunity Plan 2009-2019

The Tourism Opportunity Plan provides direction for the sustainable development of tourism in the Townsville North Queensland region to 2019. The study relies on data up to 2008, therefore has been used primarily to illustrate the trend and general tourism market of the region.

The Tourism Opportunities Plan acknowledges the indicators of tourism activity in Townsville North Queensland are lower than the neighbouring areas of Mackay-Whitsundays and Tropical North Queensland regions. The plan identifies industries that generally service a tourism economy, such as Accommodation, Cafes and Restaurants and Retail Trade comprise a lower proportion of North Queensland's Economic output than the Queensland average.

The Plan details that tourism markets are notoriously volatile and strongly affected by economic conditions, major events. In 2007/08 domestic visitation was made up of 38.3% of holiday visitors, 33.1% were visiting family and friends and the remaining 28.6% were visiting for business.

21.2.7.4 Townsville City Council Economic Development Plan 2013-2017

The Townville City Economic Development Plan identifies Townsville's key tourism strengths including assets such as the Strand, Magnetic Island, significant major events, a large visiting friends and relatives market and a growing business sector. The plan identifies approximately 25% of visitors to the Townsville region travel to Magnetic Island.

The plan identifies a Tourism Precincts Development Strategy which specifically targets three tourism destination precincts in Townsville being, Townsville CBD, Magnetic Island and Balgal Beach and Surrounds. These areas have been identified because they either possess a high level of existing tourism activity and investment and/or a high potential for further tourism development. The development strategy identifies key initiatives and actions to help promote and increase tourism levels.

21.2.7.5 Destination Tourism Strategy 2012-2016

The Destination Tourism Strategy provides the framework to guide tourism industry development in the Townsville North Queensland region by coordinating stakeholders in a common direction to maximise the tourism potential of the destination so as to achieve a balance of economic, social and environmental outcomes.

The key strategies identified included target markets, marketing and promotion, product and infrastructure development and industry development. The strategy also identifies opportunities for growth and implementation. The strategy identifies Magnetic Island as a potential sustainable destination for growth through potential innovative tourism projects.

21.2.7.6 Other sources of desktop information

Australian Bureau of Statistics (ABS) and the Office of Economic and Statistical Research (OESR) provide data sets on individual suburbs and local government areas. This assessment has utilised the community profiles from both departments.

Townsville City Council holds a Townsville Tourism Operators Database with a list of known operators in the region. In discussions with Council representatives it was advised that the database is in the process of being developed and not yet complete or up to date.

Other sources of desktop information include Magnetic Island tourism operator brochures, google searches and advertisements. These sources of information are used in the assessment to help quantify the number of operators located on the island and their activities. It is important to note that this information is not exhaustive and is very specialised.

21.2.7.7 Existing values and characteristics

Based on available information, Magnetic Island generally attracts two types of tourists, the local based tourist and the visiting tourist. Local based tourists are residents of North Queensland who go to Magnetic Island for a short stay. Visiting tourists include those not from the North Queensland region, whether visiting from interstate or overseas.

A study by Sealink and James Cook University in 2011 identifies over half of visitors to Townsville were undertaking day trips to Magnetic Island. Of these visits, the highest rated factors influencing the decision to travel to Magnetic Island included 'somewhere to relax', spending time in natural environment, seeing wildlife and adventure activities. The lowest rated factors of influence included learning about culture and history, buying products unique to the region and seeing production of local arts and crafts (JCU, 2011a).

According to the OESR and ABS data, Magnetic Island had 214 registered businesses during the year of 2011-12. Desktop reviews found Magnetic Island has approximately 60 accommodation providers, including resorts, hostels, hotels/motels, bed and breakfast and holiday houses/apartments and approximately 25 commercial food and dinner operators which come in the forms of restaurants, bars and takeaway, and are approximately 21 retail providers.

A 2011 Magnetic Island Visitor survey showed that there was no difference with expenditure, 40% of respondents in both visitor categories (i.e. from Townsville region and visitors from Australia and overseas) spending $100 or less during their visit to Magnetic Island. Specific tourism related businesses at Magnetic Island are described under the following categories:

- accommodation & food services
- retail trade
- employment.

21.2.7.8 Accommodation & Food Services

The QRSIS (Queensland Regional Statistical Information System) identifies 28 businesses on Magnetic Island as 'Accommodation and food services' (QTT, 2015). Desktop reviews identified approximately 60 accommodation providers and 25 food and dinning services. However, the business counts for 'Small business' identified 227 businesses on Magnetic Island (QTT, 2015). The concept of a 'small business' is considered intuitive; there is no

consistently used definition. Common definitions categorise small businesses based on their number of employees and annual revenue (Connolly, Norman, & West, 2012).

Due to the size of individual accommodation and food providers on the island, in terms of revenue and employees, the assumption can be made that majority of these businesses identify as a small business as opposed to accommodation and food services. It could also be assumed that this shows there is a larger number of small scale accommodation and food providers.

21.2.7.9 Retail trade

The Queensland Regional Statistic Information System (QRSIS) identified 17 businesses in the category of 'retail trade' in the business counts from 2013/14 for Magnetic Island (SA2/318021483 – Magnetic Island) (QTT, 2015). Interrogation of local government and tourism agency databases suggest that these businesses sell a range of goods including food, fashion, home supplies, plants, pharmaceuticals, art, fuel and bait, among others. However, it is important to note that the service catchment for these businesses includes the residential population of Magnetic Island as a suburb of Townsville and the visiting / tourist population. It is difficult to quantify and separate the amount of business and / or profit that is generated from visitors to the island and the amount that is generated from the residential population.

21.2.7.10 Employment

Tourism is an activity that cannot be identified directly from employment data. This is because tourism is not an industry or sector, but rather is a collection of activities that are supported partly through the spending habits of leisure and business visitors. Visitors purchase services and goods such as accommodation, food and drink, car hire, fuel and other retail items, but local residents also purchase these items.

The 2011 ABS Working Population Profile for Magnetic Island shows that 656 people were counted as working in different ANZSIC (Australian and New Zealand Standard Industry Classification) industries as shown in Table 21.14. The table shows that industry employment for Magnetic Island is dispersed across industry sectors. The figures do not differentiate between those people who work on the island and those who work on the mainland. According to ABS 2011, the total number of people employed that reside on Magnetic Island, 43 indicated that their method of travel to work was specifically by ferry. However, 170 people indicated their method of travel to work was via 'other two methods' and 'other 3 methods (ABS, 2011)'. An assumption can be made that due to the nature, size and transport available on the island that at least half are travelling to the mainland by ferry and utilising public transport, car or foot as the additional methods to get to their place of work.

Table 21.14 Employment by Industry Sector - Magnetic Island

Industry Sector	No. Employed
Agriculture, forestry and fishing	6
Mining	18
Manufacturing	34
Electricity, gas, water and waste services	19
Construction	105
Wholesale trade	12
Retail trade	109
Accommodation and food services	191
Transport, postal and warehousing	58
Information media and telecommunications	11
Financial and insurance services	11
Rental, hiring and real estate services	32
Professional, scientific and technical services	54
Administrative and support services	52
Public administration and safety	69
Education and training	65
Health care and social assistance	97
Arts and recreation services	23
Other services	24
Inadequately described/Not stated	26
Total	**1,016**

Separate identification of a tourism sector and distinction between those industries which primarily service residential versus visitor trade on Magnetic Island is not directly possible from the categories in Table 21.14. The table does show that of all of the industries, 'accommodation and food services' represent the sector with the highest proportion

of employed people (19%) reside on Magnetic Island. Accommodation and food services can be a supportive industry to tourism but may also be utilised by local residents especially 'food services').

21.2.7.11 Potentially impacted tourism operations

To assess the potential impacts that the PEP Project could have on tourism operators on Magnetic Island, this assessment focuses on the tourism operators who utilise the foreshore and fringing reefs as the basis of their operations. As mentioned above, detailed contemporary tourism data for Magnetic Island is not readily available. Available data sets are often incomplete, not regularly updated and can be difficult to interpret in terms of the causal relationships between tourism activity and external effects.

There are seven primary vessel-based tour operators for dive and snorkel businesses which utilise several inshore reefs around Magnetic Island. These reefs are located off Nelly Bay, Geoffrey Bay, Alma Bay, Arthur Bay and Florence Bay. Websites do not contain a schedule of operations but it is understood that the businesses work on a demand and 'good weather' basis. Websites for these business also identified between 1 and 4 persons were employed by the business.

Projected economic impacts to tourism values

In order to translate the projected environmental impacts to Sensitive Environmental Receptors into estimated economic impacts to tourism operators, factors to convert marginal ecological impacts to marginal costs are required. The objective of this calculation is to provide a first-order estimate of the monetised impacts to vessel-based snorkelling and boat tour operators on Magnetic Island.

The methodology applied involving using the projected changes to water quality and monetising changes to visibility using existing ecological economics willingness to pay estimates for monetising changes in visibility. The specific steps in the calculation include:

1. Identify studies that have estimated the monetary value of changes in underwater visibility
2. Identify the visibility and water quality data required for these studies
3. Estimate number of visitors that may be impacted
4. Estimate impacts.

A number of studies have investigated wider economic values of the GBR, as summarised by in Stoecki *et al* (2011)and these include the studies of KPMG (2000), Carr and Mendelsohn (2003), Windle and Rolfe (2005), Kragt *et al*. (2006), Access Economics (2007), Oxford Economics (2009), and Prayaga *et al*. (2010).

However, the majority of these studies have focused on attempting to estimate the total economic value of the GBR. It is now well accepted that estimates of Total Economic Value have little utility in impact assessment studies as it is the marginal impact that is under consideration.

Furthermore, most, if not all of the studies identified above did not adequately consider the spatial distributions of how the ecosystem values are distributed across the GBR. In particular, the studies failed to distinguish, how much tourism comes from the islands in the middle shelf zone, and outer reefs. As a result, without this demarcating of cause and effect, or demarcation of impacts and the spatial distribution of relevant values, it is almost impossible to disentangle impacts to values.

Given these shortfalls, the following three studies (Table 21.15) have been used to translate changes to water visibility into monetised impacts.

Table 21.15 Studies undertaken to translate changes to water visibility into monetised impacts

Location	Study type	Key values	Reference
Puerto Rico	Compared estimated values of water clarity using contingent valuation method (CVM) and choice experiment (CE) methods for tourists.	Value of increasing water quality from 'murky' to 2 feet of visibility values at $54 (CVM method), and $51 (CE method) per visitor day.	Loomis and Santiago (2013)
Red Sea	Stated-preference (choice modelling) for tourists.	Willingness to pay US1.20 per dive for a 50% increase in visibility.	Wielgus *et al.* (2003)
GBR	Choice modelling for Qld residents.	$5.55 per household per year for every 1% increase in water quality from pre-European levels.	Windle and Rolfe (2011)

These studies, that used slightly different methodological approaches, provide valuations ranging from $54 per day to $1.20 per dive, to $5.55 per household per % increase. The latter example was not targeted at snorkelling, diving or swimming operations, and rather general willingness to pay for increased water quality in the GBR lagoon.

The change in visibility used in the first two studies used either a 50% increase in visibility, or a change from 'murky' to 2 feet of visibility. These changes are relevant to the diving or snorkelling experience as tourism experiences are generally best represented by estimates of water clarity, commonly expressed as the underwater visibility length. For example, divers and snorkelers assess water quality by how far away objects can be seen underwater.

By contrast, whilst a number of water quality parameters are widely reported, these are mostly based on scientifically-relevant biological or chemical properties. Clarity is now commonly measured and assessed in units of NTUs (Nephelometric Turbidity Units) as this parameter can be directly measured by electronic sensors. Before electronic sensors were developed, water clarity was measured by dropping a black and white disc in the water. Measurements taken using these 'Secchi' disks can be difficult to translate to NTU measured by electronic sensors.

Valuation studies use metrics of visibility change, two stated the following: a change from 'murky' to 2 feet visibility, and a 50% increase in visibility. The water quality section provides estimates of the dredging-induced changes to turbidity (using units of NTU). Results presented in the Section 6.0 (Marine Water Quality) of the AEIS, for example suggest that for 95% of the data, the ambient turbidity around the eastern side of Magnetic Island is typically around 5 NTU (around 70- 85 cm visibility), increasing to around 15 NTU (around 40 cm visibility as increasing turbidity leads to less visibility) during the dredging campaign in Stage 1 when the TSHD dredger is operating.

Assuming a linear relationship between changes in NTU and visible depth over this range, this change is around a halving of the visible range on average during the dredging campaign. In reality this will change over periods of hours as a result of winds, tides and the actual location of the dredger at the time. However for the purposes of this calculation it is assumed that during the TSHD dredging campaign on average there will be a 50% decrease in the visibility at the main snorkelling sites.

Based on the capacity of the identified seven major vessel-based snorkelling tour operators on Magnetic Island, the maximum capacity is 31,390 dives per year. This is based on all of the vessels holding full vessel tours every day and all passengers entering the water.

In reality most of the vessels are on average likely to operate on one in three days, average across the whole year, and average occupancy is likely to be closer to 40%. The updated total number of dives then becomes around 4,185 per annum. For a 16.5 week TSHD dredging campaign in Stage 1, this becomes 1,328 impacted dives for the year during Stage 1 TSHD campaign.

Given that the per-dive cost is around $50 per person, a willingness to pay value for additional visibility of $20 per dive was selected based on the two most relevant studies. When applied to 1,328 dives per year for Stage 1, this becomes a total monetised impact to tourism operators of $26 559 in total for the sector for Stage 1 TSHD dredging.

Therefore if such short-term changes in turbidity at the most popular snorkelling and diving operations was identified as being caused by the major capital dredging, then these calculations could form an estimate of financial impacts.

21.2.8 Greater economic impacts to GBR OUV

39 submissions also raised if the projected economic benefits of the Project would be outweighed by greater costs to the economic value of the Great Barrier Reef.

The expected direct and cumulative impacts are described in the marine ecology and cumulative impacts chapters. Of relevance, the long term impacts are expected to be loss of soft sediment sub-tidal habitat at the site of the expanded reclamation, and changes to visual amenity. Both of these whilst being long-term impacts, are local in scale and therefore by definition do not impact the wider Great Barrier Reef economic values.

Similarly, the cumulative impact assessment demonstrates that if unmitigated dredging were to occur, the season following an individual or series of significant natural disturbances, the risk of long-term degradation to Sensitive Environmental Receptors increases. However assuming that the proposed mitigation measures discussed in Section 6 of the AEIS are incorporated, then the impacts to the greater GBR OUV is assessed to be negligible (refer section 25.0 and 26.0 of the AEIS). This result is also consistent with the observed impacts from the previous major capital dredging campaign that also featured a defensible and intense short and long term environmental monitoring program.

21.2.9 Changes to base data demographics

The census data was current at the time of writing the EIS; however this section contains an update on key demographic statistics based on updated information received following the production of the EIS.

21.2.9.1 Population

Table 21.16 shows the population of the NET by Local Government Area. The NET has experienced a steady increase in population over the period 2006 to 2012, mainly driven by development in the Townsville and Whitsunday Local Government Areas, which accounts for 76.9% of the population of the region.

In contrast, several of the smaller Local Government Areas with less than 2,000 inhabitants (Flinders and Richmond) exhibit negative growth over this period. The size of these areas is such that their decreasing population exerts little

impact on the overall NET situation, which shows population growth of 8.2% between 2006 and 2012. Table 21.17 shows a summary population profile.

Table 21.16 Population by Local Government Area (ABS, 2012b)

Local Government Area	Population		Share of NET 2012
	2006	2012	
Burdekin	18,085	17,914	6.32%
Burke	531	555	0.20%
Carpentaria	2,076	2,186	0.77%
Cloncurry	3,366	3,425	1.21%
Croydon	274	325	0.11%
Doomadgee	1,170	1,374	0.48%
Charter Towers	12,155	12,431	4.39%
Etheridge	900	924	0.33%
Flinders	1,911	1,831	0.65%
McKinlay	955	1086	0.38%
Mount Isa	21,114	22,628	7.99%
Richmond	969	844	0.30%
Townsville	165,278	184,526	65.12%
Whitsunday	31,355	33,324	11.76%
Total NET	**260,139**	**283,373**	100%

Table 21.17 Population Profile

Component	Townsville (%)		Queensland (%)		Australia (%)	
	2006	2012	2006	2012	2006	2012
Age distribution						
0 to 14 years	21.4	20.7	20.4	19.9	19.6	18.9
15 to 24 years	16.7	15.6	14.1	13.9	13.9	13.6
25 to 34 years	15.4	14.4	13.9	14.1	14.0	14.4
35 to 44 years	14.8	13.9	14.7	14.1	14.8	14
45 to 54 years	13.2	13.3	13.7	13.4	13.8	13.5
55 to 64 years	9.4	10.6	11.1	11.3	10.9	11.4
65+ years	9.0	11.5	12.1	13.1	13.0	14.2
15 to 64 years	69.5	67.8	67.5	66.8	67.4	66.9
Household type						
Lone person	21.3	22.0	22.8	22.8	24.4	24.3
Group	5.3	5.2	4.5	4.7	3.9	4.1
Family	73.4	72.7	72.7	72.4	71.7	71.5
couple with children	44.5	43.0	43.3	42.8	45.3	44.6
couple without children	37.2	38.8	39.1	39.5	37.2	37.8
lone with children	16.6	16.5	15.9	16.1	15.8	15.9

Source: (ABS, 2012b),

Townsville experienced a small increase in the share of people aged 55 and over, as well as a small decrease in the share of people in age groups between 0 and 44. These variations in the age distribution were in line with the trends generally observed in the state and in the country. In both censuses the total proportion of people in the age group 65 and upwards in Townsville were actually smaller than in Queensland and Australia. Townsville also has a higher proportion of people younger than 24 years compared with the state and Australia. The median age in Townsville is 33 years, while the median age in Queensland is 36 years. Overall, Townsville has a slightly younger population than the state and national averages.

In 2012, families comprising a couple with children were the most common household type in Townsville (43%), followed by couples without children (38.8%) and lone persons (22%). There was a marginal reduction in the percentage of couples with children living in a household and a similar sized increase in the percentage of households comprised of couples without children. There is little difference between household profiles in Townsville, Queensland or Australia.

Table 21.18 Population Growth, Migration and Location (ABS, 2012b)

Component	Townsville (%)	Queensland (%)	Australia (%)
Population growth (2008 to 2012)	8.7	7.6	6.4
Fertility rate (2012))	2.0	2.1	1.9
Standardised-death rate (2012)	6.4	5.9	5.7
Population background (2011)			
Indigenous population	6.1	3.6	3
Overseas born	19.9	26.3	30.2
Mobility (over 5 years) *	40.4	36.4	31

* Mobility refers to the share of population that have not been living at the same address five years ago.

Table 21.18 shows population growth and its components. The overall population growth of Townsville (8.7%) is higher than the rate in Queensland and Australia. According to the Queensland's Office of Economic and Statistical Research (OESR, 2012a), the fastest growing Local Government Areas between 2011 and 2031 are projected to be Whitsundays and Townsville, with an average annual growth rate of 2.2%.

In terms of population composition, data from the Australian Bureau of Statistics shows 6.1% of the population is indigenous and 19.9% of Townsville residents were born overseas. These percentages clearly differ at the state and national level, where there is only approximately half of this proportion of indigenous population and a much higher proportion of the population born overseas.

The rate of mobility is measured as the proportion of people that have not lived in the same address over the last five years. In Townsville this rate is 40.4%, higher than in Queensland and Australia.

21.2.9.2 Labour Force

Table 21.19 presents labour force data, including income data, workforce size, labour force participation and unemployment for Townsville in comparison with Queensland and Australia.

The workforce size in Townsville has decreased marginally, by less than 0.1%, over the period 2006 to 2011. The size of the Australian workforce has increased, however by less than 1%, whilst Queensland has demonstrated a 3.4% increase in workforce size. Labour force participation rates in Townsville were lower in 2011 than 2006, however, these rates remain greater than those in Queensland and Australia.

The unemployment rate in Townsville was below Queensland and Australia in 2011. This was an improvement on the 2006 position, when the unemployment rate in Townsville was above the state and Australia. Between 2006 and 2011 the unemployment rate decreased in Townsville from 5.5% to 5.1%, whilst over the same time period, rates increased in Queensland from 5.0 to 6.1% and Australia from 5.1 to 5.6%.

The income data indicates that wage and salary incomes in Townsville were very similar to those in Australia in 2011, but higher than those in Queensland. Between 2006 and 2011 wage and salary income in Townsville increased at a similar rate to Queensland and Australia. The average investment income in Townsville ($4,219) is relatively low compared with the Queensland and Australian averages ($6,968 and $8,329 respectively) and actually reduced between 2006 and 2011 compared to increasing averages in Queensland and Australia. In 2011, the average total income in Townsville was $52,256, which is slightly higher than the Australian average $52,234, and greater than the Queensland average.

In Townsville, the 2011 census indicated wage and salary earners were mostly professionals (17.3%) and technicians and trade workers (16.7%), followed by administrative workers (14.3%) and community and personal service providers (12.2%). Compared with Queensland and Australia, Townsville has proportionately fewer people with bachelor level degrees or higher level education, and have proportionately fewer people employed as managers and professionals, but have proportionately more people employed as technicians, trade workers and community and personal service occupations. This is consistent with the data on wage and salary incomes.

It was observed in the *Townsville Futures Plan* that defence and tourism are important activities in Townsville (Table 21.20). Defence is included in the category 'public administration and safety', which accounted for 11.9% of Townsville Local Government Area employment in 2011. Defence is especially important as Townsville is home to a major Royal Australian Air Force base and Lavarack Barracks Army base.

As previously discussed, tourism is an activity that cannot be identified directly from employment data. This is because tourism is not an industry or sector, but rather a collection of activities that are supported partly by spending from leisure and business visitors. Visitors purchase services and goods such as accommodation, food and drink, car hire, fuel and other retail items, but local residents also purchase these items. Estimates of tourism impacts

require data on visitor-spend by sector, and by how much accommodation and food sectors buy from other providers in a region (backwards linkages). Other public and private services are also required to support the population, for example health care, education, retail and energy. The proportions of employment by sector are shown in Table 21.20.

Table 21.19 Labour Force Data (ABS, 2012b)

Component	Townsville		Queensland		Australia	
	2006	2011	2006	2011	2006	2011
Average personal finance						
Wage/salary income ($)	*39,577*	52,272	37,680	49,863.5	40,276	51,922
Investment income ($)	*4,559*	4,219	6,546	6,968.5	7,025	8,329
Superannuation and annuity income ($)	*19,675*	22,960	22,383	21,738.4	23,503	23,483
Total income ($)		52,256		49,057		52,234
Labour market						
Workforce size	*91,928*	91,714	2,097,340	2,171,073	10,577,883	10,658,458
Total employment (%)	*94.5*	94.9	95.0	93.9	94.9	94.4
Unemployment rate (%)	*5.5*	5.1	5.0	6.1	5.1	5.6
Participation rate (%)	*70.7*	66.6	64.4	62.8	63.5	61.4
Qualifications (% total population)						
Postgraduate degree (%)	*1.8*	2.2	1.9	2.7	2.6	3.6
Graduate diploma and graduate certificate (%)	*1.0*	1.2	1.2	1.4	1.4	1.7
Bachelor degree (%)	*9.7*	10.7	10.0	11.7	11.6	13.5
Others: advanced diploma, diploma, certificate (%)	*37.6*	39.7	37.3	38.5	36.9	37.1
Total with qualifications (%)	*50.0*	53.8	50.4	54.3	52.5	55.9
Occupations (wage and salary earners)						
Managers (%)	*9.9*	9.8	12.4	12	13.2	12.9
Professionals (%)	*16.2*	17.3	17.1	18.9	19.8	21.3
Technicians and trade workers (%)	*16.9*	16.7	15.4	14.9	14.4	14.2
Community and personal service (%)	*11.7*	12.2	9.1	10	8.8	9.7
Clerical and admin workers (%)	*14.8*	14.3	14.8	14.7	15.0	14.8
Sales workers (%)	*9.9*	9.7	10.4	9.8	9.8	9.4
Machinery operators and drivers (%)	*8.0*	8.2	7.2	7.3	6.6	6.6
Labourers (%)	*10.8*	9.9	11.9	10.6	10.5	9.4
Others (%)	*1.7*	1.8	1.8	1.8	1.8	1.9

Table 21.20 Employment by Sector (2011) (TFPT, 2011; ABS, 2012b)

Sector	Townsville Local Government Area (%)	Queensland (%)
Public administration and safety	11.9	6.7
Wholesale trade	3	3.6
Healthcare and social assistance	12.5	11.9
Construction	9.9	9.0
Manufacturing	7.6	8.4
Education and training	8.1	7.9
Accommodation and food services	6.9	7.0
Transport port and warehousing	5.1	5.3
Professional, scientific and technical services	4.7	6.5
Other services	3.7	3.9
Retail trades	10.7	10.7
Administration and support services	3	3.2
Mining	2.9	2.6
Financial and insurance services	1.6	2.7
Rental, hiring and real estate	1.6	1.8
Information media and telecoms	1.4	1.2
Electricity, gas, water and waste	1.6	1.2
Arts and recreation	1.3	1.4
Agriculture, forestry and fishing	0.5	2.7

This shows the economy of Townsville is diversified, with a wide range of services including health, education, wholesale and retail trades. The table also shows that in terms of employment, wholesale trade, manufacturing, professional, scientific and technical services, financial and insurances services, agriculture, forestry and fishing were lower than in the Queensalnd entirely.

21.2.9.3 Housing

The median rents across the 14 Local Government Areas of Townsville and the NET are presented in Table 21.21 below. The median rent across the wider Study Area differs widely across the Local Government Areas. The highest median rent per week is in the Whitsunday Local Government Area at $306 per week. The lowest median rent per week is in Etheridge Local Government Area at $79 per week. Across the NET, the average median rent is $146 per week.

The median rent for Townsville has varied over the last four years. There has been a downward trend in rent between December 2009 and September 2010, but the median rent increased by an average of $10 per week for houses and $20 per week for units during the first quarter of 2011. The Herron Todd White report (2011) suggests that 'tightening vacancy rates means that rents may continue rising over the near term'.

Table 21.21 Median Rent and Housing Loan Repayments (2011) (ABS, 2006)

Local Government Area	Median Rent ($/weekly) 2011	Median Housing Loan Repayment ($/monthly) 2011
Burdekin	180	1,300
Burke	80	1,230
Carpentaria	110	898
Cloncurry	102	1,500
Croydon	115	844
Doomadgee	105	303
Charters Towers	170	1,350
Etheridge	79	650
Flinders	100	693
McKinlay	88	975
Mount Isa	250	2,000
Richmond	100	715
Townsville	290	1,733
Whitsunday	306	2,100
Average NET	146	1,164

21.3 Conclusion

The proposed expansion to the Port of Townsville is required to accommodate medium and long-term future growth in trade volume over a planning horizon to 2040 and beyond, and to ensure that the port remains attractive to shippers as the global fleet increases in size. Additional berths, land reclamation, channel widening and modifications to improve accessibility for vessels will allow for increased shipping movements and remove the current constraints on future growth.

While a summary view of the berth utilisation figures may suggest the port has capacity available, this is not the case. Optimum berth utilisation for any particular berth depends upon a number of factors. It is a fact that multi-cargo ports such as Townsville are not able to achieve utilisations as high as those achieved in contemporary single cargo ports and in many instances over the last five years some berths have been over their optimum capacity.

An economic disruption model was developed to assess the potential impacts of channel restrictions on economic activity on Townsville. The model simulated the potential impacts of the channel being restricted, and by implication, economic impacts of restricting future trades can be estimated. In summary, economic impact of three short-term vessel disruption or access restriction scenarios ranged from $779M to $1,429M. This result suggests that future trades at this magnitude will be missed as a result of insufficient capacity within the port land-based and channel infrastructure.

In response to the matters raised about the need to avoid dredging in the Marine Park the design refinement has investigated alternatives to the proposed deepening of the channels, which would provide an equivalent increase in channel capacity. In lieu of deepening the existing channels as proposed in the EIS, the design refinement of a widened channel will allow the Post Panamax vessels with a 43m beam access to Townsville. It is anticipated that Post Panamax vessels up to 100,000 DWT will have access to Townsville under the revised case. This compares favourably against the typical Panamax vessels which currently visit Townsville Port being in the 60,000 to 70,000 DWT size range.

To assess the potential impacts that the PEP could have on tourism operators on Magnetic Island, an assessment was carried out focusing on the tourism operators who utilise the foreshore and fringing reefs as the basis of their operations. The assessment utilised similar international studies to assign an approximate economic impact to the 16.5-week TSHD dredging campaign in Stage 1 (potentially impacting 1,328 dives). It was conservatively found that a total monetised impact to tourism operators was approximately $26,559.

In relation to the potential greater economic impacts of the PEP on the GBR Outstanding Universal Value, the expected direct and cumulative impacts are described in the marine ecology and cumulative impacts chapters. The long term impacts are expected to be loss of soft sediment sub-tidal habitat at the site of the expanded reclamation, and changes to visual amenity. Both of these whilst being long-term impacts, are local in scale and therefore by definition do not impact the wider Great Barrier Reef economic values.

The cumulative impact assessment similarly demonstrates that if dredging were to occur the season following an individual or series of significant natural disturbances, then the risk of long-term degradation to Sensitive Environmental Receptors subsequently increases. However, assuming that the proposed mitigation measures discussed in Section 6 of the AEIS are implemented, then the impacts to the greater GBR OUV is assessed to be negligible (refer section 25.0 and 26.0 of the AEIS). This result is also consistent with the observed impacts from the previous major capital dredging campaign that featured a defensible and intense short and long term environmental monitoring program.

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