4 DEMAND FORECASTS

CHAPTER SUMMARY AND CONCLUSIONS:

- Actual freight rail volumes accessing the PoT were approximately 8.5mt in 2016, with approximately 3.7mt consisting of general freight, 3.5mt minerals related and 1.3mt sugar. The total freight rail volumes were up to 13.1mt in 2015 prior to the closure of the QNI nickel refinery.
- The TEARC DBC adopts the following freight rail and road demand projections for the economic assessment (excluding coal, nickel and magnetite) to 2051:
  - 8.3mtpa (2017), declining to 7.6mtpa (2051), peaking at 10.6mtpa (2037) (Scenario 1 – Central demand case)
  - 8.2mtpa (2017), declining to 5.8mtpa (2051) (Scenario 2 – Low demand scenario)
  - 8.8mtpa (2017), increasing to 13.5mtpa (2051), peaking at 14.8mtpa (2037) (Scenario 3 – High demand scenario)
- As part of the PoT master planning process, a demand forecast (Scenario 4) has been generated to identify parameters for an ultimate port footprint to 2050. This demand case includes the following freight rail (only) projections:
  - 6.5mtpa (2017) increasing to 22.3mtpa (2051) (Demand Case – Ultimate port footprint case).
  - This scenario included coal production up to 9.5mpta by 2032, nickel returning to volumes of 4mtpa and magnetite demand peaking at 1.6mtpa in 2022. Scenario 4 has not been tested in the TEARC DBC i.e. economic and financial analysis.

This chapter provides an assessment of demand including rail and road tonnages of freight movements that will be impacted by TEARC, including from the North-West Minerals Province, in and out of the PoT.

The demand forecast has been used to estimate:

- train services required and operating costs (below and above rail costs)
- road movements and delays (congestion)
- the economic benefits of TEARC
- the potential below rail revenue impacts of TEARC.

The demand forecast was not utilised to assess the capacity of the existing rail network. There will be a theoretical limit on the freight capacity of the existing network that will limit the throughput of the port without the addition of TEARC. As the rail/road, unloading facilities, port layout, berth utilisation and ship sizes all come into play it would be recommended an overall simulation model be developed to provide a quantitative assessment of the capacity and bottlenecks. This was not within the scope of the DBC Reference Project.

The demand forecast is separated into minerals, general freight and agricultural demand. Demand is also considered under a number of different scenarios to incorporate the impact of changes in the assumptions on the forecasts.

4.1 Background

The rail network in the project area (i.e. North Coast Line accessing the PoT and the Mount Isa Line) facilitates a diverse trade mix, comprising of mineral resources, agriculture, general freight and industrial commodities. Freight movements flow domestically and internationally (both import and export), and internally within the corridor.

Over the last three years there has been a significant decline in rail volumes as a result of the closure of the QNI nickel refinery. During 2014 and 2015 nickel contributed around 3 million tonnes per annum (mtpa) on rail which declined to approximately 250,000 tonnes per annum (tpa) in 2016. In terms of net tonnes, general freight made up the majority of demand in 2016 followed by minerals related freight and sugar freight.

4.2 Demand Scenarios

The demand scenarios incorporated in the business case include assessment of rail and road based transport demand.

Three demand scenarios were assessed:

- Central case (Scenario 1)
- Low case (Scenario 2)
- High case (Scenario 3)

A summary of the demand scenario parameters is shown in Table 4.1. The Central, Low and High scenarios were assessed based on geological provinces within the region that were identified as having potential rail demand based on geological characterisation, known mineralisation, commodity type and transport infrastructure.

The Central case includes existing production for life of the current Joint Ore Reserves Committee (JORC) reserve base plus known projects which are “Giant” or “Large”, well advanced and have good prospectively (i.e. 50% of mines under exploration). For non-minerals and other general freight, demand is informed by current and historical demand and forecast growth in the population and economy, while indirect mining related freight is based on the forecast level of mining activity.

The Low case considers the same mining projects as the Central case (i.e. incorporates all operating mines), it excludes mines at the study/feasibility stage or the advanced exploration stage. This is a worst-case scenario that assumes no new mining development occurs to replace current capacity. Resource pricing would have to be in a low cycle for a period of time for this scenario to be realised, which is unlikely. Other freight is also assumed to grow at a slower rate (e.g. lower population and economic growth) while indirect mining freight is based on the low mining activity.

The High case investigated the same mining projects as the Central case, with the addition of 100% of possible projects based on an assessment of other assets within the province, and the likelihood of future discoveries of assets of high prospectively. This is based on higher margins and improved economic outlook. Other freight is also assumed to grow at a higher rate (e.g. higher population and economic growth) while indirect mining freight is based on the higher mining activity. This scenario also includes the impact of a new world-class deposit discovered within the catchment area, for example a new discovery of a similar type and scale to the Mount Isa deposits. In this scenario, it was assumed a new discovery would come online after one of the major mines is decommissioned, such as the Mount Isa Open Pit project.

All scenarios included in the business case assume there are no competing infrastructure projects (e.g. rail or port) and demand between the base case (world without TEARC), and the project case (world with TEARC) is the same, i.e. the TEARC project does not induce or generate additional (latent) demand above the base case.

Table 4.1 Demand Scenario Parameters

SCENARIO PARAMETERS	SCENARIO 1 (CENTRAL CASE)	SCENARIO 2 (LOW CASE)	SCENARIO 3 (HIGH CASE)
Mining – operating mines	Yes	Yes	Yes
Mining – study/feasibility stage	Yes	No	Yes
Mining – advanced exploration	Yes (50% of mines under exploration)	No	Yes (100% of mines under exploration)
Other general freight demand, including agriculture and indirect mining demand etc. (consistent with PoT forecasts)	Yes	Yes	Yes
New mine discovery (e.g. new Mount Isa deposits) demand	No	No	Yes
Energy product demand	No	No	No
New Magnetite and Nickel	No	No	No

4.3 Minerals Demand Forecast

A mining demand forecast was undertaken based on a first principles approach to forecast future mining freight tonnages.

The catchment area was defined as the fourteen geological provinces identified with potential for rail access to the PoT. Five provinces to the north and northwest of Townsville were eliminated following provincial assessment. Three were due to the lack of current rail infrastructure and a further two were due to the current rail alignment and access from the north of Townsville. The McArthur Basin was also eliminated in the provincial assessment, given the uranium mineralisation present is unlikely to trigger rail demand and it is located 370km from Mount Isa.

For the remaining eight geological provinces, the forecast was developed by scheduling on a project by project basis. The complete list of projects has been developed using a top down intersecting a bottom up approach using industry databases and reviews of previous studies:

The bottom up reviewed all mineral resource sites as presented in the:

- "Queensland Minerals 2015" report from the Department of Natural Resources and Mines (DNRM) Geological Survey of Queensland and associated database of information
- Queensland Tenure Database, which was updated in January 2017 by DNRM, which incorporates all mining tenure such as:
  - Exploration Permits Minerals (EPMs)
  - Mineral Development Licences (MDLs)
  - Mining Leases (MLs).

For each project the resource scale, stage of development and the potential impact on rail demand was assessed. There were 117 discrete projects identified of which, 60 projects were assessed to be included in the schedule of potential demand. For each of the 60, the "Scale" of the Resource and the "Status" were assessed based on industry and publicly available information.

Table 4.2 details the status classification for each mine and its inclusion in each scenario.

Table 4.2 Classification of Mine Status

STATUS	DEFINITION	INCLUDED IN SCENARIO
Inactive	No current tenure	N/A
Exploration	Evidence of mineralisation and exploration targets but limited proving of Resource	Scenario 3 (High)
Advanced Exploration	Established Resource generally with a JORC Resource	Scenario 3 (High) Scenario 1 (Central) – 50%
Studies/Feasibility	Well-understood Resource with evidence of varying levels of Study. Often the Study will result in the definition of a Reserve.	Scenario 1 (Central) Scenario 3 (High)
Operating	Currently operating	Scenario 1 (Central) Scenario 2 (Low) Scenario 3 (high)

4.4 Minerals Rail Demand

A list of the projects included in the demand forecast is shown in Table 4.3. A demand schedule was developed based on public and industry information on a project-by-project basis. The following assumptions were applied to developed three cases:

- Projects with a status Advanced Exploration or more mature, were scheduled on an individual basis. Projects assessed with a status of Exploration were not individually scheduled but rather seen as part of the exploration funnel. A representative Exploration 1 and Exploration 2 project were scheduled to reflect the potential impact of this funnel on long-term demand.
- The potential exists for another world-class deposit of the scale of Mount Isa Open Pit project. Discovery exploration, study and development of the deposit is likely to take in excess of 25 years particularly given the discovery maybe facilitated by improvements in exploration technology. A potential new world class deposit has been included in Scenario 3 (High) with rail demand being the same as the same levels of rail demand as Mount Isa Open Pit.
- With the exception of Mount Isa Open Pit, no ramp up profiles has been scheduled.
- Company guidance on mine life, concentrate grades, timing etc. were used when available and assessed as reasonable.
- Where logistics haulage basis is known, it has been included i.e. road verses rail.
- Earliest timing for non-operating or development projects:
  - Studies/Feasibility – 4-6 years
  - Advanced Exploration – 6 – 8 years.
- Where there is limited information available for Advanced Exploration Projects, general rules of thumb have been applied including:

  - Assumption the Project results in new concentrate volumes
  - 30% of contained metal in Total Resource (Measured, Indicated and Inferred).
- The life of the Project is dependent on Scale:
  - Large 10 years
  - Medium 5-10 years
  - Small 2 years.

Standard concentrate grades have been assumed based on a conservative (maximum) concentrate basis. It should be noted the actual concentrate grades will vary.

Table 4.3 Mines included in Demand Forecast by Status

INACTIVE	EXPLORATION	ADVANCED EXPLORATION	STUDIES/ FEASIBILITY	DEVELOPMENT/ OPERATING	CARE & MAINTENANCE
Fort Roger	Constance Range	Mount Elliott/Swan	Mount Isa Open Pit	Cannington	Lady Loretta
Deposit I	Broader Altia	Walford Creek	Capricorn Copper	Dugald River	Highway Reward
Julivon Creek	Mount Norma	Cloncurry Copper Project	Merlin and Mt Dore	George Fisher	
Mount Jennifer	Phantom Hills	Kalman	Rocklands Copper Project	Mount Isa Copper	
Mount O'Connor	Riversleigh	Maronan	Roseby Copper Project	Ernest Henry	
Limelight	Beacon Prospect	Mary Kathleen	Barbara	Lady Annie Project	
Mount Les	Black Rock JV	Mount Oxide	Mount Watson	Eloise	
	Chinova Other	Mount Philp	White Range Project	Korella	
	Eloise Copper JV	Paradise Phosphate Project		Leichhardt Project	
	Flamingo	Pegmont		Monakoff / Mount Margaret	
	Fountain Range Project	Starra Line		Mount Carlton Project	
	Granite Castle	Cloncurry Copper and Gold Project		Osborne	
	Hazel Creek Project	Lady Ella		Phosphate Hill	
	Mount Avarice	Lorena		Thalanga	
	Laroona Lime	Overlander			
	Selwyn	Victoria Stuart			

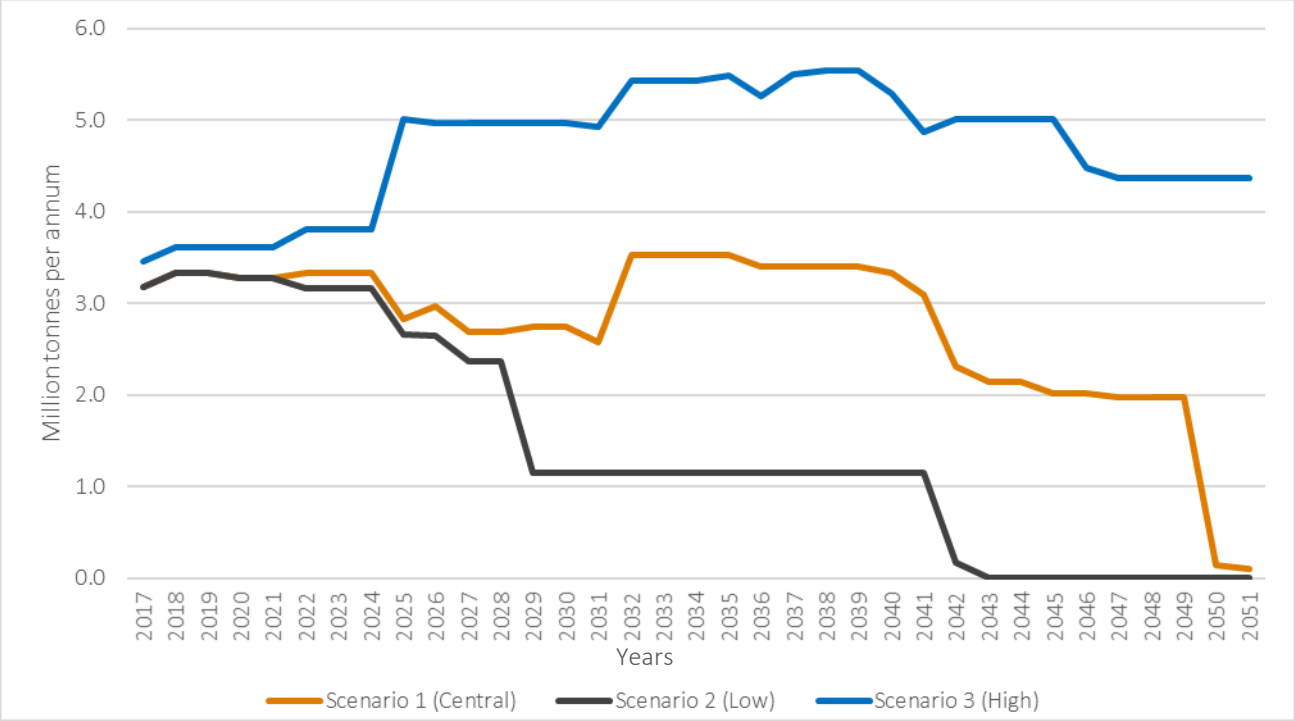
A summary of the minerals demand forecast under each scenario is shown in Table 4.4 and Figure 4.1. The main difference between Scenario 1 and 2 is the assumption that the Mount Isa Open Pit mine (around 1.2 -

1.8mtpa) (Mount Isa Silver-Lead mine) is not commissioned, while the main difference between Scenario 1 and Scenario 3 is the inclusion of the Paradise Phosphate Project (around 1.2mtpa) in 2024 of the high scenario.

Table 4.4 Minerals Demand for Each Scenario (mtpa)

TRAIN TYPES	2017	2022	2027	2032	2037	2042	2047	2051
Scenario 1 - Central	3.2	3.3	2.7	3.5	3.4	2.3	2.0	0.1
Scenario 2 - Low	3.2	3.2	2.4	1.1	1.1	0.2	-	-
Scenario 3 - High	3.5	3.8	5.0	5.4	5.5	5.0	4.4	4.4

Figure 4.1 Minerals Demand Forecast for Each Scenario



4.5 Other Freight (Non-Minerals)

The forecast growth projection for other freight (non-mining) is based on modelling assumptions, and a detailed understanding of the PoT current customers and cargoes, Queensland government projections of population, and irrigated agriculture. The non-minerals freight forecast was prepared based on the data being used by PoT for master planning purposes.

There is inherent uncertainty in growth projections, possible size, timing of future development, and the timing of trigger points for industry developments. The growth scenarios were developed based on a 30-year master planning timeframe (PoT master planning), with incremental growth over the next 10 and 20 years expected.

A range of growth scenarios have been developed to account for the inherent uncertainty in the magnitude and timing of growth, providing flexibility in a range of possible long-term port growth outcomes.

The following should be noted when reading the growth scenarios:

- Growth scenarios are for the TEARC business case assessment, focusing on maximum reasonable estimates of throughputs over the assessment period, regardless of when this throughput is achieved.
- The analysis does not form a view about the likelihood of any of the scenarios occurring or indicate government support for any particular infrastructure project or industry development.
- The analysis recognises that individual ports (as a freight generator) compete for trade, with growth scenarios for each port accommodating of maximum trades without forming a view about which port may be more likely to receive the trade.

The freight demand forecast for Scenario 1 (Central) is shown in Table 4.5. Scenario 1 includes the following overall assumptions:

- Growth in the Port's existing trade (exports and imports).
- Development of the currently known North West Minerals Province projects (including phosphate and excluding coal and uranium), northern Queensland irrigated agriculture projects and ethanol plant projects.
- Port capture of contestable agricultural export and household goods import container trades.
- Central Galilee Basin coal development starts with fuel and project cargo routed via the PoT.

Table 4.5 Other Rail Freight Demand – Scenario 1 (Central Case) (mpta)

	2017	2022	2027	2032	2037	2042	2047	2051
Total	2.8	3.0	3.2	3.4	3.5	3.6	3.7	3.8

The freight demand forecast for Scenario 2 (Low) is shown in Table 4.6. Scenario 2 has the following overall assumptions:

- Further growth in the port's existing trade (exports and imports).
- Further development of currently known North West Minerals Province projects generating dry bulk exports (including phosphate as dry bulk and excluding coal and uranium), northern Queensland irrigated agriculture projects and ethanol plant projects.
- Further part-capture of contestable agricultural export and household goods import container trades.
- Central Galilee Basin coal development is expanded with two mines being supplied with fuel and project cargo via the PoT.

Table 4.6 Other Rail Freight Demand – Scenario 2 (Low Case) (mtpa)

	2017	2022	2027	2032	2037	2042	2047	2051
Total	2.8	2.8	2.9	3.0	3.1	3.2	3.2	3.3

The freight demand forecast for Scenario 3 (High) is shown in Table 4.7. Scenario 3 has the same assumptions as Scenario 1 with the addition of increased dry bulk exports routed through the PoT.

Table 4.7 Other Rail Freight Demand – Scenario 3 (High Case) (mtpa)

	2017	2022	2027	2032	2037	2042	2047	2051
Total	2.8	3.1	3.4	3.6	3.8	3.9	4.1	4.2

4.6 Total Rail Demand

The total rail demand for TEARC incorporates both the minerals (concentrates and fertilises/phosphate) and other freight demand forecast. A summary, by train type and commodity, is shown in Figure 4.2 and Table 4.8. In the analysis, no generated demand is assumed. Consequently, the estimates of total freight tonnes are assumed to be equal in the base case and project case.

The majority of rail traffic over the forecast period is for concentrates and sugar/molasses. Fertiliser/phosphate is an important source of demand, however in Scenario 1 this demand is assumed to end in 2041.

Figure 4.2 Total Rail Demand Forecast for Scenario 1 (Central Case) (mtpa)

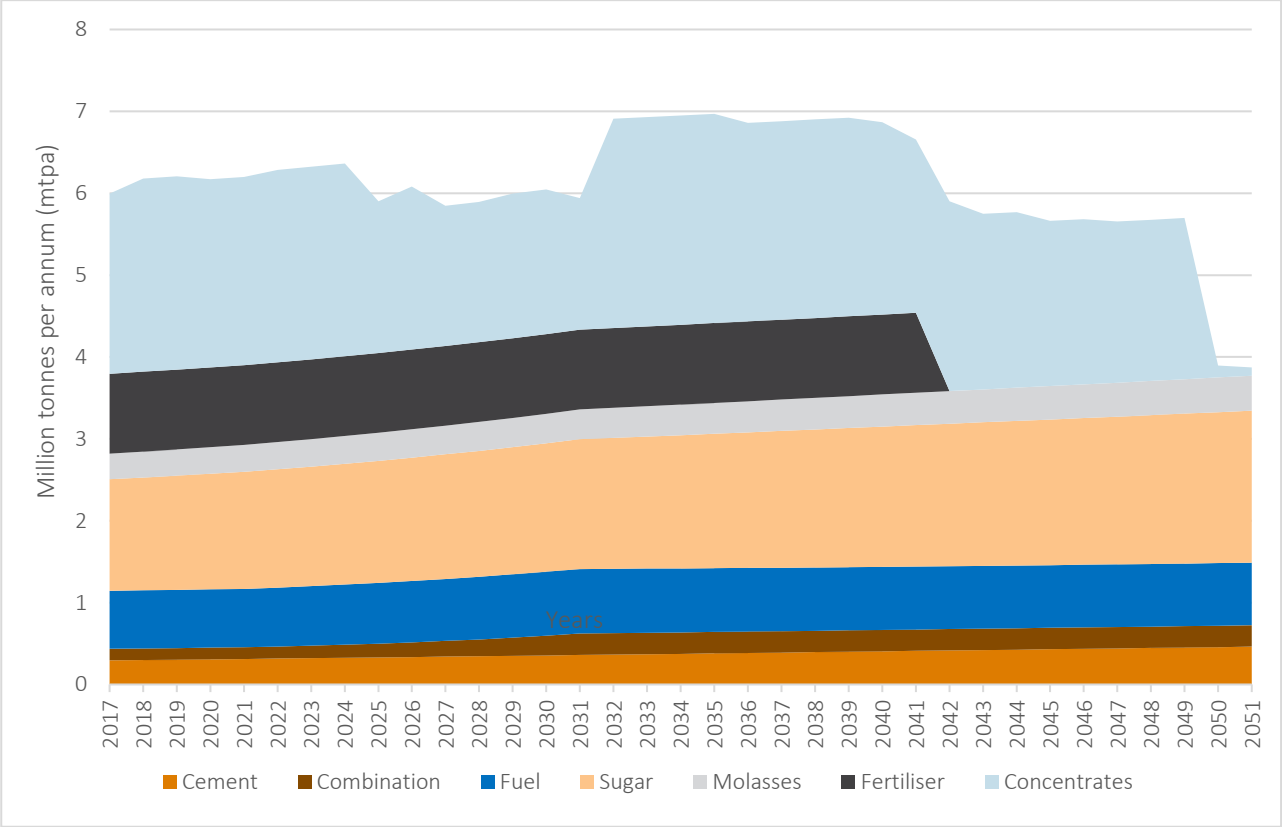


Table 4.8 Total Rail Demand Forecast for Scenario 1 (Central Case) (mtpa)

	2017	2022	2027	2032	2037	2042	2047	2051
Total	6.0	6.3	5.8	6.9	6.9	5.9	5.7	3.9

A summary of the total rail demand for all scenarios is provided in Figure 4.3 and Table 4.9.

Figure 4.4 compares the demand forecast to historical demand. The significant decline in rail traffic is predominately due to the decline in nickel that at its peak amounted for over 3mtpa. Note the nickel ore was transported from the PoT via the Jetty Branch to the North of Townsville via the North Coast Line.

Figure 4.3 Total Rail Demand Forecast (mtpa)

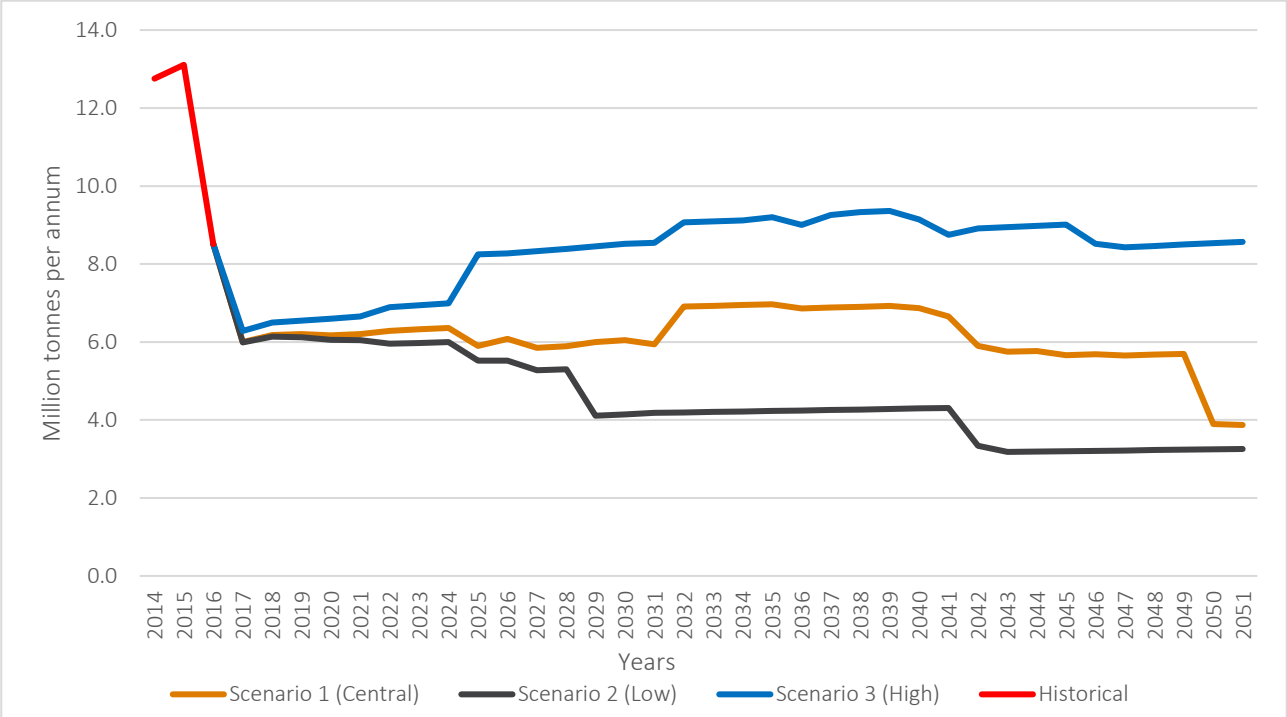


Table 4.9 Total Rail Freight Demand (mtpa)

SCENARIO	2017	2022	2027	2032	2037	2042	2047	2051
Scenario 1	6.0	6.3	5.8	6.9	6.9	5.9	5.7	3.9
Scenario 2	6.0	6.0	5.3	4.2	4.3	3.3	3.2	3.3
Scenario 3	6.3	6.9	8.3	9.1	9.3	8.9	8.4	8.6

4.7 Road Demand

In addition to the forecast rail demand, the impact to the road network was forecast based primarily on growth assumptions developed with the PoT.

The predominate road demand is from general container freight, Scenario 1 forecasts this freight at 2.3mtpa in 2017, increasing to 3.7mtpa by 2051.

The forecast road demand through the PoT is shown in Table 4.10.

Table 4.10 Total Road Demand Forecast for Scenario 1 (Central Case) (mtpa)

	2017	2022	2027	2032	2037	2042	2047	2051
Total	**2.3**	**3.6**	**3.5**	**3.6**	**3.7**	**3.7**	**3.7**	**3.7**

A summary of forecast road demand for each scenario is shown in Table 4.11.

Table 4.11 Total Road Freight Demand (mtpa)

SCENARIO	2017	2022	2027	2032	2037	2042	2047	2051
Scenario 1	2.3	3.6	3.5	3.6	3.7	3.7	3.7	3.7
Scenario 2	2.2	2.7	2.6	2.5	2.6	2.6	2.5	2.6
Scenario 3	2.5	5.2	5.2	5.4	5.5	5.5	5.0	5.0

4.8 Total Rail and Road Demand

The rail and road demand is combined to provide an indication of the forecast freight task for the PoT. Overall demand is expected to decline from 7.4mtpa in 2017 to 6.9mtpa in 2051. This is primarily due to the reduction in minerals rail traffic over the period.

Total PoT freight demand under each scenario is shown in Table 4.12.

Table 4.12 Total Rail and Road Freight Demand (mtpa)

SCENARIO	2017	2022	2027	2032	2037	2042	2047	2051
Scenario 1	8.3	9.9	9.4	10.5	10.6	9.6	9.3	7.6
Scenario 2	8.2	8.6	7.8	6.7	6.8	5.9	5.8	5.8
Scenario 3	8.8	12.1	13.5	14.4	14.8	14.4	13.4	13.5

These scenarios were used to inform the rail and road modelling simulations for economic assessment in Chapter 7.

4.9 Additional Future Demand Case

Scenarios 1, 2 and 3 are based on the demand side forecast models which is utilised for the DBC economic assessment in Chapter 7. The economic assessment for TEARC shows that higher demand i.e. more trains to the port, reduces the economic benefit and therefore Scenario 4 was not used in the sensitivity analysis (as part of the PoT master planning process, the Scenario 4 demand forecast has been generated to identify parameters for an ultimate port footprint to 2050).

It is important to understand the longer-term potential of TEARC for the purposes of the port master plan.

The PoT is one of four priority ports under the *Sustainable Ports Development Acts (2015)*. The Queensland Government is developing master planning for priority ports in accordance with the Ports Act. The master planning process has a timeframe out to 2050. Future demand is an important component of the master planning process. During this process, the PoT developed Scenario 3 to inform the possible future infrastructure requirements for the "ultimate footprint" of the port which compares to the DBC Scenario 4.

In addition to the DBC Scenario 3 (High) case, this ultimate port footprint includes:

- coal production up to 9.5mtpa by 2032
- nickel returning to volumes around 4mtpa
- magnetite demand peaking at 1.6mtpa in 2022.

Coal, oil shale, magnetite and nickel were excluded from the economic appraisal (base and project case). The resumption of nickel imports/exports will not be material on the Benefit Cost Ratio (BCR) for this DBC.

A summary of the total rail demand under the ultimate port footprint case is shown in Table 4.13 below. Overall the peak level of rail demand is 24.4mtpa. This is significantly higher than the peak level of demand which was forecast in Scenario 3 (High) case of 9.3mtpa (a comparison is shown in Figure 4.4).

This scenario has not been assessed further in the business case (i.e. economic and financial analysis). It is included in this section to provide an overview of demand that has been contemplated during the Port Master Planning process.

Should this level of demand be achieved it would require a significant change to TEARC and Port infrastructure requirements to cater for existing and new customers, (Berths, Loading/unloading facilities, land requirements and potentially additional passing loops on TEARC and the Mount Isa Line.

Table 4.13 and Figure 4.4 detail the demand profiles for the ultimate port footprint case.

Table 4.13 Total Rail (Only) Demand Forecast – Ultimate Port Footprint Case

	2017	2022	2027	2032	2037	2042	2047	2051
Total	6.5	14.6	19.1	24.3	24.4	23.9	22.7	22.3

Figure 4.4 Total Rail Demand Forecast under Various Scenarios