Port of Hastings
Rail-Port Interface Facility

Preliminary Concept Investigation

Prepared for Port of Hastings Development Authority by Raylink Consulting & John Hearsch Consulting Partnership

11 February 2014

In May 2016 the Special Minister of State asked Infrastructure Victoria to provide advice on the future capacity of Victoria's commercial ports. Specifically, the Minister has asked for advice on when the need for a second container port is likely to arise and which variables may alter this timeline. The Minister has also asked for advice on where a second container port would ideally be located and under what conditions, including the suitability of, and barriers to investing in, sites at the Port of Hastings and the Bay West location.

In undertaking this task, Infrastructure Victoria reviewed work that was completed as part of the Port of Hastings development project before it was cancelled in 2014. This document forms part of the initial work undertaken for the proposed port development at Hastings. Infrastructure Victoria considers that much of the previous Hastings work, although preliminary in nature, is relevant and suitable for informing a strategic assessment. Therefore, Infrastructure Victoria has requested that preliminary and draft reports previously commissioned for the development project be reissued to form part of the evidence base on which Infrastructure Victoria will use in providing the Minister with advice.

The opinions, conclusions and any recommendations in this document are based on conditions encountered and information reviewed at the date of preparation of the document and for the purposes of the Port of Hastings Development Project.

Infrastructure Victoria and its consultants have used the information contained in these reports as an input but have not wholly relied on all the information presented in these reports.

Port of Hastings Rail/Port Interface Facility

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Executive Summary

As part of its development work, the Port of Hastings Development Authority, in conjunction with the Department of Transport, Planning and Local Infrastructure (DTPLI), is planning for a new rail link to Hastings along the proposed Western Port Freeway corridor in close collaboration with VicRoads.

After it exits the Western Port Freeway corridor alignment the new rail link will connect to a rail/port interface facility where the container trains will arrive and depart and, in the case of regional and interstate trains, be broken into smaller lengths for operation within the port precinct. Proposed metropolitan container shuttle trains would normally bypass the facility but it would provide for limited queuing of these trains if and when needed to accommodate unplanned delays at the Port terminal/s or on the wider rail network.

In order to progress further planning work for the proposed Western Port Freeway, VicRoads is urgently seeking indicative information regarding the likely location and footprint of the rail/port interface facility. The Authority has therefore engaged the Raylink Consulting and John Hearsch Consulting partnership to develop a preliminary functional specification for the rail/port interface facility. This has been determined in the context of the Port's long term planning horizon, expected trades (based on current Port of Melbourne data) and ultimate throughput capacity of 9 million TEU with a maximum ±30% variability factor around the daily average port throughput. At 9 million TEU, this equates to a maximum peak daily throughput of 32,055 TEU, of which around 93% is likely to involve landside transport.

The functional specification has been designed to support a proposed rail operating concept for metropolitan shuttle trains at specified rail market shares and for Victorian regional and interstate services at current rail market shares. Taking into account origin/destination data and potential slot utilisation, at 9 million TEU, an approximate 50% market share for metropolitan rail shuttles and current rail shares for regional and interstate traffic, likely daily peak movements are 93 train trips and almost 4,700 truck trips each way per day. At a 10% metropolitan rail share, there would be 48 train trips and almost 7,300 truck trips per day.

The required footprint for the rail/port interface facility at approximately 50% rail market share involves a total length of approximately five kilometres. Allowing for access roadways and a buffer zone, the facility site at the fence line will need to be approximately 220m to 250m wide for much of its length and will need to maintain this width for approximately 3.3 kilometres. However, the overall dimensions of land that should be set aside for the facility and the rail and road connections into the site should be considered in the broader context of potential incompatibility with other forms of current land use in the general Hastings area.

Criteria have been developed for the facility site selection which, when applied to potential sites, both within and partly outside the currently designated Special Use Zone (SUZ), lead to the conclusion that a "North-South option" for the facility, located on a north-south axis, parallel to and generally contiguous to the proposed Western Port Freeway alignment, is the only feasible area for its placement.

There are three potentially feasible North-South sub-options which require more detailed examination during the next stage of planning for the rail and freeway alignments, all of which would be co-located with the proposed freeway near the present Western Port Highway or alternatively, some distance either east or west of the present highway. Its positioning either further north or south is constrained by a combination of topography, urban development and potential linkages to the Port.

Further work to refine these outputs should now proceed and will require a collaborative effort between the Authority, DTPLI, VicRoads and their respective consultants and advisers.

1. Introduction

As part of its development work, the Port of Hastings Development Authority, in conjunction with the Department of Transport, Planning and Local Infrastructure (DTPLI), is planning for a new rail link to Hastings along the proposed Western Port Freeway corridor. This work is being undertaken in close collaboration with VicRoads.

After it exits the Western Port Freeway corridor alignment the new rail link will connect to a rail/port interface facility where the container trains will arrive and depart and, if needed, be broken into smaller lengths for operation within the port precinct. The rail/port interface facility may also need to have ancillary facilities such as a locomotive fuelling point, wagon repair and train crew facilities. The rail/port interface facility may also need to provide an additional interface to any broader logistics precinct (including warehousing, distribution centres, etc.) that the Authority may wish to develop within the broader Special Use Zone.

VicRoads has advised that, in order to engage an engineering consultant to undertake design of the freeway, it needs indicative information regarding the likely location and footprint of the rail/port interface facility. In the absence of this information, VicRoads cannot proceed with further planning work for the freeway.

The Authority has therefore engaged the Raylink Consulting and John Hearsch Consulting partnership to develop a preliminary functional specification for the rail/port interface facility. This has been determined in the context of the Port's long term planning horizon, expected trades and ultimate throughput capacity of 9 million TEU. The functional specification has been designed to support a proposed rail operating concept for metropolitan shuttle trains at specified rail market shares and for Victorian regional and interstate services at current rail market shares. It covers such things as the number of sidings, the length of sidings as well as a possible range of other ancillary facilities, including those mentioned above.

Following preparation of a preliminary functional specification, a conceptual layout of the rail/port interface facility has been prepared to allow potential sites for the facility to be examined for their suitability in conjunction with the Authority's personnel. The site selection process has been undertaken in accordance with multiple site selection criteria.

Output from this work has been designed for the Authority to provide sufficient input to VicRoads to enable planning work on the southern section of the Western Port Freeway to proceed.

2. Underlying assumptions

2.1 Trade flows

The ultimate capacity of the Port of Hastings for development purposes has been established as 9 million TEU per annum. The rail aspects of the port development have therefore also been based on throughput at this level. Based on a 365 days per annum operation, this equates to average daily throughput of 24,658 TEU.

It has been agreed to adopt a ±30% variability factor around the daily average throughput to take account of daily, weekly, monthly and/or seasonal peaks and troughs. On this basis, the maximum peak daily throughput would be 32,055 TEU.

In the practical world of international trade and shipping, volume volatility could well exceed the ±30% level at times, however the likely reality is that a degree of peak smoothing will inevitably occur given the capital intensive nature of both port and landside facilities. Therefore it is proposed that the projected peak daily throughput of 32,055 TEU should form the basis of all landside transport capacity planning to meet projected ultimate port throughput volumes. As such, all of the remaining parameters in this report have been quantified on this basis.

In the absence at this stage of more detailed market research data, it has also been agreed to assume that the relative trade flow volumes including origins/destinations and import/export/empty container ratios will generally replicate those experienced at the Port of Melbourne. This data has been sourced from the Port of Melbourne's 2009 Container Logistics Chain Study, being the most recent data of this nature currently available in the public domain. Where considered appropriate, these forecast numbers have been rounded off to avoid the perception of false accuracy.

On this basis, the major trade flows as a proportion of the assumed maximum daily port throughput are as shown in Table 1, below

Table 1: Assumed major trade flows at 9m TEU per annum as a proportion of assumed maximum daily port throughput

Trade flows	% of total throughput	Maximum daily TEU volume
International imports	40%	12,822
International exports (including empties)	40%	12,822
Tasmania imports + exports	13%	4,167
Transhipments	7%	2,244
Totals	**100%**	**32,055**

Transhipments are internal to the working of the Port terminal and do not normally impact landside transport requirements. They are therefore disregarded for the specific purpose of this report.

Each of the remaining 93% of trade flows then need to be quantified in terms of their primary origins and destinations, as differentiated by their likely differing land transport mode shares and methods of operation, again reflecting current operations at the Port of Melbourne. For this purpose, origins and destinations are classified as:

- To/from the Melbourne metropolitan area
- To/from regional Victoria (excluding Gippsland)
- To/from Gippsland
- To/from interstate (by State)

The above origins/destinations as a proportion of total land transport demand are as shown in Table 2, below.

Table 2: Origins/destinations at 9m TEU per annum as a proportion of principal trade flows and assumed maximum peak daily TEU volumes

Trade flows	Origins/destinations	% of total throughput	Maximum daily TEU volume
International imports	To Melbourne metropolitan	87%	11,155
	To Regional Victoria	3%	385
	To NSW	3%	385
	To S.A.	6%	769
	To W.A & Queensland	1%	128
	Sub-totals	**100%**	**12,822**
International exports (including empties)	From Melbourne metropolitan	54%	6,924
	From Regional Victoria*	17%	2,180
	From Gippsland	6%	769
	From NSW	11%	1,410
	From S.A.	12%	1,539
	From W.A & Queensland	nil	nil
	Sub-totals	**100%**	**12,822**
Tasmania imports	To Melbourne metropolitan	86%	1,792
	To Regional Victoria	1%	21
	To NSW	6%	125
	To S.A.	2%	42
	To W.A & Queensland	5%	104
	Sub-totals	**100%**	**2,084**
Tasmania exports	From Melbourne metropolitan	48%	1,000
	From Regional Victoria*	30%	624
	From Gippsland	5%	104
	From NSW	7%	146
	From S.A.	3%	63
	From W.A & Queensland	7%	146
	Sub-totals	**100%**	**2,083**
	Overall total		**29,811**

(* - excluding Gippsland)

2.2 Rail and road market shares

As shown above, the greater proportion of landside container movements for both imports and exports will be to and from the Melbourne metropolitan area. However, 46% of international exports originate from Regional Victoria and interstate, as do 52% of exports to Tasmania.

Currently, all movements of containers to and from metropolitan Melbourne are transported by road however plans are well advanced to introduce a Metropolitan Intermodal System (MIS) that will use rail as its primary transport mode to handle container movements between a specialised Port of Melbourne precinct terminal and designated intermodal terminals located in the south-east, west and north of the metropolitan area.

For the purposes of this study, it has been assumed that, by the time Hastings Port is fully operational, the MIS will be well established and moving a significant volume of containers to and from the Port of Melbourne. Hence, once the requisite infrastructure is in place, its extension to also service Hastings will be a natural and non-contentious development.

The MIS will use dedicated shuttle trains for this purpose, similar in concept to those already operating in Sydney and Perth and which are also planned for introduction in Brisbane and Adelaide. However, because the MIS is yet to become operational in Melbourne and its market success cannot be gauged, it has been agreed to postulate potential market shares of 10%, 25% and 50% for the purpose of initial port planning. In this context, a further assumption is unconstrained capacity for moving containers on rail between Hastings, the metropolitan area (through the MIS) and other locations in regional Victoria and interstate.

For movements of containers to and from regional Victoria and interstate, the rail mode is well established as having a substantial market share, noting that there is a near corresponding movement of empty containers also railed to the respective loading locations. This occurs because, with the partial exception of international imports into South Australia and some from Tasmania into other states, the number of imported containers destined for regional Victoria or other states is very small.

The assumed rail market shares for container movements to and from regional Victoria and interstate and which approximates the current situation, is as shown in Table 3, below

Table 3: Assumed rail market shares for movements to/from regional Victoria and interstate

Origins and destinations	International and mainland coastal trades		Tasmanian trade	
	Imports	Exports	Imports	Exports
Regional Victoria (excl. Gippsland)	50%	50%	30%	30%
Gippsland	negligible	20%	negligible	10%
New South Wales	60%	60%	40%	40%
South Australia	70%	70%	40%	40%
W.A. and Queensland	80%	80%	80%	80%

2.3 Train length, configuration and capacity

Metropolitan rail shuttle trains for MIS operations are planned to operate as a fixed consist, initially comprising wagons with a total capacity of 84 TEU and diesel-electric locomotives at each end ("top and tail" operation) for an total train length of approximately 600 metres. All wagon types are identical and designed to accept any type or weight of a 20'or 40'container on any slot.

However, if the MIS achieves a 50% or better rail market share, operating efficiency will dictate that in later years relatively fewer but longer trains should be used. It is therefore proposed that, when the number of metropolitan rail shuttles approaches a peak of around 50 return trip services per day, train size should be increased to approximately 900 metres in length or capacity of 126 TEU.

Victorian regional and interstate trains will operate as variable consists, hauled by diesel-electric locomotives in the normal manner and typically not exceeding 1200 metres and 1800 metres in length, respectively and with average capacity of 120 TEU and 200 TEU, respectively. Wagon types also vary and restrictions will apply to positions in which heavier containers can be loaded.

Note that rolling stock used on interstate trains is generally more modern and efficient than on some Victorian regional services hence the relatively better capacity versus train length ratio for these services.

3. Train and truck operations quantification

The assessment of train operations to handle maximum peak daily TEU volumes are based on dominant directional flows which –

- for Melbourne metropolitan traffic are imports
- for Regional Victoria and interstate traffic are exports.

For rail, this approach has an implicit simplifying assumption that, since the flows of import and export containers (including empties) at the port will ultimately be more or less balanced, train operations based on the predominant directional flow will also accommodate all demand for the lesser direction flow. This can be generally justified on the basis that train services, once established, are both more predictable and less flexible than road transport and because the rail operation, being in the hands of relatively few operators, is likely to involve substantially centralised planning and control.

Hence, there will be an inherent incentive for rail operators (and customers by virtue of pricing incentives) to maximise the utilisation of available train slot capacity. For the purposes of this analysis, average train slot capacity utilisation has been assumed at either 80% or 90% for metropolitan shuttle services, at 80% for less frequent Victorian regional services and at 90% for long haul interstate services.

A further factor, particularly applicable to services that predominantly carry regional exports (including those from interstate locations in South Australia and NSW) is that empty containers required for loading at regional centres are also nearly all carried to these locations by rail.

However, the assumption of more or less balanced loading in each direction is unlikely to generally hold for road transport because:

- there are (and presumably still will be) a multiplicity of operators, both small and large;
- in many cases, different road operators satisfy the needs of importers, exporters and container park operators;
- to the extent that rail loadings are reasonably well balanced in each direction, road transport will inevitably deal with the imbalances in container flows that occur on a daily basis;
- port operations also involve numerous ancillary and support operations, virtually all of which are supplied by road.

Whilst definitive data on these imbalances is hard to come by, for the purposes of this initial assessment the simplifying (and likely conservative) assumption is made that, for every vehicle trip operated to and from metropolitan Melbourne to service the predominant directional TEU flow, a further 0.5 truck trips are made to service the unbalanced flows that occur on a daily basis and to underpin ancillary and supply operations at the port.

The remaining variables for the quantification of truck operations to and from the port are truck types in terms of TEU capacity and assumed average utilisation of that capacity. For metropolitan pick-up and delivery of containers, it is assumed that the predominant truck type will be Super B-doubles with 4 TEU capacity and 75% average slot utilisation or 3 TEU average loads over the range of fully loaded, part loaded and empty running.

For Victorian regional and interstate truck trips, it is assumed that the predominant truck type will still be standard B-doubles of 3 TEU capacity, also with 75% average slot utilisation or 2.25 TEU average load over the range of loaded and empty running that these vehicles are likely to undertake. Because of the distances involved, it has been assumed that there are no unbalanced flows for these operations.

Based on the previous data, the predominant daily peak flows are for **import** TEU's destined for Melbourne metropolitan locations and **export** TEU's arriving from regional Victoria and interstate. These comprise:

International imports to Melbourne metro	11,155
Imports ex Tasmania to Melbourne metro	1,792
Total	**12,947**
International exports ex Regional Vic. & I/state	5,898
Exports to Tasmania ex Regional Vic. & I/state	1,083
Total	**6,981**

Rail and road proportions of the daily peak **imported** TEU's destined for metropolitan Melbourne are shown in the following Table 4.

These are based on alternative rail and road market shares converted to return train trips using 84 TEU capacity consists (also 126 TEU capacity consists at 50% rail market share) at average 80% and 90% slot utilisation and on minimum numbers of return truck trips using Super B-doubles conveying an average of 3 TEU towards Melbourne after allowing for unbalanced movements on road.

Table 4: Rail and road peak daily movements at 9m TEU per annum for import containers to Melbourne metro

Rail market share	**10%**	**25%**	**50%**
Peak daily imported TEU's	1,295	3,237	6,474
Daily return train trips @ 90% slots used (84 TEU consists)	17	43	85
Daily return train trips @ 80% slots used (84 TEU consists)	19	48	95
Daily return train trips @ 90% slots used (126 TEU consists)	n/a	n/a	57
Daily return train trips @ 80% slots used (126 TEU consists)	n/a	n/a	64
Likely peak return rail trips to/from Melbourne metro per day	**19**	**48**	**64**
Average train departures ex POH per hour 24/7	**1**	**2**	**3**
Road market share	**90%**	**75%**	**50%**
Peak daily imported TEU's	11,652	9,710	6,474
Daily return truck trips @ average 3 TEU	3,884	3,237	2,158
Unbalanced loading allowance + ancillary/supply trips – 50% of above	1,942	1,619	1,079
Likely peak return truck trips to/from Melbourne metro per day	**5,826**	**4,856**	**3,237**
Average truck trips ex POH per hour 24/7	**243**	**202**	**135**

Daily peak **export** TEU's ex regional Victoria and interstate and rail proportions based on above rail market shares are shown in the following Table 5.

These have been converted to return train trips assuming average 80% slot utilisation of 120 TEU capacity regional Victoria trains and 90% slot utilisation of 200 TEU capacity interstate trains (assuming sufficient trains are operated to meet demand) plus truck movements for the non-rail component based on B-doubles assuming average loads of 2.25 TEU.

Table 5: Rail and Road peak daily movements at 9m TEU per annum for export containers from Regional Victoria and interstate

Origin	Daily peak export TEU's			Rail share %	Rail TEU's	Average train TEU's	Daily return train trips
	To Int'l	To Tas.	Total				
From Regional Vic.	2,180	624	2,804	50%	1,402	96 TEU	15
From Gippsland	769	104	873	20%	175	96 TEU	2
From NSW	1,410	146	1,556	60%	934	180 TEU	5
From S.A.	1,539	63	1,602	70%	1,121	180 TEU	6
From W.A & Qld.	Nil	146	146	80%	117	180 TEU	1
Sub-totals	**5,898**	**1,083**	**6,981**		**3,749**		**29**
Average train arrivals at POH per hour 24/7							**1.25**
Origin	**Daily peak export TEU's**			**Road share %**	**Road TEU's**	**Average truck TEU's**	**Daily return truck trips**
	To Int'l	**To Tas.**	**Total**				
From Regional Vic.	2,180	624	2,804	50%	1,402	2.25	623
From Gippsland	769	104	873	80%	698	2.25	310
From NSW	1,410	146	1,556	40%	622	2.25	276
From S.A.	1,539	63	1,602	30%	481	2.25	214
From W.A & Qld.	Nil	146	146	20%	29	2.25	13
Sub-totals	**5,898**	**1,083**	**6,981**		**3,232**		**1,436**
Average truck arrivals at POH per hour 24/7							**60**

The combined minimum numbers of daily peak return train movements and truck movements for **imports** destined for metropolitan Melbourne at an average of 3 TEU per vehicle as listed in Table 4 above and for **exports** ex regional Victoria and interstate at an average of 2.25 TEU per vehicle as listed in Table 5 above are as shown in the following Table 6.

Table 6: Combined rail and road peak daily movements at 9m TEU per annum for import containers to Melbourne metro and for export containers from Regional Victoria and interstate

Rail metropolitan market share	10%	25%	50%
Daily metropolitan return train trips@ 80% slots used (84 TEU consists for 10% & 25% market share and 126 TEU consists for 50% market share)	19	48	64
Daily regional Victoria/interstate return train trips	29	29	29
Likely peak return train trips to/from POH per day	**48**	**77**	**93**
Average train departures ex POH per hour 24/7	**2**	**3.2**	**4**
Melbourne metropolitan road market share	**90%**	**75%**	**50%**
Daily return truck trips delivering imports to Melbourne metropolitan locations @ average 3 TEU per vehicle	3,884	3,237	2,158
Unbalanced loading allowance + ancillary/supply trips – 50% of above	1,942	1,619	1,079
Daily return truck trips delivering exports ex regional Victoria and interstate @ average 2.25 TEU per vehicle	1,436	1,436	1,436
Likely peak return truck trips per day	**7,262**	**6,292**	**4,673**
Average truck departures ex POH per hour 24/7	**497**	**262**	**195**

4. Corridor rail capacity (Lyndhurst to Hastings)

The proposed rail corridor from Lyndhurst to Hastings is to generally be located within the median of the planned Western Port Freeway. Current planning envisages that the railway will be a dual (1435/1600mm) gauge facility, initially constructed as a single line with two intermediate crossing loops, each approximately 2.5km in length. When needed, the line will be fully duplicated over its entire length and signalled for conventional uni-directional running on each track.

At Lyndhurst, the railway will interface with a proposed major intermodal terminal and the South Eastern Rail Link (SERL) which is planned to run from Lyndhurst to South Dynon via Dandenong on dedicated tracks which will be fully segregated from the metropolitan electrified rail network. At Dandenong, SERL will have an interface with the main Gippsland line. At the South Dynon end, the railway will have direct links to Port of Melbourne rail terminals, other metropolitan intermodal terminals and the overall Victorian regional and interstate networks.

At the Hastings end, the railway will leave the median of the Western Port Freeway south of Pearcedale and enter the proposed Hastings Rail/Port Interface Facility (HRPIF), as described in detail in subsequent sections of this report. The HRPIF will extend over a distance of approximately 5 km, most likely to the east of the Freeway.

Both SERL and the Lyndhurst to Hastings line sections are being developed on the basis of 80km/h maximum speed (limited by the dual gauge third rail configuration), maximum vertical gradients of 2% (1 in 50) and maximum train lengths of 1,800 metres. Overall corridor length from Lyndhurst to the northern boundary of the currently designated Port of Hastings precinct is approximately 29 km.

In its single line configuration with two intermediate crossing loops, the Lyndhurst to Hastings rail corridor will have theoretical capacity to accommodate two trains per hour in each direction. This translates into practical 24/7 capacity (conventionally treated as 80% of maximum theoretical capacity) of 19 trains per day in each direction.

When fully duplicated and signalled for 8 minute follow-on movements (headways) which equates to 10 minutes for practical operational purposes, theoretical capacity rises to 6 trains per hour in each direction. This translates to practical 24/7 capacity of 115 trains per day in each direction which, based on the foregoing analysis, is likely to be adequate for normal rail operations with an approximate 50% rail market share at the 9m TEU per annum level.

Signalling configured for closer headways than 8 minutes apart is unlikely to be feasible due to the braking distance required for 1,800 metre length trains equipped with conventional pneumatic braking systems. However, shorter braking distances are achievable when long and heavy trains are equipped with electronically controlled pneumatic (ECP) braking which is likely to be in more widespread use in the coming years.

In the context of this report, it has been assumed that the capacity of SERL will match that of the Lyndhurst to Hastings rail link, or otherwise at least be sufficient to accommodate all Hastings related demand for rail movement to and from locations beyond Lyndhurst.

5. Rail/Port Interface facility operations and functional requirements

5.1 Proposed train handling processes

The following sections of the report describe in general terms the sequential processes proposed for handling of metropolitan rail shuttles as part of the MIS at or through the area of the proposed HRPIF. Separately, the sequential processes proposed for handling of Victorian regional and interstate rail services at the proposed HRPIF are also described below.

In this context, particularly as applicable to Victorian regional and interstate services, it has been assumed for this purpose that a Port Services organisation provides locomotives, shunting, movement control and other required resources for the movement of trains or part trains between the HRPIF and rail terminal/s at the Port proper. Whilst MIS trains would normally remain as a complete unit for movement to and from the Port rail terminal/s, it is assumed that the Port Services organisation would also control the actual movement of these trains in this area.

5.1.1 Metropolitan shuttle services (600 m length, potentially increased to 900m in later years):

- If a port terminal track is available, on arrival these trains will continue on the main running lines through the HRPIF for direct entry to port
- If a port terminal track is not immediately available, on arrival these trains will enter a port shuttle arrival queuing track pending port terminal track availability
- If a train path is available, these trains will directly depart from the port terminal, proceed via the main running lines through the HRPIF and continue to destination
- If a train path is not immediately available, on return from the port terminal, these trains will enter a port shuttle departure queuing track pending train path availability.
- For metropolitan shuttle trains, no provision is normally required for shunting, train break-up, locomotive detaching, attaching, provisioning or servicing. In the exceptional case that any such function is required, the train concerned would be directed to the regional arrivals yard.

5.1.2 Regional and interstate services (1200m and 1800m maximum length, respectively):

- These trains will arrive into the short or long tracks in the regional arrivals yard, as applicable, with roll-by inspection on entry
- The train locomotives are subsequently released and proceed to the loco provisioning facility
- A Local Port Services loco attaches to the train and the consist is divided as necessary to meet port terminal length or other segregation requirements
- A Local Port Services loco takes the train or part train to port when a terminal track is available
- After processing at the port terminal/s, a Local Port Services loco returns the train or part train to the short or long tracks in the regional departures yard, as applicable.
- A Local Port Services loco re-combines the train consist if necessary and then returns to the arrivals yard or elsewhere as required.
- Train locomotives are attached and a train pre-departure inspection is completed as necessary.
- Train departs onto the main line when a train path is available.

5.2 HRPIF functional requirements

5.2.1 General layout concept

The concept layout and capacity of the HRPIF must be designed and scaled to dovetail seamlessly with the rail terminals within the Port precinct proper. An initial attempt at matching the capacity of the Port precinct rail terminals with the HRPIF is discussed in Section 5.3, below.

A first cut listing of specific HRPIF functional requirements is set out in the following dot points.

- Separate areas are provided to accommodate arriving (east side) and departing (west side) services with the main running lines located between the arrival and departure tracks.
- For metropolitan shuttle trains, separate arrival and departure queuing or holding tracks are provided for use when these services cannot arrive directly into the port terminal/s or when departures from the port terminal/s cannot immediately proceed towards their destination.
- For regional and interstate services, separate arrival and departure tracks are provided to accommodate trains of variable length.
- Regional and interstate trains will often need to be broken into smaller consists after arrival preparatory to being moved to the port terminal. Subsequently, after returning from the port terminal, they are re-combined into full train consists. Suitable headshunts are therefore provided beyond the extremity of the arrival and departure tracks and located so as to permit all required shunting to occur without fouling the relevant running lines.
- Layout of the regional arrival tracks provides for locomotive release to occur with minimal impact on shunting or other movements in the immediate area.
- Locomotive provisioning and servicing facilities are provided and located to allow for direct access for train locomotives from the regional arrival tracks without having to cross any running lines. The facility is designed on "flow through" principles with suitable "ready storage" for locomotives prepared but not immediately required for service. The provisioning facility will include fuel storage and supplies of other consumables including locomotive sand and water. B-doubles will need access to replenish the fuel storage facility.
- A separate short track leading to a locomotive turntable is provided on the approach to the locomotive provisioning and servicing facility.
- A direct connection is provided to enable train locomotives (after provisioning) to intersect the running lines and proceed via a locomotive runaround track (separated from the departure tracks) into a north end short locomotive headshunt, prior to coupling to their respective trains for final pre-departure inspection. The short locomotive headshunt is separate from the general shunting headshunt.
- A small wagon repair facility is provided in the general vicinity of the locomotive provisioning facility for undertaking minor wagon repairs including wheelset, bogie and other component changeouts.
- Short sidings are suitably located at the relevant ends of each of the regional arrivals and departure track areas to accommodate Port Services locomotives when not undertaking shunting or transfer tasks.`
- Separate dead-ended wagon storage tracks are provided in each of the arrivals and departure track areas to accommodate wagons not immediately required for service.
- Suitable accommodation and amenities are provided for operational and administrative staff and train crew, including staff car parking.

The principal areas listed above are indicated on the following schematic diagram (Figure 1).

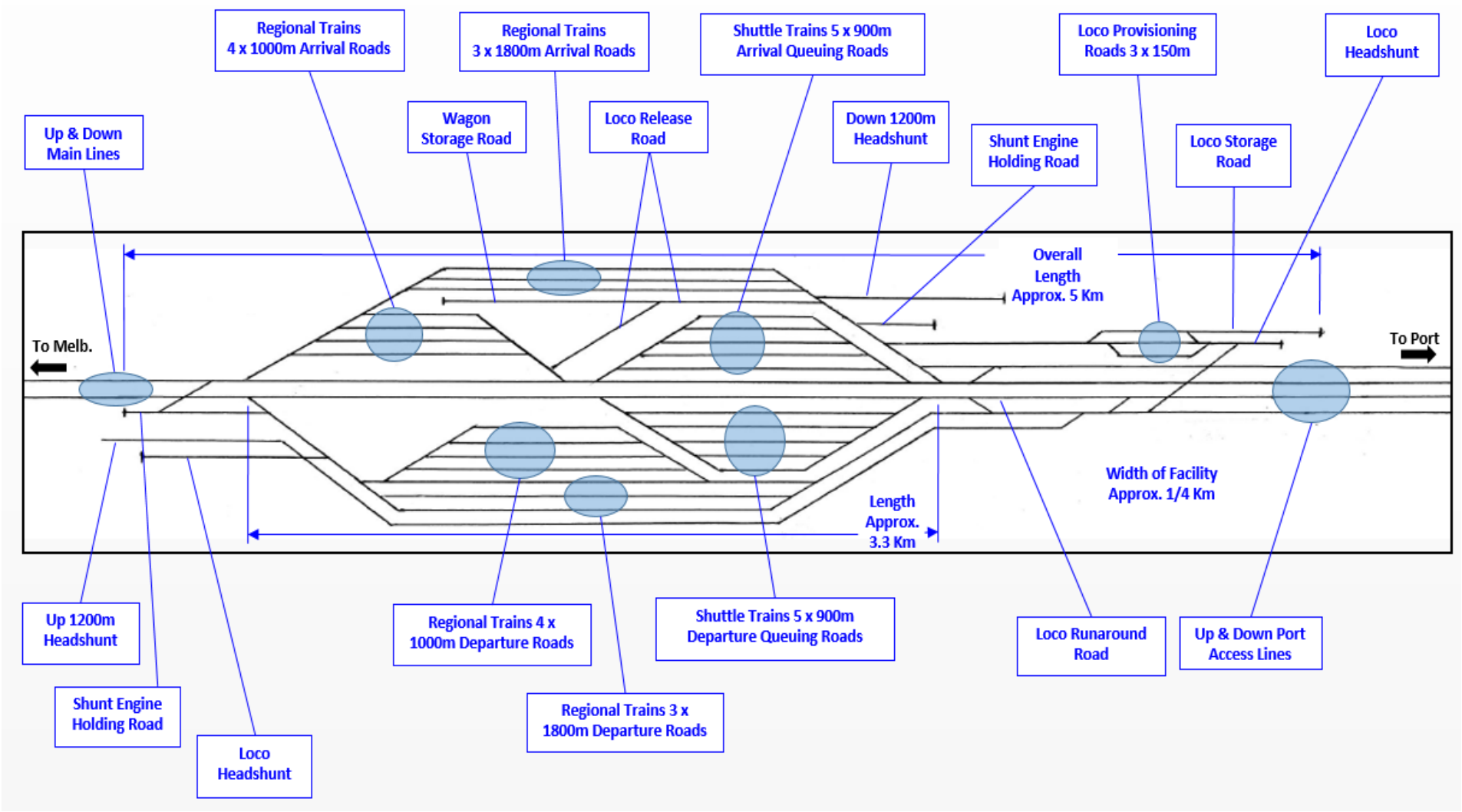

Figure 1: Schematic representation of Hastings Rail/Port Interface Facility (HRPIF) concept

5.2.2 Quantified concept layout

The operating concept for the HRPIF, as described in Section 5.1, has been applied to the estimated number of trains required to handle peak day demand at 50% rail market share of 9m TEU per annum, as set out in Table 6. For smaller volumes to be handled by rail, the facility can be scaled down within the parameters described below. High level quantification of the HRPIF physical requirements, as applied to the general layout concept described above, is proposed in the following dot points:

- Queuing capacity for metropolitan shuttle trains is provided to accommodate maximum delays of 90 minutes for arriving trains should they be unable to proceed directly to the port terminal/s for any reason. The same applies to departing trains which are unable to immediately proceed towards their destinations. Assuming the use of 900 metre trains, a maximum of 3 trains per hour would normally operate in each direction on peak days, therefore a total of five arrival queuing tracks and five departure queuing tracks, each with a minimum of 950 metres clear standing room are required.

- Victorian regional and interstate trains can arrive and depart at irregular intervals and some have relatively long layovers. Therefore, arrival and departure tracks are provided on the basis that each arrival track can be utilised by a maximum of four trains per day and each departure track (which includes time for pre-departure inspections and layovers) can be utilised by a maximum of three trains per day. On this basis, seven arrival tracks (4 x 1000 metres and 3 x 1800 metres clear standing room) and nine departure tracks (5 x 1000 metres and 4 x 1800 metres) are likely to be required.

- Headshunts of 1200 metres minimum length for breaking up trains exceeding the length of port terminal tracks without fouling the main running lines are provided at the southern and northern extremities of the arrival and departure yards, respectively.

- The "flow through" locomotive provisioning and servicing facility provides for three parallel serving tracks, each of 100 metres minimum clear standing room with capacity to allow up to four locomotives to be serviced concurrently.

- Beyond the locomotives provisioning and servicing facility, three locomotive storage tracks are required to hold "ready" locomotives, each with 200 metres clear standing room and capacity for up to eight locomotives.

- The separate locomotive turntable track is a minimum 150 metres length, inclusive of a 22 metre diameter turntable and a 30 metre long stabling/overrun track beyond the turntable.

- The short locomotive headshunt for accommodating departing locomotives prior to coupling to their respective trains will have a minimum of 150 metres clear standing room.

- Short sidings at the relevant ends of the regional arrival and departure track areas to accommodate Port Services locomotives will have a minimum of 100 metres clear standing room.

- Two separate dead-ended wagon storage tracks in each of the arrival and departure track areas will each have a minimum of 500 metres clear standing room.

- A small wagon repair facility provided in the vicinity of the locomotive provisioning and servicing facility will have three tracks, each with a minimum of 100 metres clear standing room.

5.3 Port Terminal/s and HRPIF matching

As mentioned above, the concept layout and capacity of the HRPIF must be designed and scaled to dovetail seamlessly with the rail terminals within the Port precinct proper. The purpose of this brief assessment is to provide an initial preliminary indication of the size and scope of rail terminal facilities

within the Port precinct that would be required to handle the number of peak day trains set out in Table 6 and which would broadly match the capacity of the HRPIF, as detailed above.

The key parameters assumed for the rail terminal/s within the Port precinct in this context would be as under:

- Separate loading/unloading areas for metropolitan rail shuttle services and Victorian regional/interstate services
- Length of loading/unloading pad and rail sidings for:
    - Metropolitan shuttle services – 600 metres, expandable to 900 metres
    - Regional/interstate services – 900 metres
- Terminal train turnaround and cycle times:
    - Metropolitan shuttle services – 2 hours strip and reload, 3 hours terminal cycle, maximum 8 trains per day per loading track
    - Regional/interstate services – 3 hours strip/reload, 4 hours terminal cycle per 900 metre wagon rake, maximum 6 x 900 metre rakes per day per loading track
- Number of loading/unloading tracks (based on above cycle times and peak day forecast train numbers):
    - Metropolitan shuttle services – minimum of 8 tracks (desirably 9 tracks)
    - Regional/interstate services - minimum of 7 tracks (desirably 8 tracks).

Note that the handling of metropolitan shuttle services is likely to be relatively faster and more efficient than the handling of regional and interstate trains due to their greater predictability, operating precision and the ability for any type, size and weight of container to be loaded onto any available slot on the MIS trains. Due to a greater diversity of rolling stock used and multiplicity of ownership, this is unlikely to be the situation for Victorian regional and interstate trains within the foreseeable future.

Overall, in terms of terminal design, functionality and capacity, very significant trade-offs are available if improved terminal track utilisation (brought about by more sophisticated systems and/or additional or more productive handling equipment) could achieve a reduction in scale of what would otherwise be a massive terminal facility. This will be an important issue to consider during ongoing planning for the Port's overall development.

5.4 Overall facility footprint

In order to examine potential locations for suitability as sites for the Rail/Port Interface facility it is first necessary to develop a scaled conceptual layout for the facility. The non - site specific conceptual layout is shown in Figure 2 below, to which must be added sufficient lateral area on each side of the active rail tracks to provide adequate noise and lighting buffering and meet any other environmental requirements deemed appropriate or necessary.

The overall facility footprint and ultimately selected location must assume that the facility is likely to be a busy place at all hours, 365 days per year and therefore unsuitable for placement in close proximity to residential areas.

The layout in Figure 2 below is, in effect, a scaled version of the general layout concept diagram shown in Figure 1, earlier in this report.

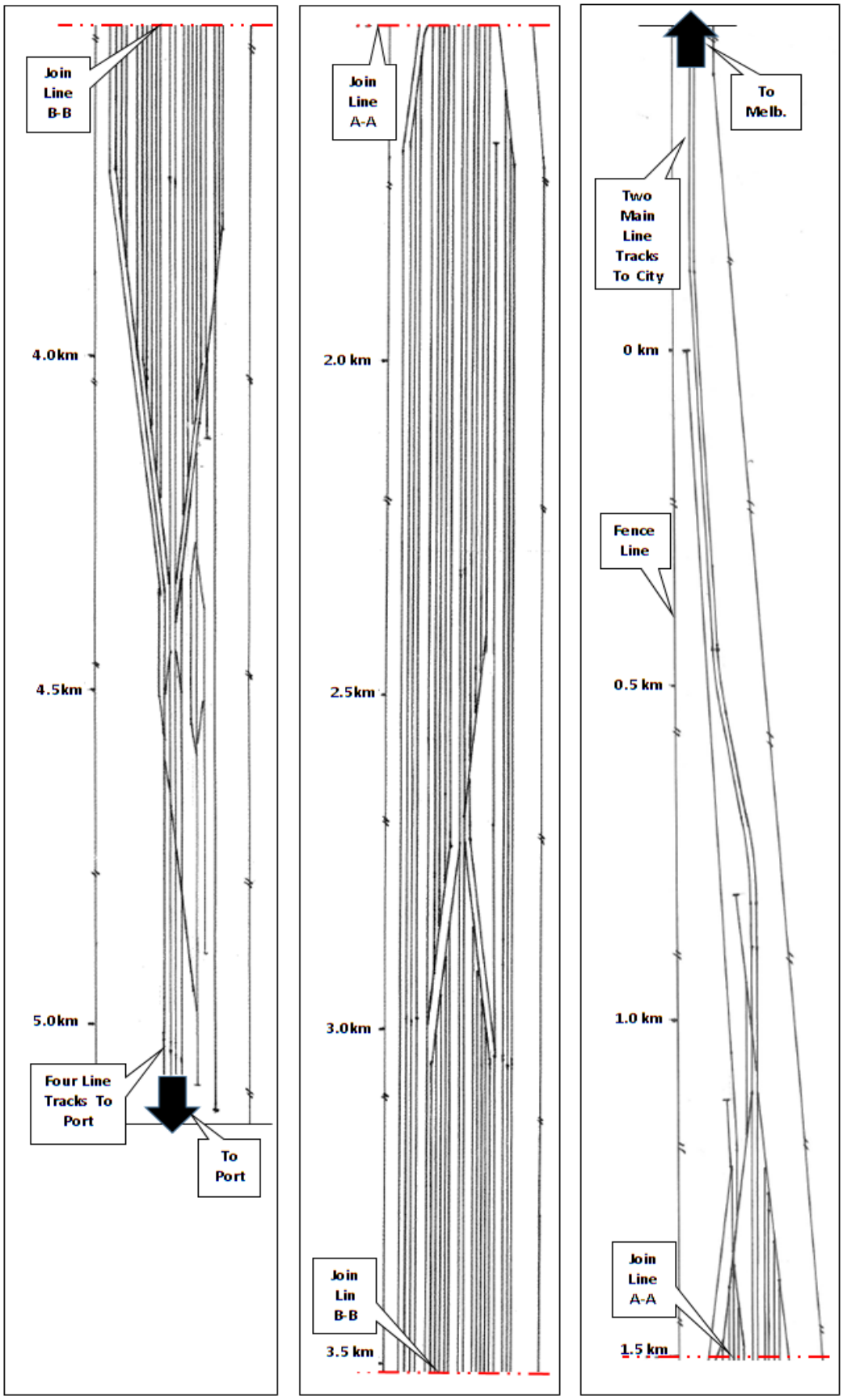

Figure 2: Conceptual scaled single line layout of Rail/Port Interface facility

6. Rail/Port Interface facility siting requirements

A potential site for the Rail/Port Interface Facility (HRPIF) for approximately 50% rail market share at a 9m TEU per annum capacity port will need to meet multiple physical criteria, as discussed in the following sections. These criteria need to be considered independently of present land use or zoning in the general area that will be influenced by the future port development.

6.1 Practical length and width requirements

Based on the conceptual single line layout diagram (Figure 2) it can be seen that the total length of the facility is approximately five kilometres. Allowing for access roadways and a buffer zone, the facility site at the fence line will need to be approximately 220m to 250m wide for much of its length. It will need to maintain this width for approximately 3.3 kilometres (as shown in Figure 1), however, it can taper at both ends where it is not necessary to have multiple parallel sidings.

However, it should also be noted that the overall dimensions of land that should be set aside for the HRPIF and the rail and road connections into the site need to be considered in the broader context of potential incompatibility with other forms of current land use in the general Hastings area.

6.2 Grading of site

The Rail/Port Interface facility will need to be located in an area that is reasonably flat ground. To meet safety requirements and particularly to prevent parked wagons from rolling away, the maximum grade of the tracks within the facility will need to be no steeper than 1 in 250 or 0.4 %. The existing topography of any selected site should aim to minimise the extent of earthworks needed to achieve this, with a cut and fill balance within the overall site a desirable objective.

6.3 Curvature

For safety reasons, the main body of the site should be straight or very nearly straight in order to maximise line of sight visibility along the length of the facility, notwithstanding the use of radio communication to authorise train movements in the area. However, some curvature would be tolerable at the ends of the facility (including for headshunts, if essential) before and beyond the main parallel sidings in the main body of the facility.

6.4 Connection to Western Port Freeway and Port

It is desirable that the HRPIF is located in an area that facilitates relatively easy connection to the proposed new rail link within the proposed Western Port Freeway. Similarly, it is desirable that the facility is located in an area that can provide a suitable direct link to the port complex.

6.5 Distance from Port terminal/s

It is important that the distance between the HRPIF and the Port terminal/s is minimised in order that the time and cost involved in transferring Victorian regional or interstate trains or part trains between the respective facilities is as low as possible. For practical operational purposes, it is proposed that this distance not exceed five kilometres.

6.6 General road access

The facility will also require a direct road connection for staff vehicles and material and consumables delivery by heavy trucks. It is envisaged that B Doubles will need to access the site to deliver diesel fuel for locomotive refuelling. Again it is desirable that the facility be located close to the freeway or a main

road so that the heavy vehicles travelling to and from the facility have a limited traffic impact on the surrounding community.

6.7 Noise and visual amenity

The HRPIF should be located well clear of townships to keep noise annoyance to a minimum. As with the proposed Western Port Freeway, rail operations in the area, including some shunting activity, is likely to become almost constant around the clock and will therefore necessitate substantial noise amelioration in the form of suitable buffering and other appropriate treatment.

Such buffering could take the form of noise walls, earth bunds, appropriate vegetation plantings or a combination of these measures. Likewise, the facility will have high intensity lighting that will have disturbance potential for any nearby residents.

6.8 Compatibility with Urban Fabric

It is highly desirable that the HRPIF is located in a way that it does not create a barrier or otherwise have the potential to be dysfunctional within the local urban fabric. The required size and operational intensity of the facility will pose particular challenges in this regard and, if not appropriately sited relative to the alignment of the proposed Western Port Freeway, could create unwanted barriers between areas that presently enjoy relatively easy interaction.

For these reasons, if possible, the site should be located contiguous to the proposed freeway reservation and/or at the outer edge of the port complex.

6.9 Application of site selection criteria

Section 7 below covers the application of the above site selection criteria to a range of potentially feasible sites in the Hastings area, both within and partly outside the currently designated Special Use Zone (SUZ). Initial examination of each of the potential sites quickly revealed the relative practicality of accommodating such a long and relatively narrow site requirement within existing land holdings in the area. At a high level the site options are described as:

- North-South options (3) which run along a north-south axis, generally parallel to the present Western Port Highway;
- East-West option which runs along an east-west axis to the north of McKirdys Road; and
- North East-South West option which runs on a north-east to south-west axis from south of O'Neills Road.

As discussed below, the East-West and North East-South West options are considered impracticable. Three North-South sub-options appear potentially feasible and will require more detailed examination as the planning process proceeds, especially in relation to the likely alignment of the proposed Western Port Freeway south of the Cranbourne-Frankston Road. The North-South three sub-options are:

- North-South (Central) option –Freeway and HRPIF co-located near the present Western Port Highway
- North-South (East) option – Freeway and HRPIF co-located some distance east of the Highway
- North-South (West) option – Freeway and HRPIF co-located some distance west of the Highway.

7. North Site Assessments

7.1 Location overview

The potential North-South (Central) site for the HRPIF would be located on a north-south axis close to the present Western Port Highway. Its positioning either further north or south is constrained by a combination of topography, urban development and potential linkages to the Port. This option assumes that the future Western Port Freeway would also generally follow the present Western Port Highway alignment. Alternative north-south alignments involving both the HRPIF and proposed freeway located some distance to the east or west of the present highway are described in Sections 7.3 and 7.4, respectively.

Figure 3 below shows the location of the North-South (Central) site option in relation to nearby towns and the road network.

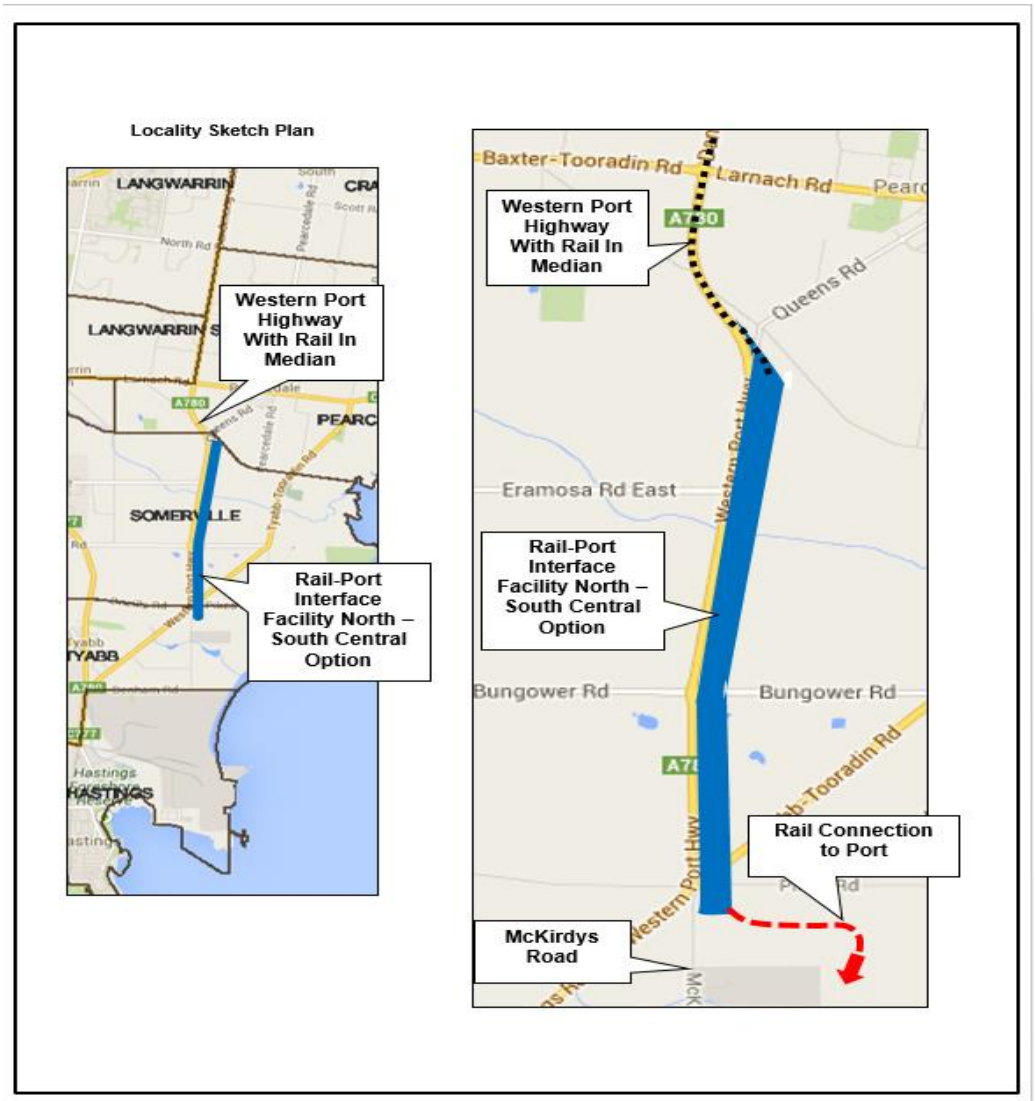

Figure 3: Locality sketch plan of North-South (Central) HRPIF site option

Based on the scaled conceptual layout for the facility shown earlier in this report (Figure 2), a conceptual layout for the North-South (Central) site has been developed. The background for this concept plan was originally prepared by VicRoads and with aerial photography as a base. The concept plan is shown in Figures 4, 5 and 6, below.

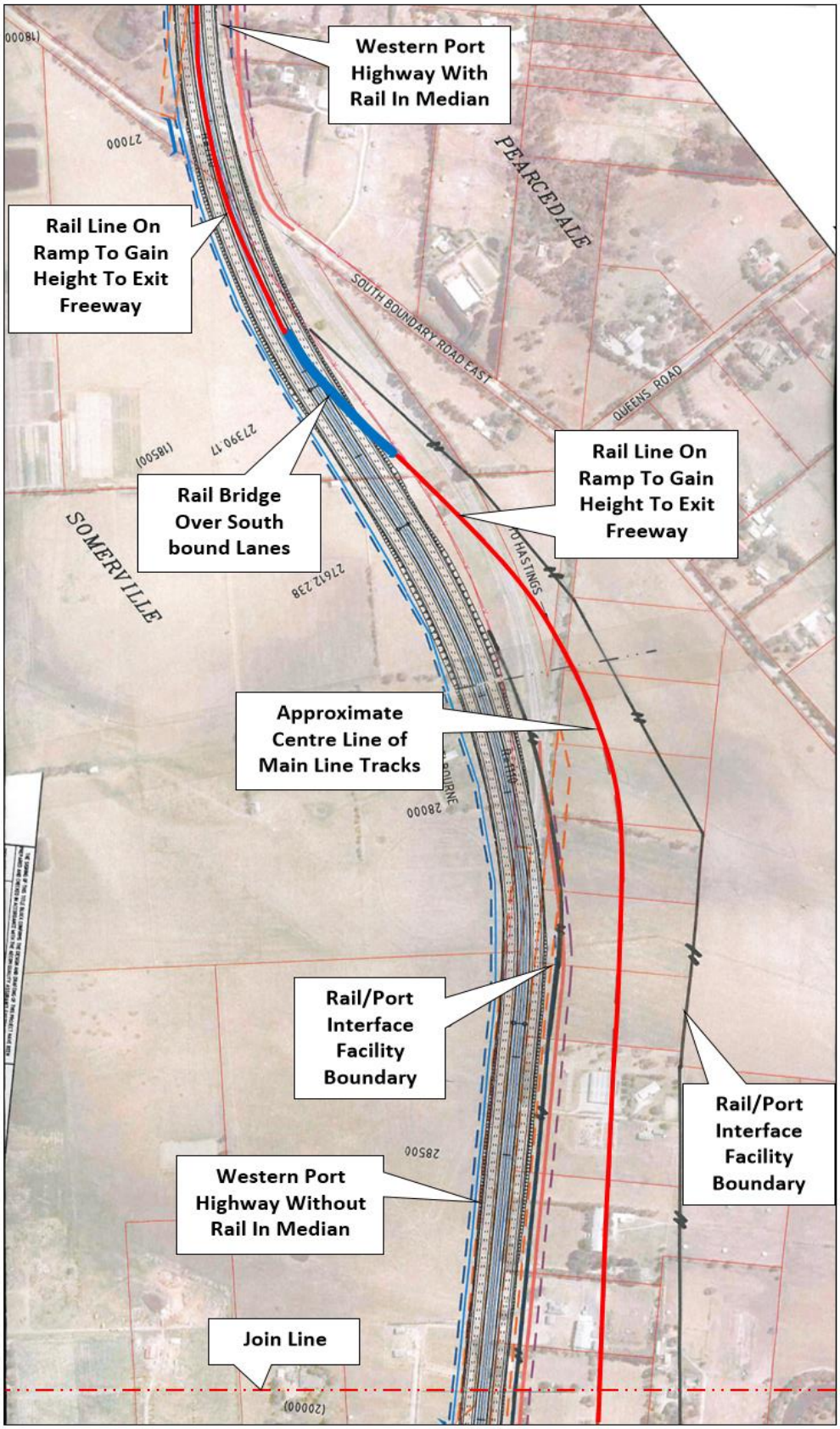

Figure 4: Conceptual Layout of northern section of North-South (Central) site option

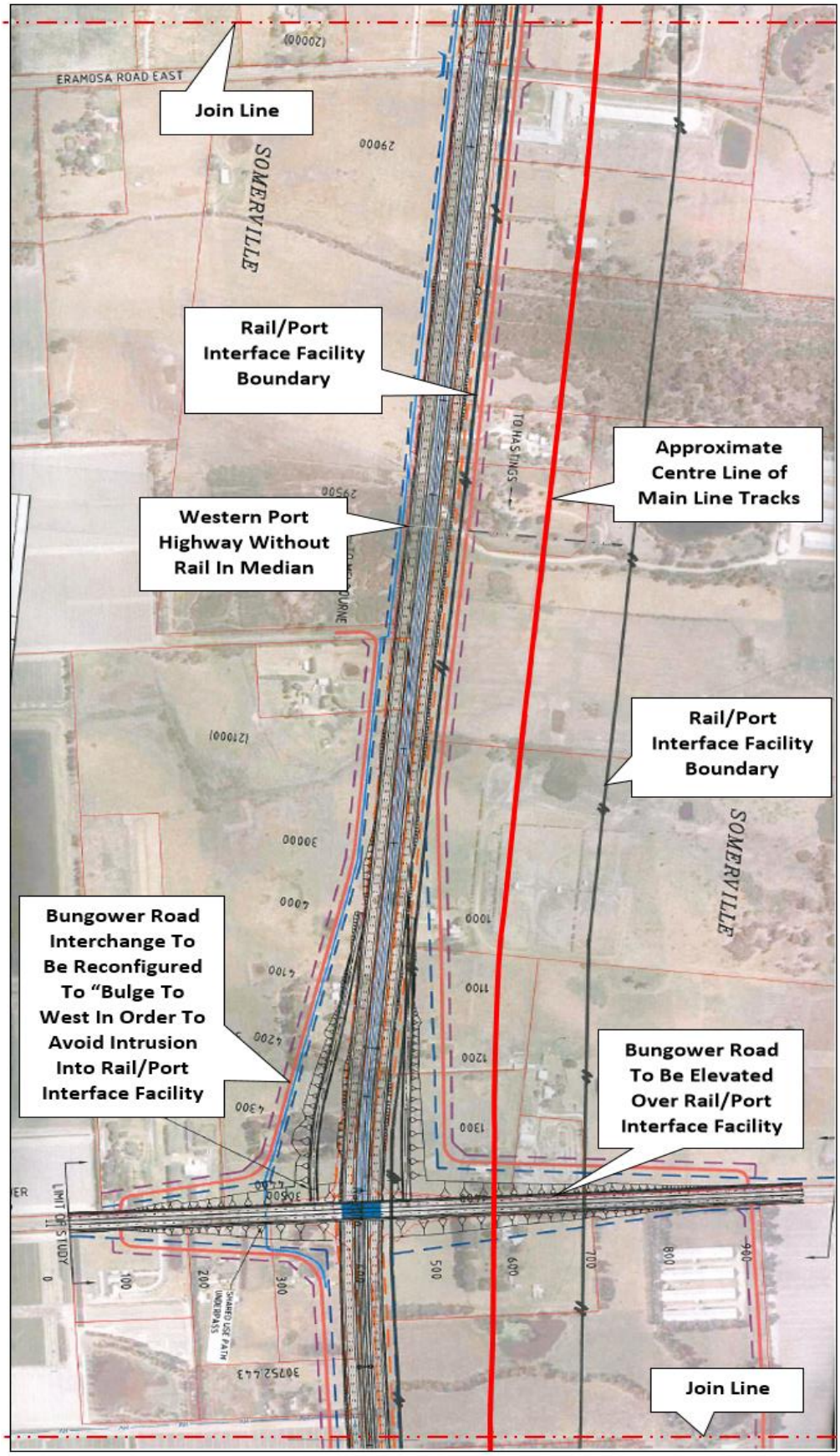

Figure 5: Conceptual Layout of centre section of North-South (Central) site option

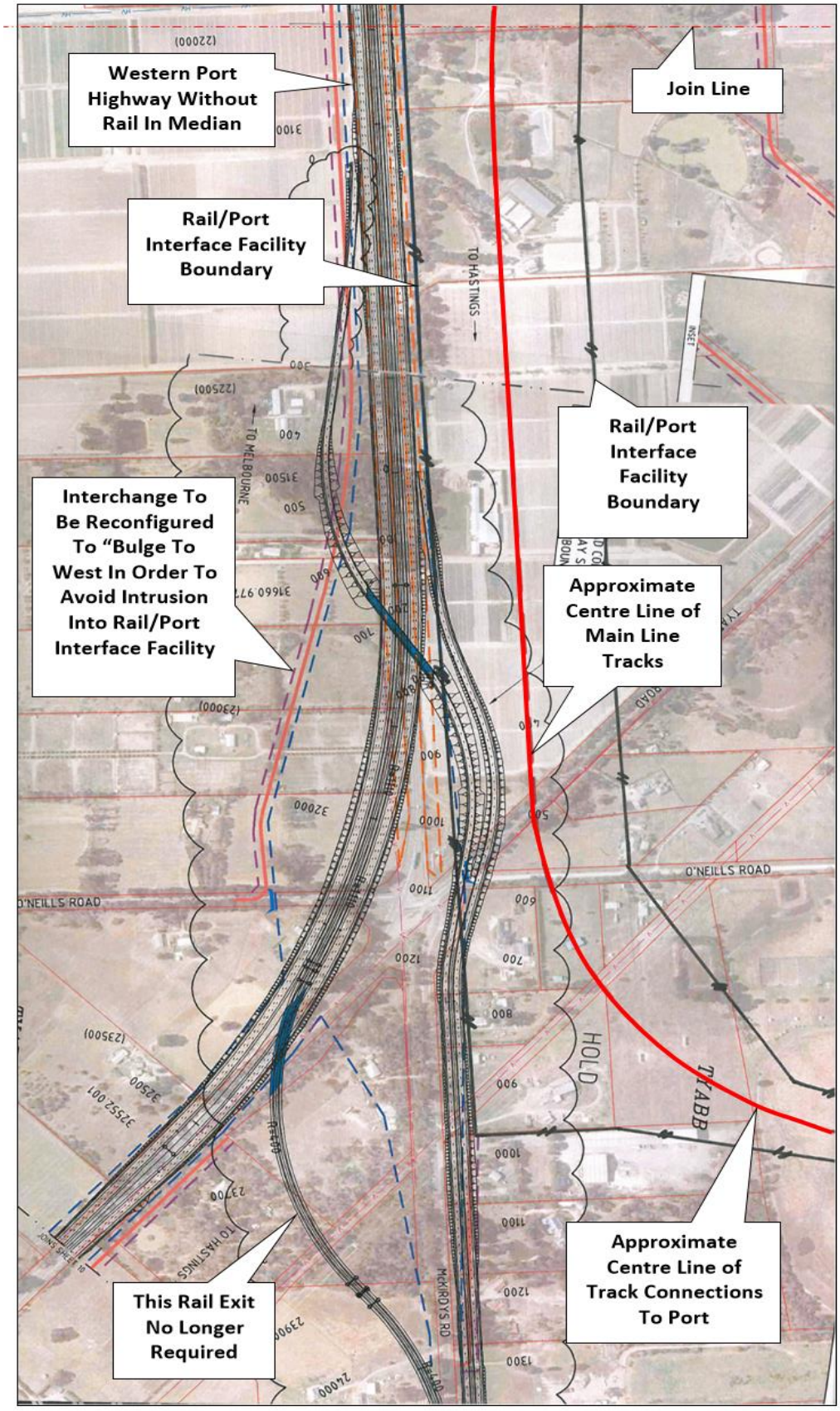

Figure 6: Conceptual Layout of southern section of North-South (Central) site option

7.2 Description of North-South (Central) site option

In the North-South (Central) option the railway in the freeway median would ramp up on a 1 in 50 (2%) grade in order to gain elevation to exit the freeway. To the south of South Beverly Road the rail line would pass over the southbound carriageway of the freeway. Once clear of the freeway the rail line would start ramping down on a 1 in 50 grade until it reaches ground level. This is where the Rail/Port Interface Facility would commence in this option.

This arrangement works well, both from the aspect of the proposed horizontal alignment and curvature of the freeway at this point and also from a vertical alignment perspective whereby the local topography effectively precludes siting of the HRPIF to the north of this location, as explained in Section 7.5, below.

If the Western Port Freeway is built on the alignment of the Western Port Highway, the North-South (Central) option is likely to be the best site for the HRPIF. The new freeway will introduce a dividing line in the urban fabric as it cannot be crossed except at interchanges. If the HRPIF were to be built away from the freeway a second dividing line would be introduced. Therefore, from a planning perspective, the North-South (Central) option has the distinct advantage of only causing one dividing line as it locates the two potential "dividers" within a single broad corridor.

The approximate location of the main line tracks through the facility is shown in red on the above concept plans. The western boundary of the facility would coincide with the eastern boundary of the freeway. The approximate location of the facility boundaries are shown as black lines with intermittent hatching.

Bungower Road would be elevated over the HRPIF and the layout of the Bungower Road interchange reconfigured to effectively "bulge" outward to the west in order to avoid intrusion into the facility.

The facility would finish just south of O'Neills Road and the tracks providing the connection to the port would curve to the east. The layout of the freeway interchange would need to be reconfigured in order to avoid the McKirdys Road exit ramp from intruding into the facility.

7.3 North-South (East) variation site option

During the next phase of the freeway options development process it may be prudent to investigate the suitability of co-locating the Western Port Freeway and the HRPIF on a similar north-south axis but approximately half a kilometre to the east of the Western Port Highway. This would necessarily change the design of the rail exit from the freeway from that proposed for the North-South (Central) option but would not significantly change its positioning either north or south.

This option is likely to be a reasonable alternative if the freeway is located next to the HRPIF and is also likely to reduce the impact on houses and businesses. However, from a planning perspective, it would not be a good option for the facility if the freeway is aligned along the Western Port Highway as this would introduce two separate dividing lines in the urban fabric.

Figure 7 below provides a map showing the notional location of a potential North-South (East) variation option.

Figure 7: Locality sketch plan of North-South (East) HRPIF site option

7.4 North-South (West) variation site option

During the next phase it may also be prudent to investigate the suitability of co-locating the freeway and the HRPIF on a north-south axis but some distance to the west of the Western Port Highway. This would also necessarily change the design of the rail exit from the freeway from that proposed for the North-South (Central) option but would not significantly change its positioning either north or south.

This option may also be a reasonable alternative if the freeway is located next to the HRPIF, although it does move this infrastructure somewhat closer to populated areas than either the North-South (Central) or North-South (East) options. However, from a planning perspective, this would not be a good option for the facility if the freeway is aligned along the Western Port Highway as this would introduce two separate dividing lines in the urban fabric.

Figure 8 below provides a map showing the notional location of a potential North-South (West) variation option.

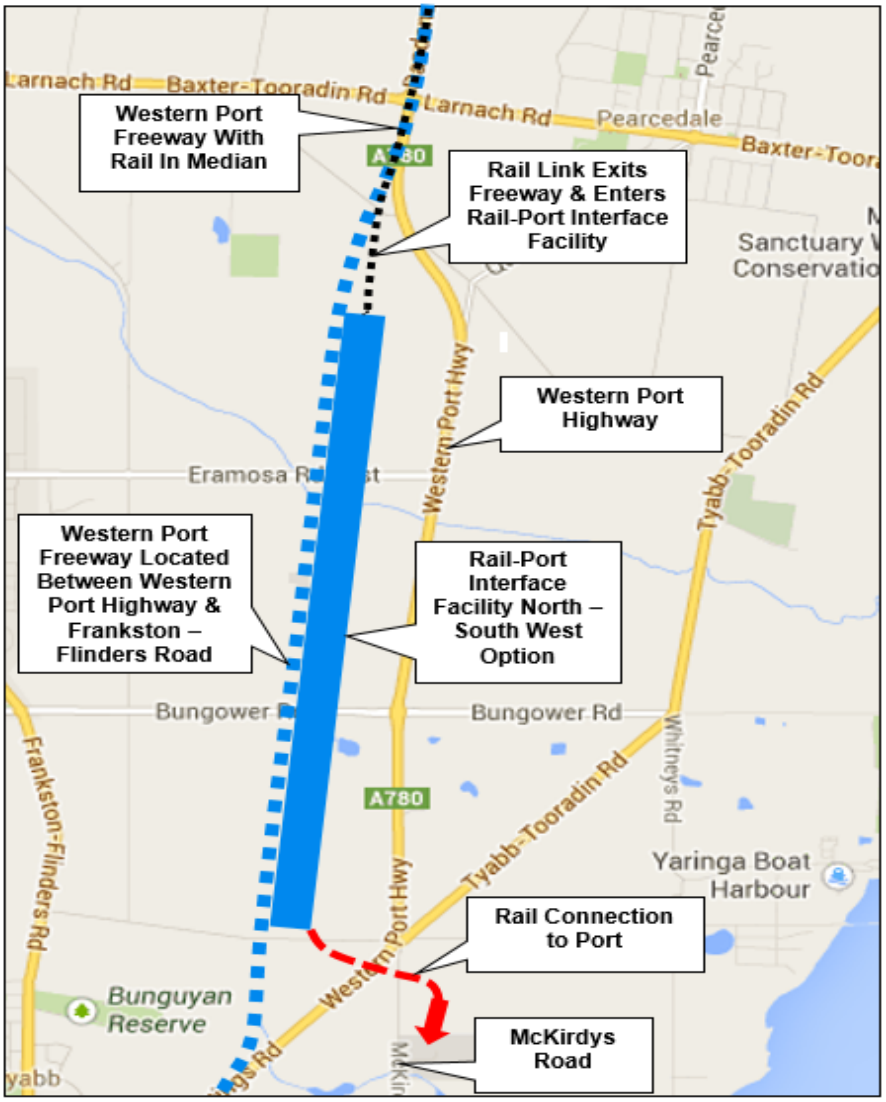

Figure 8: Locality sketch plan of North-South (West) HRPIF site option

7.5 North-South Site options grades

As mentioned previously, the Rail/Port Interface facility needs to be located in an area that has reasonably flat ground. In order to prevent parked wagons from rolling away the maximum grade of the tracks within the facility needs to be no steeper than 1 in 250 or 0.4 %.

Just north of South Boundary Road the ground rises up to the north at a grade of approximately 1.9% which is far too steep for locating the facility. Therefore, it would be impractical to move the HRPIF more than a little to the north as this would make cut and fill depths prohibitive Fortunately grades of 1 in 250 can be achieved in the general location of the suggested North Site options. It may also potentially be possible to move the facility a little to the south without excessive earthworks, depending on the layout of the port facilities.

Figures 9 and 10 below show the conceptual grade lines for the facility using the VicRoads' conceptual freeway longitudinal section base.

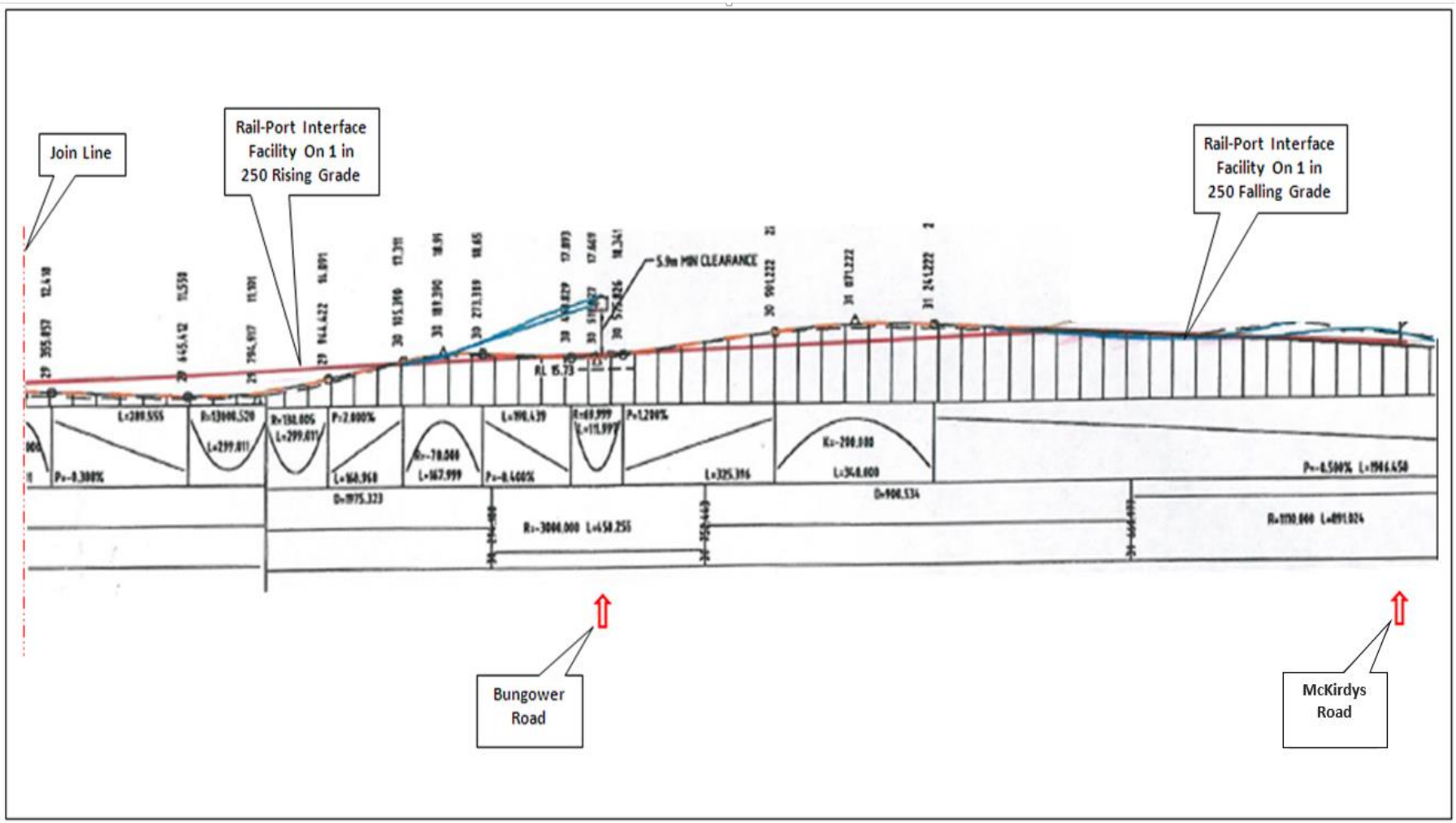

Figure 9: Conceptual Gradient diagram - Southern section of North-South Site options

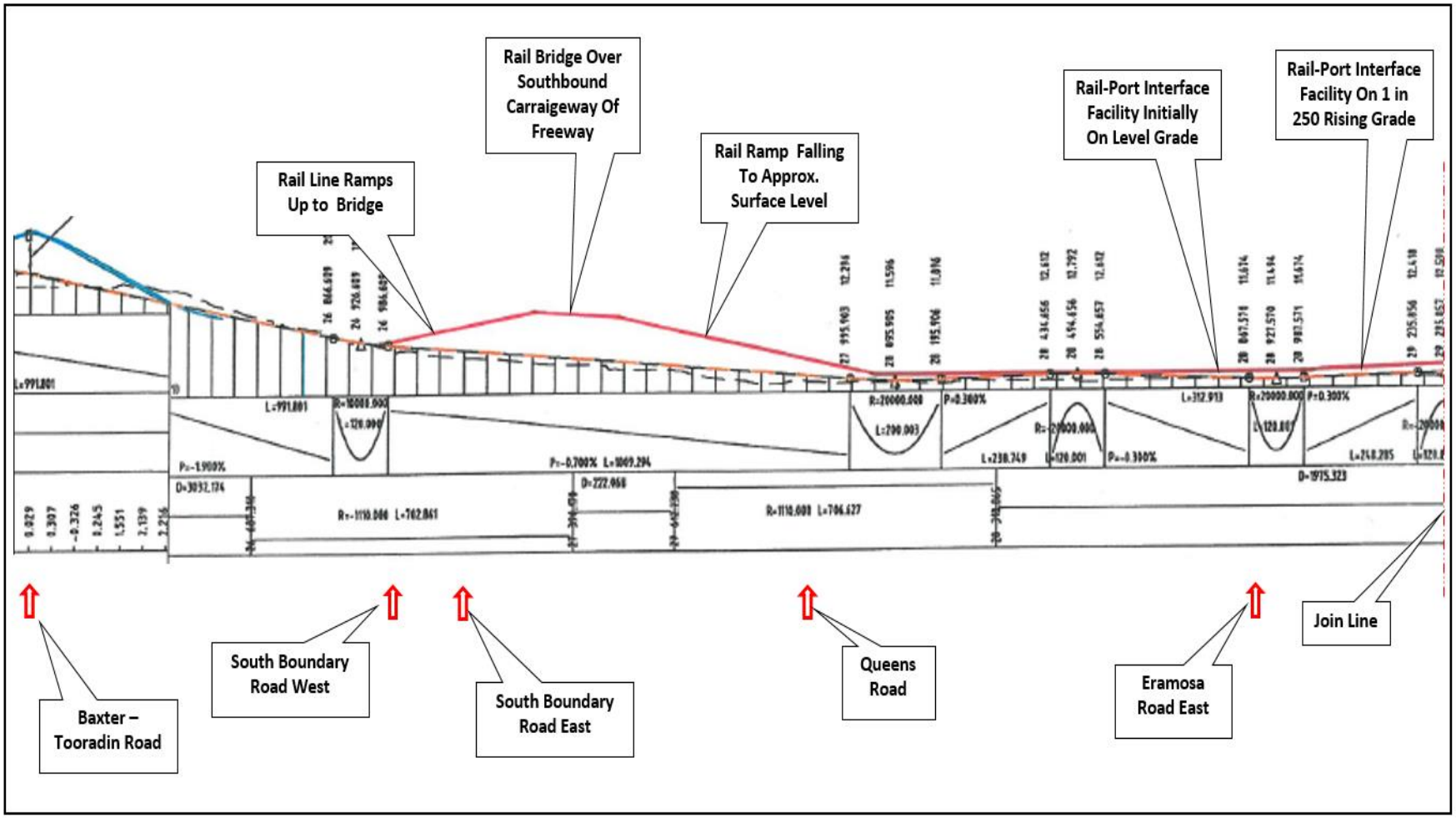

Figure 10: Conceptual Grade diagram – Northern section of North-South Site options

7.6 High level assessment of North-South Site options

The North-South site options for the Rail/Port Interface facility appear to be reasonably well sited having regard to the siting criteria outlined earlier in this report. The available length and width are satisfactory. The site would require only a small degree of curvature in the facility and the ground is flat enough to provide satisfactory grades within the limited tolerances for moving the facility either north or south (as explained in Section 7.5, above).

As explained previously, the tolerance for moving any of these sites either to the north or south is very limited due to a combination of topography, urban development and potential linkages to the Port.

All three of the North-South sites would be located adjacent to the assumed location of the Western Port Freeway which provides good road access to the site and avoids creating two separate barriers within the urban fabric, one with the freeway and another with the Rail/Port Interface facility.

8. East-West Site Assessment

A potential East-West site for the Rail/Port Interface facility would be located south of Pikes Road. Figure 11 below shows the location of the East site option in relation to nearby towns, the road network and Western Port Bay.

Figure 11: East-West Site option conceptual location

As can be seen from Figure 11 above, the site is not long enough to accommodate the facility unless it were to extend well out into Western Port Bay. As this is not seen as viable this site is considered unsuitable and should not be investigated any further.

9. North East-South West Site Assessment

A potential North East-South West site for the HRPIF would be located adjacent to, and immediately south of the proposed Western Port Freeway. This site would commence just south west of the proposed McKirdys Road interchange. Figure 12 below shows the location of the North East-South West site option in relation to nearby towns, the road network and Western Port Bay.

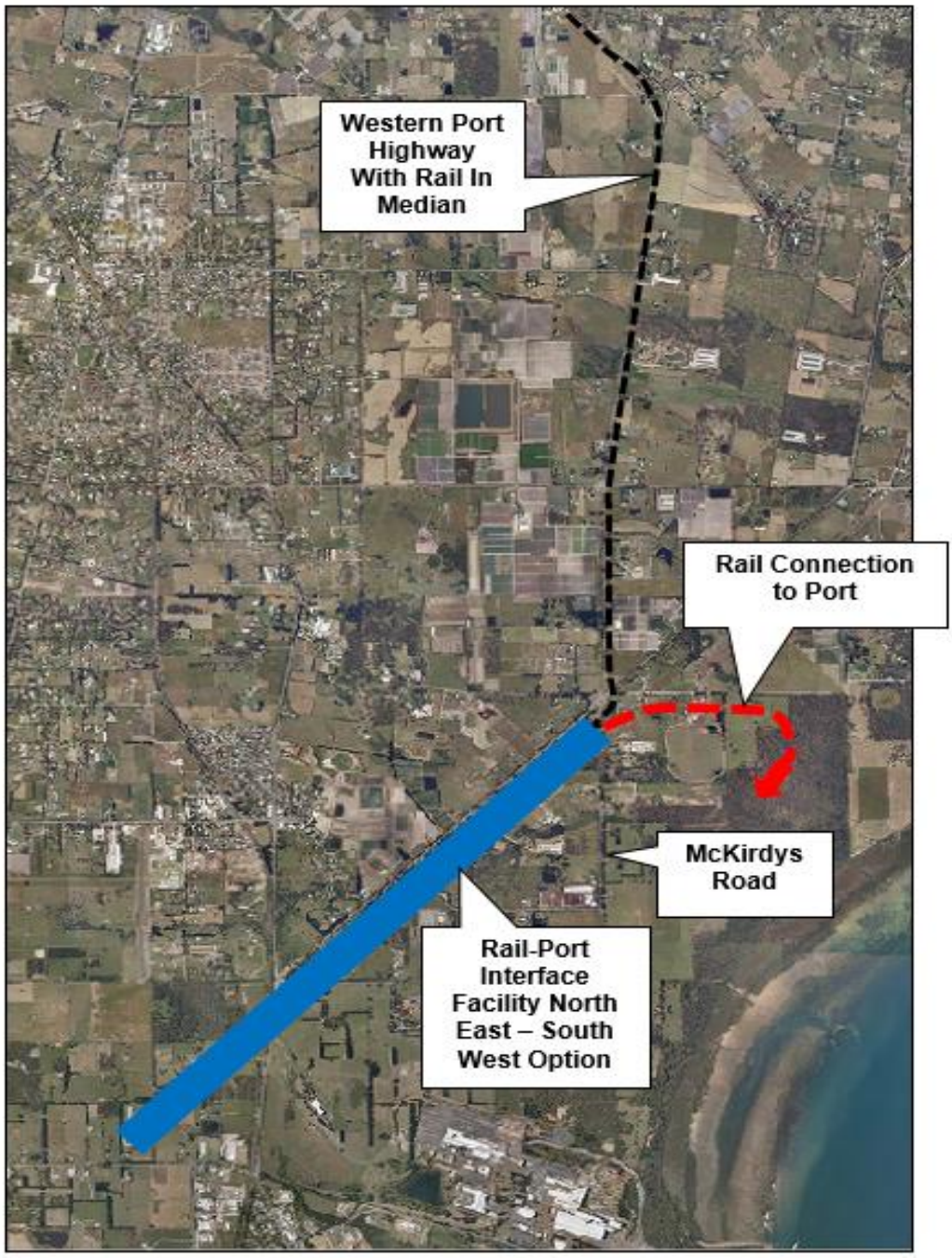

Figure 12: North East-South West Site Option Conceptual Location

As shown in Figure 12 above, the southern end of this site would be in very close proximity to the township of Hastings. Locating the facility at this site would also introduce a barrier between the townships of Tyabb and Hastings. These two issues would make this site unsuitable and this option should not be investigated any further.

10. Conclusions

- At planned capacity of 9m TEU per annum and allowing for a ±30% variability factor around the daily average port throughput, the peak maximum daily throughput would be 32,055 TEU.
- Based on current trade flows at the Port of Melbourne, 7% of the above throughput would be represented by internal port transhipments with the remaining 93% involving a landside transport task segregated by import/export and origin/destination flows.
- Import and export container volumes through the Port are assumed to be essentially balanced, although a substantial proportion of exports are likely to comprise empty containers.
- It has been assumed that, by the time Hastings Port is fully operational, a Metropolitan Intermodal System (MIS) will be using rail as its primary transport mode to handle container movements between the Port and intermodal terminals located in the south-east, west and north of the metropolitan area.
- Potential MIS rail market share options of 10%, 25% and 50% have been adopted for initial port planning together with current rail market shares for movements to and from Regional Victoria and interstate.
- A further assumption is unconstrained capacity for moving containers on rail between Hastings, the metropolitan area (through the MIS) and other locations in regional Victoria and interstate.
- Based on specified TEU capacity for various train and truck types, assumed average slot utilisation and extent of potentially balanced movements to and from the Port, at 9m TEU and approximately 50% rail share for MIS and current rail shares for regional and interstate traffic, likely daily peak movements are 93 train trips and almost 4,700 truck trips each way per day. At a 10% MIS share, there would be 48 train trips and almost 7,300 truck trips per day.
- The proposed Lyndhurst to Hastings rail link with a single line configuration with two intermediate crossing loops would have practical capacity for 19 trains per day in each direction. When fully duplicated, this would increase to 115 trains per day in each direction.
- Provision of a rail/port interface facility (HRPIF) is proposed to the north of the Port precinct with train handling processes and functional requirements as set out in the body of the report. MIS trains would normally bypass the facility but the HRPIF would provide for limited queuing of MIS trains to accommodate unplanned delays at the Port terminal/s or on the wider rail network.
- The required footprint for the HRPIF at approximately 50% rail market share involves a total length of approximately five kilometres. Allowing for access roadways and a buffer zone, the facility site at the fence line will need to be approximately 220m to 250m wide for much of its length and will need to maintain this width for approximately 3.3 kilometres.
- The overall dimensions of land that should be set aside for the HRPIF and the rail and road connections into the site need to be considered in the broader context of potential incompatibility with other forms of current land use in the general Hastings area.
- Criteria have been developed for HRPIF site selection which, when applied to potential sites, both within and partly outside the currently designated Special Use Zone (SUZ), lead to the conclusion that a "North-South option" for the facility, located on a north-south axis, parallel to and generally contiguous to the proposed Western Port Freeway alignment, is the only feasible area for its placement.
- There are three potentially feasible North sub-options which require more detailed examination during the next stage of planning for the rail and freeway alignments:
  - North-South (Central option) –Freeway and HRPIF co-located near the present Western Port Highway
  - North-South (East) Option – Freeway and HRPIF co-located some distance east of the Highway
  - North-South (West) Option – Freeway and HRPIF co-located some distance west of the Highway.
- Positioning of the HRPIF either further north or south is constrained by a combination of topography, urban development and potential linkages to the Port.
- Further work to refine these outputs should now proceed and will require a collaborative effort between the Authority, DTPLI, VicRoads and their respective consultants and advisers.