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.

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Memorandum

To	Lal Edirisinghe, Udhaya Arambawela, Matt Primmer, Sam Williams
CC	Richard Hill, Peter Fountain, Austin Kennedy, Ben Gray
Subject	Vessel Clearances and Safety Zones at Long Island Point
From	Richard Clarke
File/Ref No.	AGH-CEPO-MEM-0015 Review Approve Date 2-Nov-14

Final Working Draft

The purpose of this document is to define the relationship between the Long Island Point Jetty, the Esso shore facilities at Long Island Point and the proposed container berth immediately to the north of these facilities. An aerial photograph of the area as it exists is shown below as Figure 1.

Figure 1 Long Island Point Jetty and Esso Facilities

The Existing Installations

The Esso plant takes in gas by pipeline from Longford, approximately 165 km to the east. This gas passes through a fractionation plant where it is separated into butane, propane and ethane. The

ethane is then sent by pipeline to Altona and the other gasses are stored and then shipped out either by road tanker or by sea in tankers with a capacity of approximately 4,000 T. There are approximately 28 LPG tanker export calls a year.

The Long Island Point jetty is also used to export crude oil in tankers up to Aframax size (115,000 DWT). The vessels are on spot charter and some are smaller than Aframax. There are typically 15 crude oil tanker calls per year. Table 1 shows the typical dimensions, including fully laden draught, for the LPG carriers and the Aframax crude oil carriers.

Table 1 Typical Tanker Dimensions

Vessel Type	DWT	Length m	Beam m	Fully Laden Draft
Aframax Crude Oil Carrier	115,000	250	44	15.5
LPG Carrier	4,000	100	16.5	6.5

Note that each dimension is approximately the 90% fleet value. A vessel with all the dimensions given would be larger than the class specified.

It is unlikely that these ships will get significantly larger in the future as there are very few LPG tankers larger than 4000 DWT. For the crude oil carriers, the next larger class is Capesize which has too deep a draft to transit the Hastings channel fully laden.

Figure 2 shows a typical Aframax tanker on the Long Island Point Jetty. The dimensions of this vessel are very close to the maximum of ships using the berth.

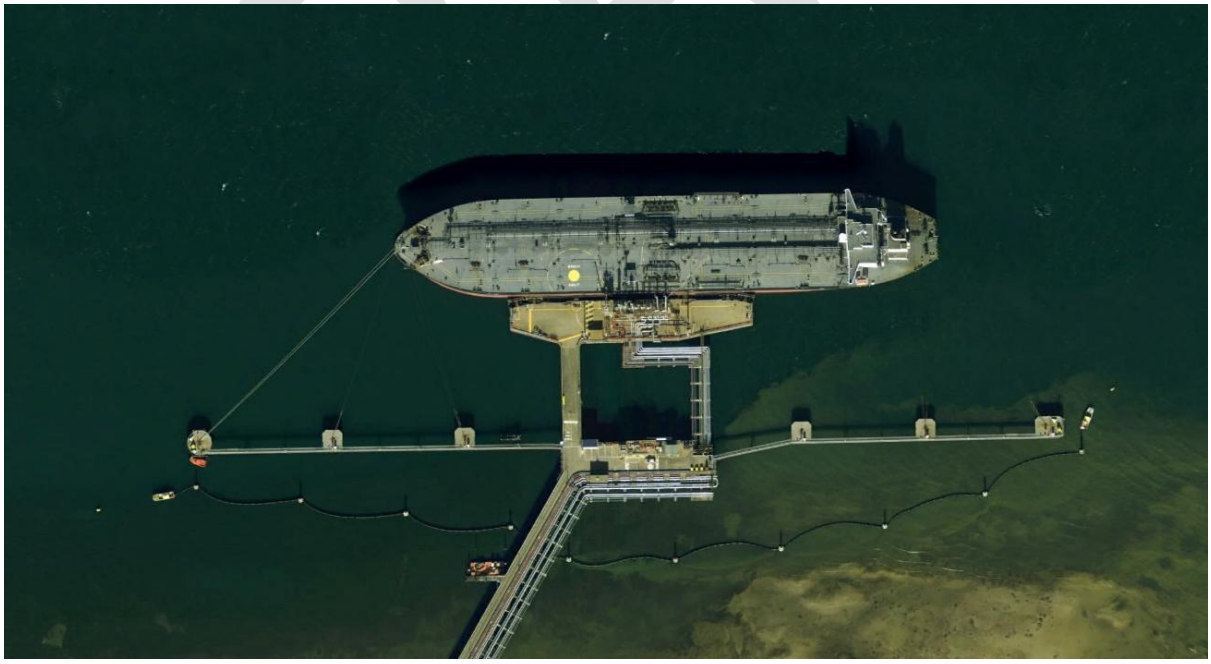

Figure 2 An Aframax tanker on the Long Island Point Jetty

It should be noted that the long Island Point Jetty has a very long spread of mooring dolphins and those dolphins are set further back from the berth than is current practice. Modern mooring practice in line with the OCIMF recommendation would not require the outer mooring dolphins.

Berth Alignment

The normal recommendation is that the berthing lines of adjacent facilities should be in line if at all possible. This minimises the interference between ships during berthing. In this case it would be possible to put the new berth line inshore of the Long Island Point berth line but this is unlikely as there is already some doubt about the area of land available for the container yard behind the berth.

If the new berth were built to seaward of the Long Island berth line, it is likely that the new structure would cause siltation of the tanker berth. On the ebb tide, the end of the container berth is likely to shed eddies and these would make the handling of a tanker on and off Long Island Point more difficult.

Unless there is some overwhelming reason to do otherwise, it is best at this stage to plan for the new wharf berth line to be closely aligned with the Long Island Point berth line.

Berth Proximity

There are a number of sets of regulations that determine how close to the Long Island Point berth the new wharf can be built. Many of the regulations relate to the minimum distance between ships rather than distance between the berths. The largest ships on Long Island Point are 250m long and, as most tankers have their inlet manifolds amidships, the bow or stern could be taken as 125m from the centre point of the berth. Looking at the range of tankers in the Lloyds/Fairplay database, there are some which have their manifolds up to 10% of their length from the centre point. Looking at the aerial photographs of Long Island Point, the loading arms cover a 20m length of the loading head. It is however very unlikely that a maximum size tanker with the maximum manifold offset will want to connect to the northernmost loading arm. A balanced approach is to set out the berths to allow for a 25m off centre on the berth by a tanker.

The applicable regulations appear to be:-

1. Australian security regulations require a 100m exclusion zone around tankers.
2. The harbour masters regulations do not allow another craft within 50m of a tanker.
3. The OCIMF regulations require a 30m (100') ignition source clearance from a live tanker and 60m (200') from a live gas carrier.
4. AS 3846 requires a 25m separation from a live liquid or gas tanker for electrical safety.
5. The other Australian Standards have no definite statement on the matter but require a risk assessment to be carried out.
6. The OCIMF mooring recommendation is a minimum gap between ships of the beam of the largest vessel which will be 59m.

If we look at the structure or the existing berth, the centre of the northern mooring dolphin is 650' from the berth centre (the jetty was designed in imperial units). The dolphin is 30' wide and the

extreme piles rake at 1 in 4 from a position 3' north of the centre. The toe of the pile is at -90' with the cut off at +12. The extremity of the pile will therefore be 30' north of the centre point of the dolphin and 680' north of the centre of the berth. This equates to 208m north of the centre of the berth. To take the risk of damage out of building the new berth, the closest point of any structure should be 215, north of the centre point.

With a 250m long tanker berthed 25m north of its central position, the bow or stern of the ship will be 150m north of the berth centre point. This gives a clearance of 65m from the closest point to which a berth can be built structurally.

Taking all of the criteria set out above, the largest dimension is the 100m ship to ship distance dictated by the security regulations. Taking 100m from the bow or stern at the northernmost location of the tanker, the end of the new structure is 250m north of the centre point of the Long Island Point jetty.

Safety Zones around the Esso Gas Plant

The Esso fractionation plant and gas storage area is registered with the State of Victoria as a Major Hazard Facility and must therefore be subject to a full risk analysis to determine the buffer zones around it as they would apply to a port development. This risk analysis must be carried out with Worksafe Victoria to comply with current legislation.

In response to the PLUTS work, Esso published a diagram showing the buffer zones around the plant that they considered to be appropriate to a port development. This diagram is drawn freehand and no explanation is provided as to how the buffer zone outline was arrived at.

Esso have also provided an overpressure diagram for a vapour cloud explosion on the plant and a series of heat radiation hazard zones for various events on the plant. The diagram that corresponds most closely to the earlier buffer zone is that for a jet fire centred close to the B train fractionation plant. The radiation diagram has a radius of approximately 250m.

The normally accepted limits for a sparsely populated work area such as a container terminal is an overpressure of 3.5 kpa and a heat radiation level of 4.7kW/m2. These levels have recently been applied in the risk assessment for a similar development in New South Wales. A 3.5 kpa pressure will break windows but has a low chance of causing major injuries. A heat radiation level of 4.7kW/m2 causes second degree burns to exposed skin after 30 seconds exposure but is not considered life threatening.

The Esso overpressure diagram shows an overpressure of 0.6psi (approximately 4.4kpa) extending approximately 80m maximum from their boundary. This pressure would reduce to 3.5kpa approximately 100m from the boundary.

The approximate 250m radius tabled by Esso as the buffer zone requires a major pipe break of around a 150mm pipe to produce a jet fire giving a heat radiation level of 4.7kW/m2 at this radius. This zone extends approximately 200m from the Esso boundary. Whether the internal plant safety

systems would allow a continuous jet fire from such a major pipe break is a matter for the risk assessment to consider.

Figure 3 shows the likely position of the container terminal berth line. The distance back to the pressure zone is approximately 550m which would allow a range of operating systems to be installed on the terminal. If the heat zone is taken as the limitation, the remaining terminal depth is 330m which does not provide enough space for full container operations.

Figure 3 Safety zones around the Esso plant

Other Safety Considerations relating to the Esso Installation

The gas storage at the Esso site is partly in a series of pressurized horizontal tanks (bullets) situated close to the northern edge of the installation. This is illustrated in Figure 4.

These tanks have been placed in this location because in a fire event it is possible for the ends to come off the bullets creating a rather extensive hazard zone. Modern practice is to put these bullets into a mound to remove this possibility but an easier option in this case is to build an earth bund between the tanks and any adjacent use. Figure 4 shows the location of such a bund. The existing Esso installation is at approximately the same level as the terminal is likely to be. A 10m high bund

would provide protection from the storage tanks. It will also modify the heat and pressure zones outside the Esso compound. The extent of the changes to the zones will depend on the height of the heat/pressure source above ground level.

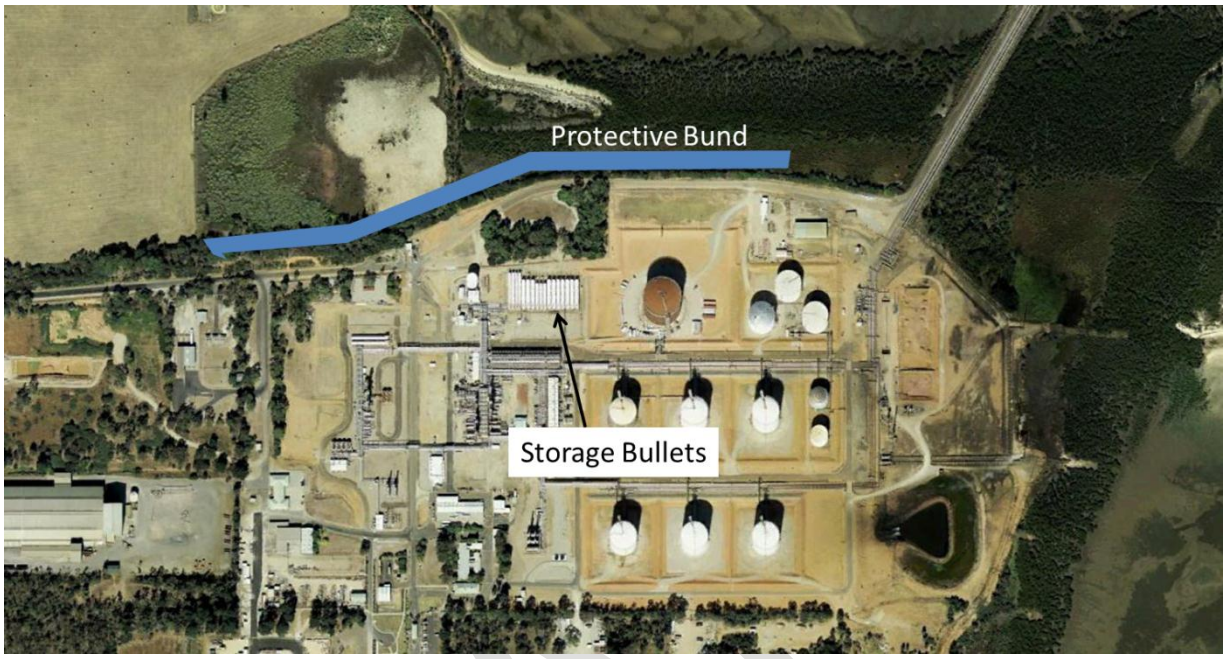

Figure 4 Location of gas storage bullets and possible protective bund

Conclusions

From this preliminary analysis, it appears that the potential heat radiation from an incident on the Esso installation could severely limit the area of the proposed container terminal based around the Tyabb reclamation. The over pressure zone also impinges on the terminal area but only to an extent that can be managed. It may be possible to mitigate these effects by the construction of an earth bund or other protective measures.

The next steps are to discuss this paper with Esso and then carry out a formal risk assessment in under the procedures set out by WorkSafe Victoria.