Chapter 10
Contamination and acid sulfate soils

This chapter discusses the potential impacts associated with the disturbance of contaminated soils, groundwater and marine sediment, and acid sulfate soils (ASS) as a result of the construction and operation of the Gas Import Jetty and Pipeline Project (the Project). This chapter is based on the impact assessment presented in EES Technical Report E: *Contamination and acid sulfate soils impact assessment*.

10.1 Overview

The construction and operation of the Project has the potential to impact human health and the environment as a result of disturbance and inappropriate handing, storage and disposal of contaminated soils, groundwater and marine sediments, and ASS.

The Project Area is largely surrounded by open agricultural or farmland where the potential for contamination is generally considered to be low, although still possible. Areas of commercial and industrial land use, including a former landfill that may give rise to contamination are present within the study area. The presence of ASS does not necessarily correlate with contamination, but more with underlying geology.

The operation of the floating storage and regasification unit (FSRU) and movements of liquified natural gas (LNG) carriers may disturb the seabed, therefore, understanding the existing conditions of marine sediments is important because the redistribution of potentially contaminated marine sediments may impact the local marine ecosystem.

What is contamination?

Contamination of land and groundwater is primarily caused by human activity which results in the direct or indirect release of harmful substances such as industrial chemicals into the existing environment. Contamination can be caused by historic and current practices including poor storage, handling and disposal of substances.

Typical land uses that can result in land contamination include spills or leaks from fuel service stations, industrial manufacturing facilities or landfills, the use of agricultural chemicals or improper disposal of waste. Contamination of land can lead to harmful impacts on the environment and human health through direct contact with contaminated soils, vapour from the contaminants and secondary contamination through groundwater and surface water. Many historic practices not considered acceptable today have resulted in long-term contamination of soil and groundwater.

10.2 EES evaluation objective

The scoping requirements for the EES set out the following relevant draft evaluation objectives:

> **Water and catchment values** – To minimise adverse effects on water (including groundwater, waterway, wetland, estuarine, intertidal and marine) quality and movement particularly as they might affect the ecological character of the Western Port Ramsar site.
>
> **Waste** – To minimise generation of wastes by or resulting from the Project during construction and operation, including accounting for direct and indirect greenhouse gas emissions.

A contamination and ASS impact assessment was undertaken to assess potential impacts of the Project on human health and the environment due to disturbance and inappropriate handling and storage of contaminated soils, groundwater and marine sediments, and ASS.

10.3 Methodology

The approach adopted for the contamination and ASS impact assessment involved the following key tasks:

- a review of relevant legislation and policy at Commonwealth, state and local level
- a desktop review of relevant baseline data and reports, including:
  - historic land use literature and aerial imagery to identify industrial and commercial sites, quarries, landfill or other areas of potential contamination
  - Groundwater Quality Restricted Use Zones (GQRUZ) included within the study area
  - the EPA Victoria list of issued Certificates and Statements of Audit
  - the *EPA Victoria Priority Sites Register*
  - the *Atlas of Australian Acid Sulfate Soils* (AAASS) to assess the potential for acid sulfate soil conditions
  - the *Western Port Ramsar Site Management Plan* and the *Western Port Ramsar Site Ecological Character Description Addendum* to understand current condition and threats to the Ramsar site
- a field investigation including:
  - an initial site walkover on 3 December 2018 in areas identified by the desktop review as having high potential for contamination so as to assess site conditions, groundwater and soil bore locations and current land use practices. The site walkover was conducted within publicly accessible land only
  - a soil sampling program to assess the presence of contamination and ASS. Soil samples were collected from 96 bores across the study area including samples collected during the installation of groundwater monitoring bores by the EES groundwater team
  - a groundwater sampling program, including installation of four groundwater monitoring wells in areas that have been identified, through desktop review, to have higher potential for contamination. Groundwater gauging and sampling was completed from 26 groundwater monitoring wells (with 22 groundwater monitoring wells installed as part of the groundwater impact assessment (see EES Technical Report D: *Groundwater impact assessment*)
  - a marine sediment sampling program undertaken by Consulting Environmental Engineers Pty Ltd (CEE) near the Crib Point Jetty, consisting of 20 sediment samples from four locations; Berth 1, Berth 2, a reference site 500 metres north of Berth 1, and a reference site 500 metres south of Berth 2
- assessment of potential risk to beneficial uses relevant to the study area by comparing soils, groundwater, and marine sediment laboratory analytical results to the adopted investigation levels (ILs)
- consultation with EPA Victoria in relation to management approach for ASS and applicable guidelines for managing discharge of dewatered water from open trenches and bell holes, and hydrostatic test water to land
- a risk assessment as described in **Chapter 5** *Key approvals and assessment framework* to inform the impact assessment and development of mitigation measures
- assessment of contamination and ASS potential impacts during construction and operation of the Project
- development of mitigation measures in response to the contamination and ASS impact assessment.

10.4 Study area

For the soil and groundwater contamination investigation, and ASS investigation, the study area included the pipeline right of way (ROW) and alignment alternatives and a 50-metre buffer area either side of the ROW, the Pakenham Delivery Facility, the End of Line Scraper Station (EOLSS), Mainline valves (MLVs) and the landside component of the Gas Import Jetty Works, which includes the gas piping and the Crib Point Receiving Facility.

For the contaminated marine sediment investigation, the study area included Berth 1 and 2 and a buffer area of approximately 200 metres east of the berths.

10.5 Existing conditions

A detailed site investigation report of the existing conditions is provided in Appendix A of EES Technical Report E: *Contamination and acid sulfate soils impact assessment*. A summary of the existing conditions is provided below.

10.5.1 Contaminated soils and groundwater

Desktop review

Topography and surface water

The Project is located within the Western Port catchment. The catchment covers an area of around 3,700 square kilometres and contains over 2,200 kilometres of rivers and creeks. Seventeen waterways enter Western Port including major rivers and creeks such as the Bunyip, Tarago, Cardinia, Yallock, Lang Lang and Bass river networks, all of which discharge directly into the Western Port Ramsar site. The marine ecosystem within Western Port is of regional, national and international significance and supports mangrove, saltmarsh, seagrass, reef and soft seabed habitats.

Much of the catchment has been modified to support rural and green wedge land use. Historically, the Koo Wee Rup swamp covered large areas in the Western Port hinterland but was drained for development and has resulted in a number of watercourses in the lower catchment becoming channelised drains. Although the area contains a mix of land uses, the predominant land use is agriculture consisting of dairying, grazing and horticulture.

The proposed Pipeline Works crosses 64 watercourses and surface drains. The watercourses are ephemeral with the exception of Watson Creek and Cardinia Creek.

Further information on the surface water and hydrology of the Project Area is provided in **Chapter 8** *Surface water*.

Regional geology and hydrogeology

The Project Area is located within Western Port Basin (the Basin), which is a relatively shallow, structurally controlled sedimentary basin consisting of sediments and volcanic flows. These sediments and volcanic flows form a multi-layered aquifer system, which is dominated by a Tertiary Age sedimentary sequence that thickens out to approximately 200 metres in the Koo Wee Rup area, and pinches out along Basin margins. The Tertiary Age sediments are overlain by a relatively thin veneer of Quaternary sediments, including coastal and inland dune deposits, swamp and lake deposits and alluvial deposits.

Within the depth of the study area (three to four metres) along the pipeline alignment the geology is expected to comprise unconsolidated material that includes clay, silt and sand with occasional gravel.

Regional groundwater flow is generally from the Basin margins towards Western Port. The presence of shallow aquitards, surface water features and the extraction of groundwater locally affect depths to groundwater. The water table across the Basin would generally be a subdued version of topography, with the depth to groundwater increasing beneath topographical highs and shallow groundwater in the lower reaches of the Basin.

Further information on the geology and hydrogeology of the Project Area is provided in **Chapter 9** *Groundwater*.

Western Port Ramsar site

The Crib Point Jetty is located within the Western Port Ramsar site, which was designated as a wetland of international significance in 1982. The Western Port Ramsar site covers more than 59,000 hectares and consists of large shallow intertidal areas dissected by deeper channels, and a narrow strip of adjacent coastal land in some areas.

The *Western Port Ramsar Site Ecological Character Description* (ECD) (Kellogg, Brown & Root, 2010), which had an addendum issued in 2016 (Hale, 2016), describes the critical components, processes and services for the Ramsar site. The ECD report established baseline values for the Western Port wetlands against which potential impacts can be assessed.

The *Western Port Ramsar Site Management Plan (DELWP, 2017)* identifies increased sediments and toxicants as one of the high priority threats to Western Port. The main source of sediments to Western Port is catchment derived from rural lands, with agriculture (cropping and dairy) accounting for the largest loads (Melbourne Water, 2009). The sediments are transported around the embayment as a result of the complex pattern of water circulation and are subject to resuspension and dispersal by the tides, waves and wind, resulting in persistently high turbidity (Wallbrink et al., 2003).

The *Understanding the Western Port Environment 2018* report (Melbourne Water, 2018) indicated that toxicants in Western Port sediments were found to be at low levels and unlikely to impact resident flora and fauna except in localised areas, generally confined to estuarine sediments and areas that receive flows from catchment tributaries, where several toxicants were at levels of concern. Risks from heavy metals, hydrocarbons and organotins were comparatively low, with the exception of isolated areas receiving catchment inflows or high boating activity. Elevated organotin concentrations were reported in areas of high boating activity although the concentrations may be declining in Western Port since controls on their use were implemented (DELWP, 2017).

Further information on the Western Port Ramsar site is provided in **Chapter 6** *Marine biodiversity* and **Chapter 7** *Terrestrial and freshwater biodiversity.*

Existing and historic land uses

The existing land uses within the study area are considered to have a relatively low potential for soil and groundwater contamination, with the exception of the former Western Port BP refinery, Tyabb Resource Recovery Centre (former Tyabb landfill), commercial/industrial areas, railway corridor and market gardens.

Historical information indicates there have been no significant changes in land use within the study area since the 1940s, as the majority of the area has remained as farmland. Some areas of prominent change were noted and considered relevant to the contaminated land assessment, including:

- the former Western Port BP refinery established in 1965 – the former BP refinery was closed and dismantled in 1985, although the jetty facilities (Berth 1) continue to be used for the import of refined petroleum products
- the development of residential and commercial/industrial properties along Frankston–Flinders Road in Hastings – including automotive service/repair centre, fuel service stations, bus depot, Hastings State Emergency Services, clinics, garden supplies, metal recycling, reclaimed timber, retails, food and beverages
- the Stony Point, Bairnsdale and Leongatha railway lines (with the latter closed except for heritage operations between Nyora and Leongatha)
- the former Tyabb landfill which operated as a landfill from 1988 to 1995 and is now a green waste recycling facility
- the abattoir near Koo Wee Rup Rd in Pakenham.

Contaminated land register search

The Environment Protection Authority (EPA) Victoria Priority Sites Register lists sites that have been issued with a formal Clean Up Notice (CUN) or Pollution Abatement Notice (PAN). At these sites, the EPA Victoria considered the condition of the site requires assessment/management to reduce risks to human health or the environment. Notices are issued for a broad range of sites, including industrial and commercial sites as well as landfill sites where contamination is suspected.

As of 31 July 2019, only one current priority site was located within the study area. The priority site is a former landfill located in Tyabb (owned by the Mornington Peninsula Shire) (referred to from here as the former Tyabb landfill).

Statutory environmental audits

Statutory environmental audits are undertaken by an EPA Victoria-appointed independent Environmental Auditor. As of 29 September 2019, there were two sites located within the study area that have been issued with a Statement or Certificate of Environmental Audit: the Crib Point easement and jetty and the former Tyabb landfill site. These two sites are shown in **Figure 10-1** and **Figure 10-2**.

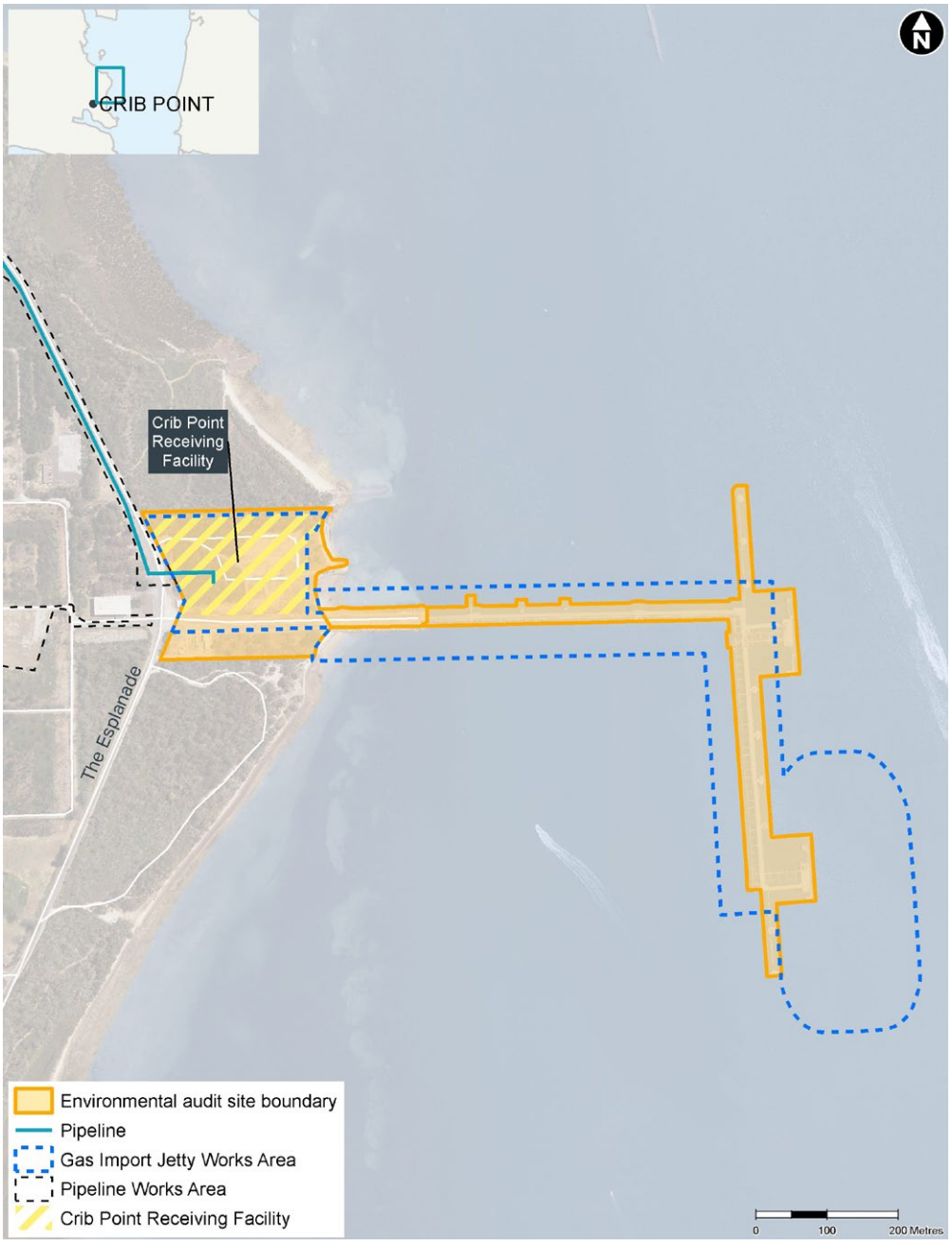

Figure 10-1: Statutory environmental audit site boundary for the Crib Point easement and jetty (completed in 1998)

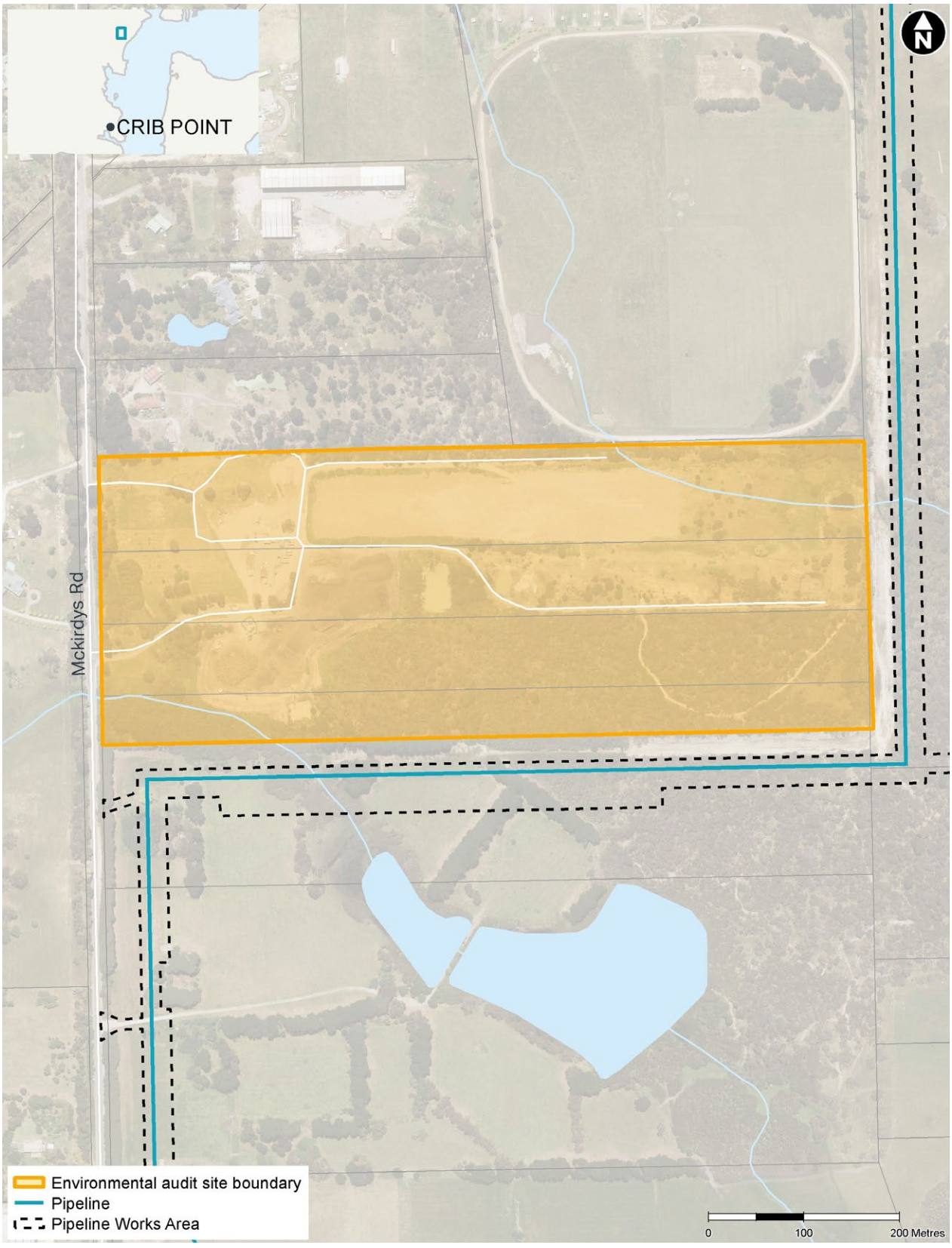

Figure 10-2:
Statutory environmental audit site boundary for the former Tyabb landfill (completed in 2002, 2017 and 2019

The Crib Point easement and jetty site was issued with a 53X Statement of Audit (on 18 September 1998) due to aesthetic issues and concentrations of arsenic and chromium in soil as well as lead in groundwater exceeding the environmental assessment criteria. The audit concluded the site is suitable for port use subject to restricted public access within the current fenced area, no development for more sensitive beneficial uses, and access to the Crib Point Jetty continuing to be restricted to authorised personnel only.

The Project is considered to fit within the current beneficial uses of the site. Access to the Crib Point easement and jetty would remain restricted to authorised personnel during construction and operation of the Project, and so no change to the existing risk profile is expected.

The risk assessment undertaken as part of the Section 53V Environmental Audit of the former Tyabb landfill (completed on 21 January 2019) identified:

- a medium risk of inadequate containment, treatment or disposal of leachate impacting on groundwater beneficial uses of 'Stock Watering' – the auditor rated the risk as medium based on the interpreted groundwater flow directions (towards the south and south-east) and the quality of groundwater, impacting this beneficial use with regards to total dissolved solids (TDS)
- a medium risk of sub-surface landfill gas migration and accumulation impacting the health of workers undertaking works in underground mains or trenches – the auditor rated the risk as medium due to insufficient monitoring data to fully characterise the risk
- all other potential impacts on beneficial uses of groundwater were considered low risk.

Based on the interpreted groundwater flow directions, it is likely that groundwater beneath the study area, adjacent to the former Tyabb landfill is impacted by groundwater and/or leachate migration from the landfill. There is also the potential for sub-surface landfill gas migration and accumulation to impact the health of workers undertaking works in underground mains and trenches. Therefore, during construction activities, particularly during trenching along the former Tyabb landfill, air quality must be monitored so that trench workers are not exposed to landfill gas that may have potentially migrated from the landfill site.

EPA Victoria licence register

The *Environment Protection (Scheduled Premises) Regulations 2017* require scheduled premises to apply for an EPA Victoria licence, unless the premises are exempted. The licence covers the actual operation of the site, and sets operating conditions, waste discharge limits and waste acceptance conditions.

As of 29 September 2019, there are two scheduled premises located within the study area: G & K O'Connor meat packer facility and the Australian Growing Solutions waste processing facility.

G & K O'Connor holds a licence to operate a rendering facility and manufactures products from mixed abattoir material. Wastewater from the abattoir and rendering plant is treated in a lagoon system and either irrigated or discharged to sewer. This licence allows for discharges to air and the discharge of treated wastewater to land.

Australian Growing Solutions holds a licence to operate an organic waste processing facility that allows for up to 25,000 tonnes of pine to be treated at the premises within a 12-month period.

Potential sources of contamination

Table 10-1 and **Figure 10-3** outline the locations identified as potential sources of contamination within the study area.

Table 10-1: Potential sources of contamination identified within the study area

Location	Potential source of contamination
Berth 1 of the Crib Point Jetty	Potential loss of hydrocarbons (motor spirit and automotive diesel throughout the importation, pipelines and other operational activities); and anti-fouling paints used on ship hulls entering the marine environment.
Former BP Western Port refinery and jetty facilities	Potential loss of hydrocarbons throughout the importation, transport, processing and storage (including underground and above-ground tanks, pipelines and other operational activities); and use of firefighting foam containing PFAS for testing, training or emergency response. PFAS potentially windblown during the period when the BP refinery was in operation.
Existing gas and oil pipelines	Leaks of pipelines carrying automotive diesel, light crude oil, ethane and methane.
Automotive service/repair centre and car rental facilities adjacent to the Project Area	Leaks and spills from use and storage of fuels and chemicals.
Rail corridors	Chemical treatment of railroad ties, fuel/chemical spills and leaks.
Metal recycling yard adjacent to the Project Area	Leaks and spills from equipment to be recycled (e.g. vehicles, lubricating oil and coolant), parts cleaning and wash down bay.
Vehicle yard	Leaks and spills from vehicles, and from use and storage of fuel/chemical.
EPA Victoria prescribed industrial waste site	Stormwater runoff from contaminated soil.
Boat building and maintenance adjacent to the Project Area	Leaks and spills from use and storage of fuels and chemicals.
Former Tyabb landfill	Landfill gas, leachate and groundwater migrating off-site.
Intensive agricultural, market gardens, orchard	Pesticides, herbicides, nitrates, nutrients and arsenic.

Figure 10-3: Potential sources of contamination

Figure 10-4: Potential sources of contamination north

Field investigation

Soil sampling program

Following the desktop review and site inspection, an intrusive soil and groundwater investigation was undertaken. The soil sampling program consisted of 145 primary soil samples from 72 soil bores analysed for the EPA Victoria publication IWRG621 suite of analytes. Laboratory analytical results were compared against the adopted investigations levels (ILs) derived from the relevant quality indicators and objectives nominated in SEPP (Prevention and Management of Contaminated Land) and classified in accordance with the EPA Victoria publication *IWRG621 – Soil hazard categorisation and management*.

The investigation concluded that based on broadly spaced and targeted intrusive investigations undertaken, soil contamination is considered to be limited in extent. Contaminated soils were identified at the following locations, noting that localised impacts may be present at other locations and may be encountered during Project construction works:

- Crib Point Receiving Facility
- The Esplanade adjacent to the former Western Port BP refinery
- Railway corridor in Hastings.

The elevated zinc concentration detected at the Crib Point Receiving Facility is considered unlikely to impact surrounding ecology as it was collected within imported crushed rock and has not leached into the underlined sample at 0.4 mbgl. Presence of benzo(a)pyrene on The Esplanade and within the railway corridor is considered unlikely to present risk to ecology at either site, and since it is not a leachable compound, would also unlikely present risk to off-site receptors. Both contaminants are therefore unlikely to pose risks to off-site receptors.

The surface soil sample at the Crib Point Receiving Facility is classified as Category B, due to Polycyclic Aromatic Hydrocarbons (PAHs) concentration exceeding the Category C upper limit, with concentrations of zinc and arsenic recorded as exceeding the Fill Material upper limit. Review of historical information and previous investigation reports indicate that historically the area may have been used as a laydown area during construction and operation (1964 to 1985) and decommissioning of the Western Port BP refinery (post 1985).

A soil sample collected from an area along The Esplanade adjacent to the former Western Port BP refinery was classified as Category C due to concentrations of benzo(a) pyrene and PAHs exceeding the Fill Material upper limit. The elevated concentration of benzo(a)pyrene is likely associated with asphalt and roadmaking materials.

Soil hazard categorisation and management

The EPA Victoria Industrial Waste Resource Guidelines (IWRG) 2009 provides guidance on compliance with the Environment Protection (Industrial Waste) Regulations for the classification and management of waste soil. Where a site has potentially contaminated soil, the soil must be assigned a hazard category of A, B, C or fill material as outlined in publication IWRG621:

- Category A: The highest class of prescribed industrial waste and cannot be disposed of to landfill without being treated
- Fill material: Non-hazardous fill material that may include soil, rock and stone from naturally occurring materials
- Category C: The lowest class of prescribed industrial waste or contaminated soil, accepted at several licensed Victorian landfills
- Category B: Contaminated soil categorised between Category A and C, accepted at only one licensed Victorian landfill.

Under the proposed Environment Protection Regulations, waste soil must be categorised in accordance with the *Waste Disposal Categories - Characteristics and Thresholds*:

- Fill material: Industrial waste with contamination levels below the minimum Category D thresholds
- Soil containing asbestos only: Reportable priority waste and the only contaminant is asbestos
- Category D: Reportable priority waste with lower levels of contamination than Category C which can be safely contained at the same project site where the soil was unearthed
- Category A, B, and C: Considered as reportable priority wastes and are based on the existing categories.

Soils samples collected from the former BP refinery report concentrations below the adopted investigation level for commercial/industrial land use however exceeded the EPA Victoria Publication *IWRG621*. The soil sample was classified as Category C due to concentrations of Polychlorinated biphenyls (PCBs) exceeding the Fill Material upper limit. It is noted that the sample density does not comply with the recommendation made in the EPA Victoria publication *IWRG702*.

The surface soil sample collected from the rail corridor between High Street and Cool Store Road in Hastings, has been classified as Category C due to concentrations of arsenic, copper, lead and zinc exceeding the Fill Material upper limit. An elevated concentration of benzo(a)pyrene was also detected and is likely to be associated with operational activities undertaken within the rail corridor.

It is noted that the sample density does not comply with the recommendation made in the EPA Victoria publication *IWRG702 – Soil sampling* as the sampling density was adopted to assess the potential for widespread/regional contamination of soil based on the largely rural setting and not for the purpose of soil hazard categorisation for off-site reuse, treatment or disposal. Where contaminated soils are to be disposed off-site, soil sampling and categorisation in accordance with EPA Victoria publications *IWRG702 – Soil sampling* and *IWRG621 – Soil hazard categorisation and management* must be undertaken. Also, due to dense vegetation restricting access to the study area between kilometre point (KP) 7.3 – 7.9 in Hastings, intrusive investigation was unable to be completed to assess potential impacts from the adjacent industrial premises (such as the metal recycling yard). Intrusive soil and groundwater investigation would need to be undertaken at this location before construction of the Project started to confirm the presence or absence of contaminated soils within the area, due to historical and existing land uses.

Groundwater sampling program

A total of 15 primary groundwater samples were collected from 26 groundwater wells installed as these wells only had sufficient water for sampling and analysed for contaminants during the groundwater sampling and gauging program from 23 January 2019 to 30 January 2019. Based on data collected, groundwater contamination is limited across the study area.

It is noted that groundwater investigation at the landside component of the Gas Import Jetty Works was not undertaken as part of this investigation as groundwater levels measured and reported in previous investigation reports for the Crib Point Jetty indicated that based on the existing Project description, the Project would unlikely encounter groundwater beneath the area. Groundwater levels at the Crib Point Jetty as reported within the previous investigation reports are presented in **Figure 10-5**.

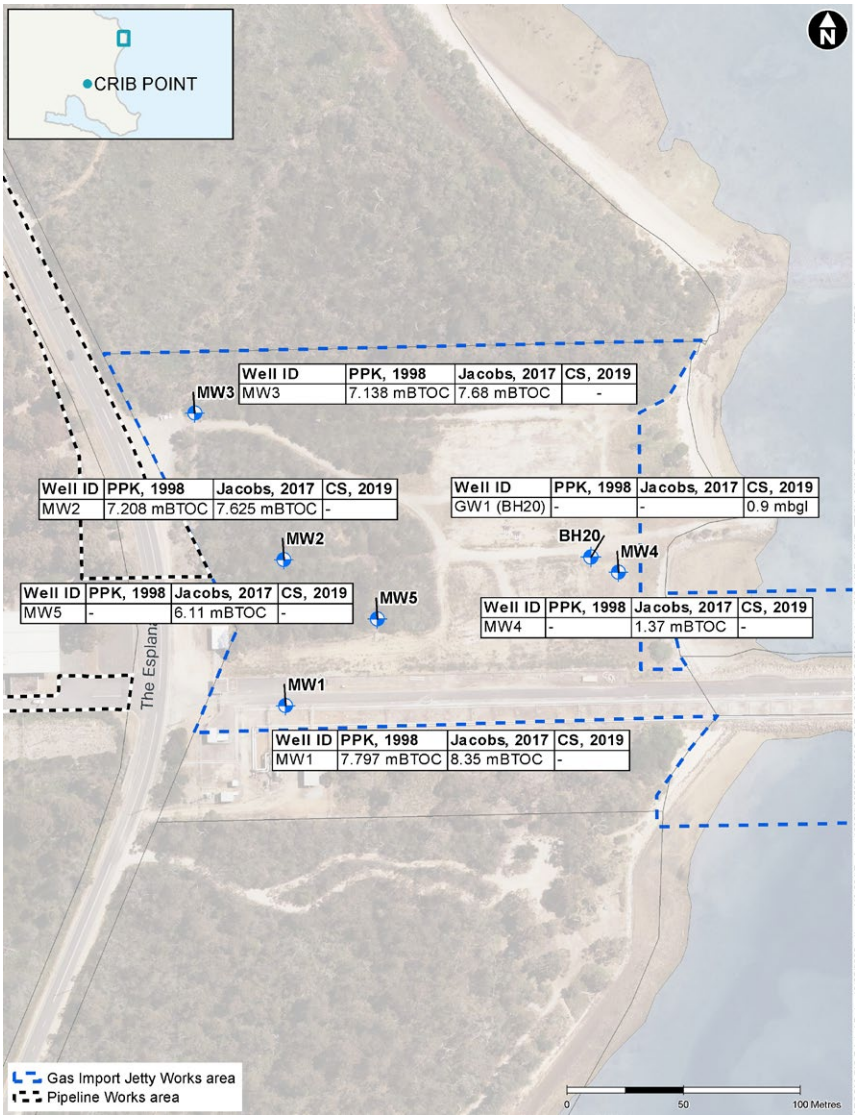

Figure 10-5: Groundwater levels in the Crib Point Jetty area reported within previous site investigation reports

Groundwater from beneath the study area has been shown to exceed the adopted investigation levels; although the majority of the exceedances including TDS, ions (such as calcium and sulfate as SO_4) and metals are attributed to background concentrations, with the exception of the following locations:

- adjacent to the former Tyabb landfill
- adjacent to the metal recycling yard in Hastings.

Groundwater samples collected immediately east of the former Tyabb landfill reported concentrations of PFOS exceeding the *PFAS National Environmental Management Plan (January 2018)* Freshwater and Marine water 99 per cent criteria. An elevated concentration of nickel was also detected in groundwater south of the former landfill, as well as at the metal recycling yard. The concentrations were higher than the rest of the groundwater samples collected across the study area, indicating potential impact from historical and/or adjacent land use.

Based on the horizontal directional drilling (HDD) construction method proposed for the area south of the Tyabb landfill, and given that nickel concentrations were detected below the adopted criteria at the other two groundwater monitoring wells also located adjacent to the former Tyabb landfill, it is considered unlikely that management of groundwater would be required at this location. It is considered unlikely to present risk to ecology at the site and to off-site receptors. However, contaminated groundwater would likely be encountered during construction of the Pipeline Works adjacent to the metal recycling yard in Hastings and east of the former Tyabb landfill as the existing groundwater table (measured in January 2019) is shallower than the proposed depth for trenching.

Groundwater salinity was measured in 15 monitoring wells along the study area, and TDS concentrations were calculated to be between 884 mg/L (MW07) and 18,700 (MW11) with an average of 6,217 mg/L, which can be classified as brackish. Although the TDS is naturally elevated and is not related to contamination, it may preclude the use of the groundwater for beneficial uses including agriculture and irrigation (stock watering), agriculture and irrigation (irrigation), industrial and commercial and water-based recreation. Discharges to land and potential receiving waters must be managed in accordance with mitigation measure MM-SW01 described in **Chapter 8** *Surface water.*

The pH of groundwater sampled from along the proposed pipeline alignment ranged between 5.96 and 7.34 and did not exceed adopted investigation levels. However, due to presence of ASS across the study area, potential for the Pipeline Works to encounter acidic groundwater during construction exists (see **Figure 10-3**).

It is noted that due to dense vegetation restricting access between KP7.3 – 7.9 in Hastings, intrusive investigation was unable to be completed to assess potential impacts from the adjacent industrial premises (such as the metal recycling yard). Intrusive soil and groundwater investigation would need to be undertaken before construction of the Project started at this location to confirm the presence or absence of contaminated groundwater within the area, due to historical and existing land uses.

10.5.2 Acid sulfate soils

Desktop review

The *Australian Soil Resource Information System* (ASRIS) indicates that 16 kilometres of the pipeline alignment intersects an area with a high probability of occurrence of ASS, generally within the upper one metre of soil. A high probability refers to greater than 70 per cent chance of ASS occurrence (see **Figure 10-6**).

Previous investigations were undertaken for the Project by Monarc in August 2018 and Construction Science in January 2019. Monarc identified the presence of AASS and PASS soils at two out of 10 sampling locations at Woolleys Road in Crib Point. Construction Science also identified the presence of ASS (four locations) and PASS (one location) soils at the Crib Point Receiving Facility.

Field investigation

The ASS investigation was undertaken in conjunction with the contaminated soil investigation between 29 November 2018 and 26 April 2019, where a total of 180 soil samples were collected and analysed. The investigation concluded there is a presence of ASS throughout the proposed pipeline alignment, including areas adjacent to 44 watercourse crossings. Of these, trenchless construction methods are proposed for 17 of the watercourse crossings and open trench method for the remaining 27 watercourses.

It is estimated the open cut trench sections of the Pipeline Works and the Gas Import Jetty Works would disturb approximately 91,500 m^3 and 2,500 m^3 of soil (in-situ) respectively. Both sets of works are therefore classified as having high hazard under the *Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soils* (CASS BPMG, 2010) which may only proceed with an approved environmental management plan.

What are Acid Sulfate Soils?

Acid Sulfate Soils (ASS) are soils affected by iron sulphide minerals, predominantly pyrite. ASS can occur naturally in coastal environments such as estuarine systems, mangrove swamps, backswamps and in inland environments such as river and stream channels, lakes, wetlands, billabongs, floodplains and marches.

Generally, ASS is classified into two broad types:

- Potential Acid Sulfate Soils (PASS) – soil that contains unoxidised metal sulfides. This only exists under oxygen-free or waterlogged conditions. If disturbed and exposed to air, it can produce sulfuric acid causing the soil to become acidic.
- Actual Acid Sulfate Soils (AASS) – soil that has been exposed to oxygen and water and is already acidic.

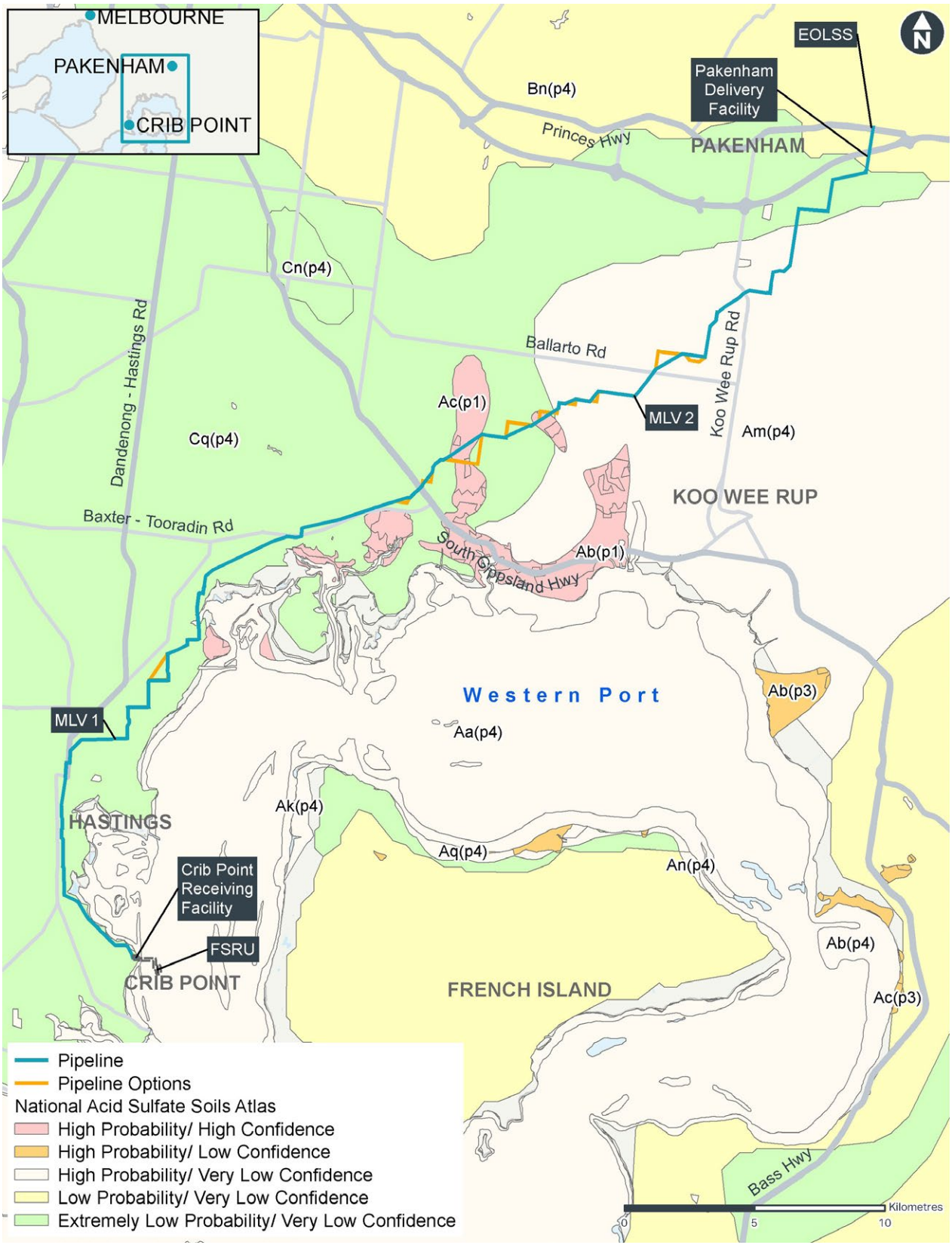

Figure 10-6: Acid sulfate soil classification

10.5.3 Contaminated marine sediments

Desktop review

The Crib Point Jetty was established in 1965 to provide berthing facilities for import of crude oil to the former Western Port BP refinery. The jetty has two berths (Berth 1 and 2) located in the northern and southern portion of the jetty. Berth 1 is currently in operation for the import of refined petroleum products. Berth 2 was decommissioned when the Western Port BP refinery was closed in the 1980s.

Jacobs undertook a baseline environmental contamination investigation of the Crib Point Jetty in 2018 for the Port of Hastings Development Authority (PoHDA). Six different contaminants were identified in marine sediment below the Crib Point Jetty. Concentrations of arsenic, benz(a) anthracene, fluoranthene, phenanthrene, pyrene and Tributyltin (TBT) all exceeded the ANZECC and ARMCANZ (2000) ISQG trigger values. The exceedances were considered generally low and may be considered acceptable for current use of the Crib Point Jetty. No sampling was undertaken from Berth 2.

Field investigation

A total of 20 marine sediment samples including four samples from reference sites located approximately 500 metres north of Berth 1 and south of Berth 2 were collected during the two rounds of sampling undertaken by CEE on 1 March 2019 and 18 July 2019.

Field investigation indicated that contamination from historical and/or existing activities at the Crib Point Jetty is limited to Berth 1, where concentrations of TBT exceeded the Sediment Quality Guideline Value (SQGV). Note that Berth 1 is located outside of the Project Area and is not impacted by the proposed Project activity and that no construction works are proposed beneath the jetty as part of the Gas Import Jetty Works.

PFAS compounds were detected above the laboratory limit of reporting (LOR) at three locations within Berth 2. However, Australian guideline values for maintaining ecosystem health for PFAS in marine sediments is currently not available. Therefore, in the absence of guideline values for PFAS in marine sediments, it is considered that based on low concentrations of PFAS (that is, within the same magnitude of the LOR) the existing beneficial use of protecting water dependent ecosystems and species is protected.

The marine sediment investigation concluded that no contamination exceeding the adopted guideline values has been identified at Berth 2 and the existing beneficial use of protecting water dependent ecosystems and species at Berth 2 is protected, and contamination from historical and/or existing activities at the Crib Point Jetty is limited to Berth 1 only. Impacts from contaminated marine sediments are therefore not addressed further in this risk assessment.

10.5.4 Conceptual site models (CSMs)

Conceptual site models are a representation of project-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. **Table 10-2** summarises the potential human and ecological receptors and transport pathways.

Table 10-2: Potential contaminant transport pathways and receptors

Source	Potential transport pathway	Receptors	Comment
Contaminated soil from historical industrial activity: fuel storage, landfill, farming	Stockpiles of contaminated soil	On-site workers via direct contact.	Surface soils at the proposed Crib Point Receiving Facility are impacted by zinc and benzo(a) pyrene. Surface soils at location along the Esplanade and rail corridor in Hastings (KP5.9 – KP6.8) are impacted by benzo(a)pyrene.
	Leaching of contaminants from soils and transport within groundwater	Terrestrial ecosystem if water is discharged to land, and aquatic ecosystem if water is discharged to surface waters.	
	Runoff from contaminated stockpile flowing into receiving waters	Receiving waters leading to Western Port.	
	Windblown dust from contaminated soil or stockpile	On-site workers via direct contact and inhalation.	
Contaminated groundwater	Abstraction of groundwater, discharge to land or surface water body	Human health via direct or secondary contact.	Groundwater near the former Tyabb landfill is contaminated with PFAS and groundwater beneath the rail corridor in Hastings adjacent to the metal recycling yard potentially impacted by historical and existing land uses (subject to instructive investigation).
		Aquatic ecosystems	
		Stock (where suitable for reuse).	
Acid sulfate soils	Generation of acid leachate through oxidation of previously submerged soils	Terrestrial ecosystem if water is discharged to land, and aquatic ecosystem if water is discharged to surface waters. Human health via direct or secondary contact.	AASS was identified in soil samples from throughout the study area, although PASS was identified at MW09 (KP17.8), MW10 (KP19.4), BH207 (KP32.4), BH209 (KP32.6) and BH34 (KP35.4), and at Crib Point (assessed by Construction Sciences (2019), see Section 10.5.2 of this chapter). The ASS sampling density does not comply with the EPA Victoria Publication IWRG655.1, however, the distribution of ASS throughout the study area would suggest that this is not required, other than to calculate or refine liming rates, and that all soils would need to be managed as AASS or PASS in accordance with CASS BPMG (2010
	Runoff from ASS or stockpile flowing into receiving waters	Terrestrial ecosystem if water is discharged to land, and aquatic ecosystem if water is discharged to surface waters. Human health via direct or secondary contact.	

10.6 Risk assessment

The risk assessment identified the risks associated with contamination and ASS as a result of the construction and operation of the Project. This included consideration of the environmental, social, economic and health and safety consequences of each risk and their likelihood of occurring.

Contamination and ASS risks identified during construction and operation of the Project are rated as low, with one exception rated very low (Risk ID C3).

Table 10-3 summarises the contamination and ASS risks identified. A complete risk register, including the likelihood and consequence of each risk pathway, is provided in EES Attachment III *Environmental risk report*.

Mitigation measures for the identified contaminated soil, groundwater, marine sediments and ASS risks are presented in full in **Section 10.9** (Mitigation measures) of this chapter and in **Chapter 25** *Environmental Management Framework*.

Table 10-3: Risks – Contamination and acid sulfate soils

Risk ID	Works area	Risk pathway	Initial mitigation measure	Initial risk	Additional mitigation measure	Residual risk
Construction						
C1	Gas Import Jetty Works and Pipeline Works	Disturbance, handling, storage or disposal of contaminated soils that affects human health via direct contact; surface water quality due to contaminated runoff; and groundwater quality due to leaching of contaminants from soils.	MM-C01 Contaminated soils	Low	No additional mitigation identified	Low
C2	Gas Import Jetty Works and Pipeline Works	Disturbance, handling, storage, treatment or disposal of acid sulfate soils that results in generation of acidic waters that affects human health via direct or secondary contact, surface water and/or groundwater quality.	MM-C02 Acid sulfate soils management protocol MM-C03 Acid sulfate soils management plan Discharge of trench water and watercourse trenching in accordance with mitigation measures outlined in **Chapter 8** *Surface water* (MM-SW01, MM-SW03 and MM-SW04)	Low	No additional mitigation identified	Low
C3	Pipeline Works	Generation of acid leachate through oxidation of previously submerged soils (dewatering from trenches and bell holes) leads to generation of acidic waters that affects human health via direct and secondary contact, surface water and/or groundwater quality.	MM-C02 Acid sulfate soils management protocol Minimise the time that trench sections and bell holes are open in accordance with mitigation measures listed in **Chapter 9** *Groundwater* (MM-HG01)	Very low	No additional mitigation identified	Very low
C4	Pipeline Works	Contaminated groundwater encountered during pipeline construction that affects human health via direct and secondary contact and the environment, due to inappropriate handling, storage and disposal.	MM-C04 Contaminated groundwater/trench water	Low	No additional mitigation identified	Low
C5	Pipeline Works	Dewatering activities affects soil, surface water and/or groundwater quality.	MM-C04 Contaminated groundwater/trench water Non-contaminated water will be discharged in accordance with mitigation measures outlined is **Chapter 8** *Surface water* (MM-SW01)	Low	No additional mitigation identified	Low
C6	Pipeline Works	Dewatering (during trenching and thrust-boring works) results in intersection of contaminated groundwater and/or mobilisation of contaminant plumes from outside the Project Area impacting on beneficial uses.	MM-C04 Contaminated groundwater/ trench water	Low	No additional mitigation identified	Low

Risk ID	Works area	Risk pathway	Initial mitigation measure	Initial risk	Additional mitigation measure	Residual risk
C7	Pipeline Works	Inappropriate management, handling and disposal of drilling mud that affects human health and the environment.	MM-C05 Drilling muds disposal Drilling conducted by a HDD specialist contractor. Use biodegradable and non-toxic drilling mud, where geotechnical conditions allow, in accordance with mitigation measures outlined in **Chapter 9** *Groundwater* (MM-HG02 and MM-HG03) Prevent discharge from trenchless drilling sites in accordance with mitigation measures outlined in **Chapter 8** *Surface water* (MM-SW09)	Low	No additional mitigation identified	Low
C8	Pipeline Works	Inappropriate handling, storage and disposal of contaminated water from hydrostatic test affects human health via direct and secondary contact, soil surface water and/or groundwater quality.	MM-C06 Hydrostatic test water Prevent discharge from trenchless drilling sites in accordance with mitigation measures outlined in **Chapter 8** *Surface water* (MM-SW09)	Low	No additional mitigation identified	Low
C9	Gas Import Jetty Works and Pipeline Works	Unknown contamination encountered and disturbed during construction results in an impact to human health and the environment.	MM-C07 Unknown contamination	Low	No additional mitigation identified	Low
C10	Gas Import Jetty Works and Pipeline Works	Dust from contaminated soil/ stockpile blown by wind affects human health via direct contact, soil and/or surface water quality.	Dust suppression methods and management of odorous soils in accordance with mitigation measures listed in **Chapter 12** *Air quality* (MM-AQ01, MM-AQ05 and MM-AQ08)	Low	No additional mitigation identified	Low
C11	Gas Import Jetty Works and Pipeline Works	Leaks or spillages during construction from machinery/ plant, fuel and chemical storage impact human health via direct and secondary contact, and the environment.	MM-C08 Fuel and Chemical leaks/ spills Spill management and refuelling of vehicles and mobile machinery in accordance with mitigation measures outlined in **Chapter 8** *Surface water* (MM-SW07 and MM-SW08)	Low	No additional mitigation identified	Low
C12	Gas Import Jetty Works and Pipeline Works	Mismanagement of waste streams (solid inert, liquid, organic, packaging etc.) generated during Project construction affects human health, aesthetics and the environment.	MM-C09 Construction Waste Management - Environmental Management Plans	Low	No additional mitigation identified	Low

Risk ID	Works area	Risk pathway	Initial mitigation measure	Initial risk	Additional mitigation measure	Residual risk
Operation						
C13	Gas Import Jetty Works and Pipeline Works	Leaks or spillages from machinery/plant, fuel and chemical storage impact human health via direct and secondary contact, and the environment.	MM-C08 Fuel and Chemical spills - Operational Environmental Management Plan (OEMP) Spill management and refuelling of vehicles and mobile machinery in accordance with mitigation measures outlined in **Chapter 8** *Surface water* (MM-SW07 and MM-SW08)	Low	No additional mitigation identified	Low
C14	Gas Import Jetty Works and Pipeline Works	Mismanagement of waste streams (solid inert, liquid, organic, packaging etc.) generated during Project operation affects human health, aesthetics and the environment.	MM-C10 Waste Management - Operational Environmental Management Plan	Low	No additional mitigation identified	Low

10.7 Construction impacts

The construction of the Gas Import Jetty Works and the Pipeline Works both have potential to cause the following impacts:

- disturbance, handling, storage or disposal of contaminated soils and/or ASS that affects human health and the environment
- generation of acid leachate through oxidation of previously submerged soils that affects soil, vegetation, surface water and/or groundwater quality
- unknown contamination encountered and disturbed during construction that affects human health, and/or the environment
- leaks or spillages during construction from machinery/plant, fuel and chemical storage that affects human health and/or the environment
- mismanagement of other waste streams (solid inert, liquid, organic, packaging and food scraps) that affects human health, aesthetics and the environment
- generation of dust from contaminated soil or stockpile blown by wind affects human health and the environment.

The following are potential impacts associated with construction of the Pipeline Works only:

- disturbance, handling, storage and disposal of contaminated groundwater that affects human health and/or the environment
- discharge or dewatering of non-contaminated, acidic and/or brackish trench water that affects soil, surface water and/or groundwater quality
- mobilisation of unknown contaminant plumes from outside the Project Area that affects beneficial uses
- inappropriate handling, storage and disposal of drilling mud affects human health and/or the environment
- inappropriate handling, storage and disposal of contaminated water from hydrostatic test that affects human health and/or the environment.

The following sections outline the potential impacts associated with construction of the Project, in regard to the risks identified in **Section 10.6**:

- impacts from disturbance of contaminated soils (Risk ID C1 and Risk ID C10)
- impacts from disturbance of ASS (Risk ID C2 and Risk ID C3)
- impacts from acidic, brackish and/or contaminated groundwater (Risk ID C4, Risk ID C5 and Risk ID C6)
- impacts from drilling mud (Risk ID C7)
- impacts from hydrostatic test water (Risk ID C8)
- impacts from unknown contamination, spills and waste streams (Risk ID C9, Risk ID C11 and Risk ID C12).

10.7.1 Impacts from disturbance of contaminated soils and acid sulfate soils

Contaminated soils (Risk ID C1)

A minor quantity of contaminated soils is expected to be encountered during construction of the Project. Although limited in extent, the majority of the contaminated soils are expected to be encountered near the Crib Point Receiving Facility, adjacent to the former Western Port BP refinery and the rail corridor in Hastings during excavation and/or trenching.

The disturbance of contaminated soils is considered to have a low risk of impacting human health and the environment, including the Western Port Ramsar site, due to identified contaminants being non-leachable and generally low in concentration. Erosion and sediment control measures would be implemented at the Crib Point Receiving Facility during construction to prevent sediments from the construction area entering the Western Port Ramsar site. Public access to the construction sites would also be restricted.

Contaminated soils would be managed in accordance with the EPA Victoria waste management hierarchy as defined in the *Environment Protection Act 1970*. Before excavation and off-site disposal, EPA Victoria-licensed waste disposal and soil treatment facility operators would be engaged to identify potential disposal and/or treatment sites, so that stockpiling durations are minimised. Any material imported to be used as backfill would comply with the EPA Victoria publication *IWRG621 – Soil categorisation and management* for '*Fill Material*' (see mitigation measure MM-C01).

Categorisation of contaminated soils for off-site disposal would need be assessed against the EPA Victoria publication *1828 – Waste disposal categories – characteristics and thresholds.*

Dust from contaminated stockpile (Risk ID C10)

Wind-borne dust from stockpiles of contaminated soil may contain contaminants such as PFAS, heavy metals and PAHs. There is potential for these contaminants to be absorbed into the blood stream when very fine particles are inhaled deep into the lungs. Exposure to larger particles may be through ingestion, and further deposition of dust may also result in surface water contamination. The risk to human health and the environment is considered to be low as soil contamination has been shown to be very limited in extent and is located away from sensitive receptors.

Management of dust is also a consideration in meeting the general environmental duty required by EPA Victoria and would form part of the Environmental Management Plan (EMP) for the Gas Import Jetty Works and the Construction Environmental Management Plan (CEMP) for the Pipeline Works. Mitigation measures include dust suppression such as reducing/minimising the storage of excavated material on site where possible (see mitigation measures described in **Chapter 12** *Air quality*).

Acid sulfate soils (Risk ID C2)

Soil disturbance activities undertaken during construction of the Project such as excavation, trenching, horizontal directional drilling (HDD) and thrust boring have the potential to encounter ASS and oxidise PASS. The preferred management option for the pipeline construction is to prevent oxidation of ASS by staging soil excavations to minimise the amount of time soil is exposed to oxygen. Where soils are to be stockpiled for a longer timeframe and acidic leachate runoff poses a risk to the surrounding environment, they would be neutralised via addition of lime.

Acid leachate generation during the construction of waterways crossing using the open trenching method is considered unlikely due to the ephemeral nature of the waterways; and the likelihood is further reduced with the construction to be undertaken during no flow conditions only, as prescribed in mitigation measures MM-SW03 and MM-SW04 (refer to the **Chapter 8** *Surface water*). The construction methodology has been designed to minimise the potential for generation of acidic leachate and therefore the quantity of leachate is expected to be low. Any leachate that is captured within the trench will only be discharged in accordance with mitigation measure MM-SW01 (see **Chapter 8** *Surface water*) to prevent loss to watercourses.

The proposed construction methodology outlined above (trenching timeframe, neutralisation and avoidance of wet waterway crossings) is considered unlikely to result in generation and loss of acidic leachate to the surrounding environment and eventual discharge into Western Port. Therefore, the disturbance of ASS is considered to have a low risk of impacting human health and the environment, as the impacts would be confined to the Project Area and managed in accordance with the Industrial Waste Management Policy (Waste Acid Sulfate Soils), EPA Victoria publication *IWRG655.1 – Acid sulfate soil and rock, and the Victorian Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soils* (CASS BPMG, 2010). Further mitigation measures that would be implemented include minimising construction work during wet weather to reduce the potential for leaching/loss from stockpiled soils (see mitigation measures MM-C02 and MM-C03).

Potential ASS activation (Risk ID C3)

PASS has been identified during field investigations at depths below and above the groundwater table at several locations along the pipeline alignment. Where PASS is present below the groundwater table, at MW09 (KP17.8) and MW10 (KP19.4), trenching would likely intersect the groundwater table during construction resulting in the need for dewatering before installation of the pipe. Dewatering may lower the water table in these areas, resulting in sulphide minerals in the soil to oxidise generating acidic conditions. Based on the drawdown estimates in EES Technical Report D**:** *Groundwater impact assessment*, the potential for oxidation of PASS in these areas is expected to be confined within the pipeline ROW and have very limited effect on the surrounding area.

Activation of PASS during construction of the Project is considered to have very low risk of impacting human health and the environment due to the limited extent of PASS that could interact with Project activities, as well as the short construction timeframe the interaction would occur. PASS activation would be managed by minimising the duration and extent of dewatering activities, such as dewatering immediately before installation of the pipe and for a select short distance at a time (see mitigation measures MM-C02 and MM-C03).

10.7.2 Impacts from acidic, brackish and/or contaminated groundwater

Contaminated groundwater (Risk ID C4)

Contaminated groundwater would most likely be encountered during construction of the Pipeline Works in areas adjacent to the former Tyabb landfill and metal recycling yard in Hastings. Based on the quality of groundwater samples collected, management of contaminated groundwater during construction of the Project is generally considered to have a low risk of impact to water-dependent ecosystems, due to the low concentration of contaminants detected. However, PFAS impacted groundwater from areas adjacent to the former landfill must not be discharged to surface or stormwater or otherwise permitted to enter aquatic ecosystems (see mitigation measure MM-C04). Management options for PFAS impacted groundwater near the former Tyabb landfill include:

- Dewatering and treatment of PFAS impacted groundwater off-site at a licensed facility. The volume of dewatered water can be minimised by dewatering immediately before installation of the pipe.
- Adopting an approach where pipe can be laid down without dewatering the trench, while preventing discharge of PFAS-impacted groundwater to surface soils.

As noted in **Section 10.5** (Existing conditions) of this chapter, due to dense vegetation restricting access to the study area between KP7.3 and KP7.9 in Hastings, intrusive soil and groundwater investigations must be undertaken before construction of the Project starts to confirm the presence or absence of contaminated soils and groundwater within the area, resulting from historical and existing land uses.

Dewatering of non-contaminated, acidic and/or brackish water (Risk ID C5)

Inappropriate management and disposal of non-contaminated but acidic and/or brackish groundwater/trench water has the potential to impact soil and/or surface water. The release of acidic and/or brackish water into the environment can result in changes to soil and surface water chemistry, which could impact protected beneficial uses.

So that pipeline construction meets applicable standards, the trench may need to be dewatered to remove any water which has collected while it is open. The Pipeline Works would discharge dewatered water from the open trenches and bell holes to adjacent land (with permission/approval from relevant landholder (where appropriate) and water authority). Based on the quality of groundwater in samples collected, dewatering or discharge of non-contaminated acid and/or brackish groundwater/trench water to land during construction of the pipeline is generally considered to have a low risk of impact to soils and receiving waters.

Dewatering activities would be managed in accordance with SEPP (Waters) and the Pipeline Works CEMP. Mitigation measures to be included in the CEMP involve treatment of water to meet relevant discharge criteria before discharge, and disposal of water that cannot be treated to meet the relevant discharge criteria to an EPA Victoria-licensed disposal facility (see mitigation measures described in **Chapter 8** *Surface water*).

Contaminant migration (Risk ID C6)

Dewatering during construction has the potential to mobilise groundwater contaminant plumes from outside the Project Area that affects beneficial uses. As the estimated drawdown of the water table would only extend up to 30 metres from the pipeline alignment, increased contamination migration as a result of the Pipeline Works is considered to have a low risk of impacting beneficial users and does not require further assessment.

10.7.3 Impacts from drilling muds (Risk ID C7)

Drilling muds, consisting predominantly of natural bentonite clay, are used in HDD pipe installation to act as a coolant, to wash in-situ material (cuttings) from the drilled hole and to seal and line the hole to facilitate insertion of the pipe.

The main potential impact associated with HDD is the migration of drilling muds away from the drill path and entering the groundwater table or surface via an existing fracture or formation opening in the soil or rock substrate. This could result in impacts to human health, terrestrial ecosystems, surface water quality and groundwater quality. However, these impacts are considered to be of low risk. Drilling muds are classified by the Victorian EPA as a non-prescribed industrial waste, so long as drilling did not encounter contaminated soils and does not contain synthetic additives.

The uncontrolled loss of large quantities of drilling muds is considered unlikely, and any impacts would be managed and localised, when a suitably qualified and experienced HDD contractor is used. The potential effects could be further reduced if non-toxic and biodegradable drilling muds (potentially not including synthetic additives) are used where possible. The risk associated with uncontrolled loss of drilling muds is discussed in **Chapter 9** *Groundwater* and has been assessed to be very low with the implementation of mitigation measure MM-HG02 described in **Chapter 9** *Groundwater*.

Inappropriate disposal of drilling muds can also contribute to these associated impacts. The development and implementation of the HDD Management Plan would mitigate the impacts associated with the inappropriate management, handling and disposal of drilling muds (see mitigation measure MM-C05 and the mitigation measures described in **Chapter 8** *Surface water*).

10.7.4 Impacts from contaminated hydrostatic test water (Risk ID C8)

Depending on the final configuration of hydrostatic test sections and the availability of water, biodegradable oxygen scavengers and biocides may be added as required to hydrostatic test water and would be neutralised before disposal. The inappropriate handling, storage and disposal of contaminated water from hydrostatic testing is considered to have a low risk of impacting human health and the environment, as the hydrostatic test water would be neutralised and aerated in accordance with manufacturer guidelines so that the post hydrostatic test water was free from any remaining active biocide and oxygen scavengers (see mitigation measure MM-C06). Hydrotest water would be reused where practicable to conserve water and minimise the number of discharge locations.

10.7.5 Impacts from unknown contamination, spills and waste streams

Unknown contamination (Risk ID C9)

While it is possible that unknown contamination including asbestos containing material (ACM) would be encountered during construction of the Project, the risk of impacting human health and the environment is considered to be low. The risk is mitigated by managing visible signs and/or odours in accordance with the Gas Import Jetty Works EMP and Pipeline Works CEMP. If contamination was uncovered, ground disturbance would cease, and site contamination assessed followed by appropriate remedial action (see mitigation measure MM-C07).

Spills (Risk ID C11)

There is a possibility that leaks, and spills may occur during construction of the Project from machinery, fuel and chemical storage resulting in impacts to human health and the environment. However, the risk is considered to be low with application of industry-standard mitigation measures during construction. In addition to good practice such as minimal storage of chemicals at the work site, bunding of areas where storage is required and storing chemicals away from waterways, a potential spill would be localised and contained at the active work site rather than being widespread (see mitigation measure MM-C08 and the mitigation measures in **Chapter 8** *Surface water*).

Waste streams (Risk ID C12)

The Project would generate wastes other than soil, groundwater and drilling muds, including waste from transportation and storage of pipe, pipeline coating waste, welding/grinding waste and machinery waste. There is potential for these wastes to be released into the environment impacting aesthetics as well as the environment, if not appropriately managed. These impacts are considered to be low risk, and would be mitigated by suitable storage, reusing and recycling construction wastes where practicable, or disposal at licensed facilities (see mitigation measure MM-C09).

10.8 Operation impacts

10.8.1 Spills (Risk ID C13)

There is a possibility that leaks, or spills may occur from machinery/plant/pipeline, storage and use of fuels and chemicals and other maintenance activities resulting in impacts to human health and the environment. However, the risk is considered to be low with the application of industry-standard mitigation measures during operation of the Project. In addition to good practice such as minimal storage of chemicals at the work site, bunding of areas where storage is required and storing chemicals away from waterways, a potential spill would be localised and contained at the active work site rather than being widespread. These mitigation measures would be included in the Project Operational Environmental Management Plans (OEMP) (see mitigation measures in **Chapter 8** *Surface water*).

Potential spills associated with the FSRU moored at Crib Point are addressed in **Chapter 6** *Marine biodiversity*.

10.8.2 Waste streams (Risk ID C14)

The Project would not likely generate large amounts of wastes associated with ongoing operation and maintenance activities except discharges from the FSRU which would include:

- grey water that would be stored in holding tank before its disposal off-site to a licensed waste management facility
- black water/sewage generated from the FSRU operation that is treated in the sewage treatment plant in accordance with relevant Commonwealth and State regulations, and the International Maritime Organization (IMO) regulations and disposed off-site to a licensed waste management facility
- sludge from marine diesel oil and lube oil purifiers, as well as oil residue from drain, drip trays, oil separators and sludge unit produced from ongoing operation of the FSRU would be collected and sent off-site for disposal to a licensed waste management facility
- bilge water collected in a holding tank which would either be pumped to deck for discharge to shore/barge or sent to the Oily Bilge Separator where the bilge water would be treated to an oil content of less than 15ppm and sent to the Clean Bilge Tank. The bilge from this tank may be pumped to deck for disposal off-site to a licensed waste management facility
- mixed solid waste such as food scraps, paper, glass, packaging and recyclables.

In addition, the Gas Import Jetty Works is also expected to generate wastewater from testing and maintenance activities. Firefighting water generated during testing would be discharged to the ocean as it would not contain any contaminants. It is noted that no PFAS containing firefighting foam would be stored or used for the Project.

Wastes that may be generated from the pipeline operation and maintenance include:

- oil and grease from pipeline maintenance activities
- dust and steel flakes from infrequent maintenance or pigging activities.

Waste volumes generated from pigging is expected to be less than one cubic metre for the entire pipeline, which would be collected at scraper stations approximately every 10 years as a part of maintenance operations. Pigging waste would be tested for waste classification before its disposal at a licensed waste management facility.

Inappropriate management and disposal of waste streams is considered to have a low impact on human health and the environment and would be mitigated through measures such as managing waste in accordance with Environment Protection (Industrial Waste Resource) Regulations 2009 and reusing and recycling wastes where practicable (see mitigation measure MM-C10).

10.9 Mitigation measures

The mitigation measures developed for the identified contamination and ASS risks are summarised in **Table 10-4**.

In addition to the contamination and ASS mitigation measures recommended in **Table 10-4**, mitigation measures to avoid, minimise and mitigate impacts from contamination and ASS are also recommended in:

- **Chapter 8** *Surface water*
- **Chapter 9** *Groundwater*
- **Chapter 12** *Air quality.*

Table 10-4: Contamination and ASS mitigation measures

Mitigation measure ID	Mitigation measure	Works area	Stage
MM-C01	**Contaminated Soils** a. Contaminated soil will be managed in accordance with the SEPP (*Prevention and Management of Contaminated Land*) and EPA Victoria interim Position Statement on PFAS. b. All Project personnel will be made aware of the presence of contaminated soils at the following locations during the site(s) induction: - The Crib Point Receiving Facility - The Esplanade adjacent to the former BP refinery - The former BP refinery - within the railway corridor between High Street and Cool Store Road in Hastings - Between KP7.3 and KP7.9 in Hastings (if intrusive investigation confirms presence of contaminated soils). c. An intrusive soil investigation will be undertaken in the area between KP7.3 and KP7.9 once vegetation has been cleared, to confirm the presence or absence of contaminated soils, due to historical and existing land uses. Should contamination of soil and/or groundwater be encountered, consider additional mitigation measures (if required). d. Construction works during wet weather will be avoided unless conditions are such that property damage, contaminated soils, and surface water issues can be managed. e. Where excess soils, including HDD screened cuttings, are required to be disposed off-site, these will be sampled and categorised in accordance with EPA Victoria publications *IWRG702 – Soil sampling* and *IWRG621 – Soil hazard categorisation and management.* f. Handling and transport of contaminated spoil for off-site treatment/ disposal will be in accordance with Environment Protection (Industrial Waste Resource) Regulations 2009. g. Any material imported for use as backfill will comply with the EPA Victoria publication *IWRG621 – Soil hazard categorisation* and management for 'Fill Material' and will be accompanied by relevant documentation confirming its compliance to the 'Fill Material' criteria.	Gas Import Jetty Works and Pipeline Works	Construction

Mitigation measure ID	Mitigation measure	Works area	Stage
MM-C02	**Acid Sulfate Soils Management Protocol** An Acid Sulfate Soils (ASS) Management Protocol will be developed in accordance with the *Industrial Waste Management Policy (Waste Acid Sulfate Soils)* 1999 and EPA Victoria publication *IWRG655.1 – Acid sulfate soil and rock*, and the *Victorian Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soils (CASS BPMG, 2010)*. As agreed with EPA Victoria, the Pipeline Works ASS Management Protocol will be developed and included in the Pipeline Works CEMP which will be approved in accordance with the *Pipelines Act 2005*, in consultation with EPA Victoria. The Pipeline Works ASS Management Protocol will include: a. All soils be managed as AASS or PASS in accordance with CASS BPMG (2010). b. A risk assessment together with proposed risk mitigation and management measures across the Project Area including justification of why certain areas may be excluded from treatment by liming. c. Monitoring of the performance of mitigation and management measures, including potential remedial measures where/if required. d. All relevant site-based personnel will be made aware of the locations where PASS (MW09 at KP17.8, MW10 at KP19.4, BH207 at KP32.4, BH209 at KP32.6 and BH34 at KP35.4) has been identified. e. Relevant site-based personnel must be trained on the requirements of the acid sulfate materials management procedure including the recommended time period over which soils may be temporarily stockpiled before treatment commences as recommended by the CASS BPMG (2010). f. Construction works will not occur during wet months unless conditions are such that land degradation and surface water management problems can be avoided or appropriate mitigation measures implemented. g. Minimise the duration of stockpiling of untreated ASS by staging soil excavations in a manner that takes in constraints on stockpile duration where treatment of ASS may not be required, as per the CASS BPMG (2010). h. Include a procedure for managing unexpected discovery of ASS/PASS in the ASS Management Protocol. i. If ASS are to be stockpiled for an extended time period (exceeding the CASS BPMG (2010) recommended short-term stockpiling durations), the potential generation of acidic leachate will be managed by treating the stockpile and or spreading a guard layer before stockpiling and/or covering the stockpile. j. Run-off that has the potential to be impacted by stockpile material will be directed into the open trench (where practicable). k. Minimise activation of PASS by minimising duration (less than 10 days) and extent of dewatering activities, such as dewatering immediately prior to installation of pipe and minimise the time that trench sections and bell holes are open. l. Implement a monitoring program in accordance with the CASS BPMG (2010) to measure the effectiveness of the management strategy and to provide an early warning of any environmental degradation or impact to surface water, groundwater and soils.	Pipeline Works	Construction

Mitigation measure ID	Mitigation measure	Works area	Stage
MM-C03	**Acid Sulfate Soil Management Plan** An Acid Sulfate Soil Management Plan (ASSMP) will be developed in accordance with the *Industrial Waste Management Policy (Waste Acid Sulfate Soils) 1999* and EPA Victoria publication *IWRG655.1 – Acid sulfate soil and rock*, and the Victorian Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soils (CASS BPMG, 2010). The ASSMP shall be approved by EPA and will include: a. Relevant site-based personnel must be trained on the requirements of the acid sulfate materials management procedure including the recommended time period over which soils may be temporarily stockpiled before treatment commences as recommended by the CASS BPMG (2010). b. The duration of stockpiling of untreated ASS will be minimised by taking into consideration the constraints on stockpile duration where treatment of ASS may not be required, as per the CASS BPMG (2010). c. Include a procedure for managing unexpected discovery of ASS/PASS in the ASSMP. d. If ASSs are to be stockpiled for an extended time period (exceeding the CASS BPMG (2010) recommended short-term stockpiling durations), the potential generation of acidic leachate will be managed by treating the stockpile and or spreading a guard layer before stockpiling and/or covering the stockpile. e. Run-off that has the potential to be impacted by stockpile material will be captured (where practicable) and managed in accordance with the CASS BPMG (2010). f. A monitoring program will be implemented in accordance with the CASS BPMG (2010) to measure the effectiveness of the management strategy and to provide an early warning of any environmental degradation or impact to surface water, groundwater and soils.	Gas Import Jetty Works	Construction
MM-C04	**Contaminated groundwater/trench water** a. Contaminated groundwater/trench water will be managed in accordance with: - *SEPP (Waters)* - *PFAS National Environmental Management Plan*. b. All Project personnel will be made aware of the presence of contaminated groundwater containing PFAS east of the former Tyabb landfill. c. Disturbance of saturated soil and groundwater within the PFAS affected area will be minimised. The management plan will include measures to prevent migration of PFAS into the surrounding soil or surface water. d. An intrusive groundwater investigation will be undertaken in the area between KP7.3 and KP7.9 once vegetation has been cleared, to confirm presence or absence of contaminated groundwater within the area, due to historical and existing land uses. e. Water from areas that have been identified as contaminated will not be discharged to the environment (land, waterways, sewer). f. Contaminated water will either be treated on-site, depending on contaminant encountered (this may require approval from the EPA Victoria) or disposed off-site to an EPA Victoria licensed facility. Alternatively, adopt a construction approach where contaminated groundwater may be left in-situ (i.e. not abstracted or disturbed).	Pipeline Works	Construction

Mitigation measure ID	Mitigation measure	Works area	Stage
MM-C05	**Drilling muds disposal** Drilling muds/additives used in horizontal directional drilling (HDD) will be selected to avoid impact to sensitive environments during drilling activities as per **Chapter 9** *Groundwater* (MM-HG02). Place bunds and/or drainage channels around the upper edges of the drill site and work area, to divert natural runoff around and away from the drill site and avoid cross contamination of the drilling compound runoff as per **Chapter 8** *Surface water* (MMSW09). a. Monitor circulation of drilling muds throughout the HDD operation for indication of an inadvertent drilling mud release. b. Drilling muds will be disposed in accordance with Environment Protection (Industrial Waste Resource) Regulations 2009 and '*EPA Victoria Industrial Waste – Classification for Drilling Mud*', Victoria Government Gazette G37. c. Records of HDD mud disposal will be maintained and kept for 2 years in accordance with '*EPA Victoria Industrial Waste – Classification for Drilling Mud*'.	Pipeline Works	Construction
MM-C06	**Hydrostatic test water** a. Hydrostatic test water will be managed in accordance with SEPP (Waters) b. Water will be reused where practicable to conserve water and minimise the number of discharge locations. c. If oxygen scavengers and biocides are used during hydrostatic testing, they will be neutralised before disposal, in accordance with manufacturer guidelines, to ensure that the water is free from any remaining active biocide and oxygen scavengers before discharge land. d. Dams and hydrostatic test water may remain for land holders beneficial use with landholder and regulatory approval if water quality requirements are met.	Pipeline Works	Construction
MM-C07	**Unknown contamination** In the event that unknown contamination (including asbestos containing material) is encountered during construction: a. Cease ground disturbance at the unknown contamination location and within the immediate vicinity. b. Assess site contamination and identify appropriate remedial action.	Gas Import Jetty Works and Pipeline Works	Construction
MM-C08	**Fuel and Chemical Leaks/Spills** a. Diesel generators will be bunded. b. Routine and scheduled maintenance of vehicles and plant/machinery/equipment will be undertaken to minimise the potential for leaks/spills to occur.	Gas Import Jetty Works and Pipeline Works	Construction and operation
MM-C09	**Construction Waste Management** a. Waste will be managed in accordance with Environment Protection (Industrial Waste Resource) Regulations 2009, including establishment of appropriate and secured waste storage locations on-site, as required. b. Waste management procedures will be developed and implemented. c. Identification of suitable waste disposal locations will occur prior to construction commencing in consultation with a licenced waste contractor. d. Waste materials will be reused or recycled where practicable or collected and transported by licensed waste contractors for disposal at appropriately licensed facilities. e. Portable toilet facilities will be available for work construction crews at designated locations. f. Waste containers will be available for different types of waste generated on-site. g. Waste containers will be located at each worksite to enable collection of waste, with regular removal from worksites to designated storage areas. h. Refuse containers will be lidded to mitigate fauna access.	Gas Import Jetty Works and Pipeline Works	Construction

Mitigation measure ID	Mitigation measure	Works area	Stage
MM-C10	**Operation Waste Management** a. Waste will be managed in accordance with Environment Protection (Industrial Waste Resource) Regulations 2009, including establishment of appropriate and secured waste storage locations on-site, as required. b. Waste management procedures will be developed and implemented. c. Waste materials will be stored appropriately, reused or recycled where practicable, or collected and transported by licensed contractors for disposal at appropriately licensed facilities. d. Waste containers will be available for different types of waste generated on-site. e. Waste containers will be lidded to mitigate fauna access.	Gas Import Jetty Works and Pipeline Works	Operation

10.10 Conclusion

The contamination and ASS impact assessment has identified the associated risks and potential impacts of the construction and operation of the Project on human health and the environment as a result of disturbance and inappropriate handling, storage and disposal of contaminated soils, groundwater, marine sediments and ASS.

The construction and operation of the Project pose limited risks to soils, groundwater and receiving surface water due to the limited extent of contamination present across the study area.

The potential environmental risk associated with ASS is limited by the shallow depth of trenching and horizontal boring, and the short duration of stockpiling and dewatering activities (where groundwater is intersected).

Where dewatering would be required, the reduction in groundwater levels are also estimated to be of limited magnitude and limited lateral extent (assessed in EES Technical Report D: *Groundwater impact assessment*).

The proposed construction methodologies would confine potential impacts within the Project Area and so have very limited effect on the surrounding area.

As such, the risks of potential impacts from soil and groundwater contamination and ASS from construction and operation of the Project have been identified as low or very low with the relevant mitigation measures in place.

The marine sediments contamination investigation concluded the existing beneficial use of water dependent ecosystems and species at Berth 2 would be protected, and contamination from historical and/or existing activities at the Crib Point Jetty would be limited to Berth 1. No mitigation measures have therefore been proposed.

Risks associated with spills and waste streams as a result of construction and operation of the Project have been identified as low, with measures in place to manage waste in accordance with relevant guidelines, as well as the implementation of measures to prevent spills/leaks as outlined in the Gas Import Jetty Works EMP and Pipeline Works CEMP.

Overall, the assessment concluded that the potential for disturbance and/or inappropriate management of contaminated soils, contaminated groundwater, ASS, and waste materials and streams to affect the ecological character of the Western Port Ramsar site during construction and operation of the Project is considered to be low.

In response to the waste and water and catchment values draft evaluation objectives, impacts of the Project associated with the disturbance of contaminated soils, groundwater and marine sediment, and ASS have been assessed and mitigation measures have been identified to reduce or minimise these impacts.