# 18 Soils and contaminated land

# Tables



# Figures

## 18.1 OVERVIEW

This chapter considers the potential health and environmental impacts that may result from the disturbance and handling of contaminated soils or potential acid sulfate soils (PASS) during construction of the project. The findings discussed here are based on the impact assessment prepared by WSP for the project and presented in Appendix L: *Contaminated land impact assessment*. This chapter also details environmental performance requirements (EPRs) with measures to avoid, mitigate and manage potential impacts from disturbance of these materials.

Contaminated soil contains harmful substances in concentrations that may harm human health or the environment. Relevant chemicals can include inorganic materials (e.g. metals, asbestos) and organic substances (e.g. petroleum hydrocarbons). Contamination can be caused through human and non-human activities, such as agricultural practice, urban and industrial waste. Land contamination is a common legacy of past industrial land uses and waste disposal practices.

The assessment identified several areas within and near the project area that are known to be contaminated and some that are potentially contaminated. Former landfills in the northern portion of the site contain contaminated soil and groundwater, as well as landfill gas and leachate. Disturbance of these sites may also encounter waste materials, odorous material and poly and perfluoroalkyl substances (PFAS). Asbestos containing material was also identified in a localised area within the central portion of the project area which can be managed through the implementation of established practices during construction.

Acid sulfate soils (ASS) are likely to be present in the southern half of the project area. These soils may become oxidised if disturbed during piling and excavation works.

Given the nature of construction works, it may not be possible to avoid disturbing contaminated land and/or ASS entirely. EPRs have been recommended to manage and mitigate potential impacts from disturbance of these sites, reducing residual risks to acceptable levels. The focus of the EPRs is on developing, preparing and implementing management plans in accordance with legislation, policies and standards to achieve acceptable environmental and public health outcomes.

## 18.2 EES OBJECTIVES AND REQUIREMENTS

The draft evaluation objective for land contamination and ASS is defined in the *Scoping Requirements for Mordialloc Bypass Environment Effects Statement* (scoping requirements) (DELWP 2018).

**DRAFT EVALUATION OBJECTIVE**

*To prevent adverse environmental or health effects from disturbing, storing or influencing the transport/ movement of contaminated or acid-forming material.*

Table 18.1 summarises key issues relating to soil and contaminated land as identified in the scoping requirements.

### Table 18.1 EES key issues — soil and contaminated land

| Key issues |
|---|
| Potential for adverse environmental or health effects resulting from disturbance of or influencing the transport/movement of contaminated soil gases/vapours or groundwater. |
| Potential for adverse environmental or health effects resulting from handling, storage or transportation of excavated contaminated spoil or PASS. |
| Potential for adverse environmental or health effects from other waste materials/streams generated from project works. |
| Potential for adverse environmental effects on the Edithvale-Seaford Wetlands Ramsar site resulting from disturbing, storing or influencing the transport/movement of contaminated or acid-forming material. |

## 18.3 LEGISLATION AND POLICY

The main legislation, policy and guidelines relevant to managing soils and contaminated land within Victoria are outlined in Table 18.2. Full details are provided in Appendix L: *Contaminated land impact assessment*.

### Table 18.2 Legislation and policy — soils and contaminated land

| Legislation/policy | Description |
|---|---|
| Commonwealth | |
| *National Environment Protection Measure (NEPM) 2013* | Provides the national framework for conducting contaminated land investigations in Australia. |
| CRC CARE Technical Report No. 10: Health screening Levels for Petroleum Hydrocarbons in Soil and Groundwater | Outlines the criteria and approach for developing health screening levels for petroleum hydrocarbons for four generic land use settings (low and high density residential, recreational/open spaces and commercial/industrial). |
| State | |
| *Environment Protection Act 1970* | Aims to prevent pollution and environmental damage by setting environmental quality objectives and establishing programs to meet them.<br>Establishes the powers, duties and functions of the Environment Protection Authority of Victoria (EPA). These powers include the administration of the Act and any regulations and orders made to achieve the Act's aims, recommending State Environment Protection Policies (SEPP), issuing works approvals, licences, permits, pollution abatement notices and implementing NEPM. |
| State Environment Protection Policy (SEPP) Prevention and Management of Contamination of Land | Establishes general uses of land in Victoria and provides a mechanism for determining whether these uses are being protected, such as indicators and objectives of use in assessing impacts. It also identifies the links between the environmental audit system and the statutory planning system, ensuring sites that need to be audited are subject to audit, and that any conditions associated with the audit outcome are implemented.<br>Sets out requirements for the prevention of contamination, reinforces the role of the waste hierarchy in selecting preferred approaches for site clean-up and identifies measures by which people can access relevant information on site contamination. |
| SEPP Groundwaters of Victoria | Developed to meet community demands for an integrated framework of environment protection goals for groundwater. It aims to maintain and, where necessary, improve groundwater quality to a standard that protects existing and potential beneficial groundwater uses.<br>Sets a consistent approach to, and provides quality objectives for, groundwater protection throughout Victoria. |
| Industrial Waste Resource Guidelines (IWRG) 621 — June 2009 | Provides the classification criteria for disposal and potential management methods for disposal. |
| Industrial Waste Resource Guidelines (IWRG) 702 — June 2009 | Outlines the soil sampling requirements to adequately classify soils for offsite disposal or reuse. |
| Best Practice Environmental Management (BPEM) — Siting, design, operation and rehabilitation of landfills (Landfill BPEM) EPA Publication 788.3, August 2015 | Provides the framework and guidelines for managing landfills. |

| Legislation/policy | Description |
|---|---|
| Acid Sulfate Soil (ASS) and Rock guidance note, EPA Publication 655.1, July 2009 | Outlines the requirements and guidance for investigating PASS. |
| State Environment Protection Policy (SEPP) Air Quality Management (SEPP AQM) No. S 240, 21 December 2001 | Establishes the framework for managing emissions into the air environment in Victoria from all sources of air pollutants. |
| Heads of EPA (2018) PFAS National Environmental Management Plan | Designed to achieve a clear and effective approach to the environmental regulation of PFAS. Provides guidance for the regulation of PFAS contaminated sites, PFAS contaminated materials and PFAS-containing materials. |

## 18.4 METHODOLOGY

The assessment methodology for ASS and contaminated land investigations consisted of:

- an existing conditions assessment involving:
  - establishing a study area for potential contamination issues in the project area and within 150m of the project boundary
  - conducting a desktop review of publicly available literature, aerial photos, databases and reports for potential sources of current and historical contamination and PASS within the study area
  - a soil sampling and analysis program to verify and further investigate contamination and ASS areas identified in the desktop review. These investigations involved drilling and sampling for potentially contaminated materials and potential acid sulfate soils (ASS), including the sampling of soils, surface water, groundwater, landfill leachate and landfill gas
  - performing a quantitative landfill gas risk assessment for the northern portion of the project area
- a risk assessment process as described in detail in Chapter 4: *EES assessment framework and approach*
- an impact assessment involving:
  - reviewing the project design and proposed construction methods to determine where contaminated areas and ASS may be disturbed, and the location of sensitive receptors, including residents, businesses and nearby wetlands
  - estimating the volumes of excavated spoil and identifying other waste streams resulting from the construction activities
  - identifying where PASS and potential contamination occur and the associated environmental risks to sensitive receptors, including the Edithvale Wetlands
  - assessing the potential for negative environmental or health impacts from disturbing contaminated land, PASS, or other waste materials generated during project construction
- development of EPRs.

The approach follows the method in the NEPM and aims to provide a high level indication of contamination and ASS being present in the area, as well as an indicative classification of excavation spoil for offsite disposal, should it be required during construction.

The full assessment methodology can be found in Appendix L: *Contaminated land impact assessment*.

## 18.5 STUDY AREA

The study area for the contaminated land investigation included the project area (as defined in Chapter 6: *Project description*) and land within 150m of the project boundary (refer Figure 18.1).

For the purposes of the assessment the project area has been divided into three key study areas:

- **Northern portion:** between Dingley Bypass and Centre Dandenong Road
- **Central portion:** between Centre Dandenong Road and the Mordialloc Creek
- **Southern portion:** between Mordialloc Creek and the southernmost boundary of the project area at Thames Promenade, Chelsea Heights.

## 18.6 EXISTING CONDITIONS

The investigations characterised the geology of the project area, and identified areas of PASS and potentially contaminated soil, groundwater, landfill gas and leachate within the study area.

### 18.6.1 Geology

Geotechnical field investigations and sampling showed that the geology in the project area includes:

- recent fill material
- Quaternary alluvium
- Tertiary Brighton Group sediments and rock
- Tertiary Fyansford Formation sediments.

It is anticipated that recent fill, Quaternary alluvium, and Tertiary Brighton Group and Fyansford Formation sediments would be encountered during construction which is consistent with the regional geology as shown in Figure 18.2.

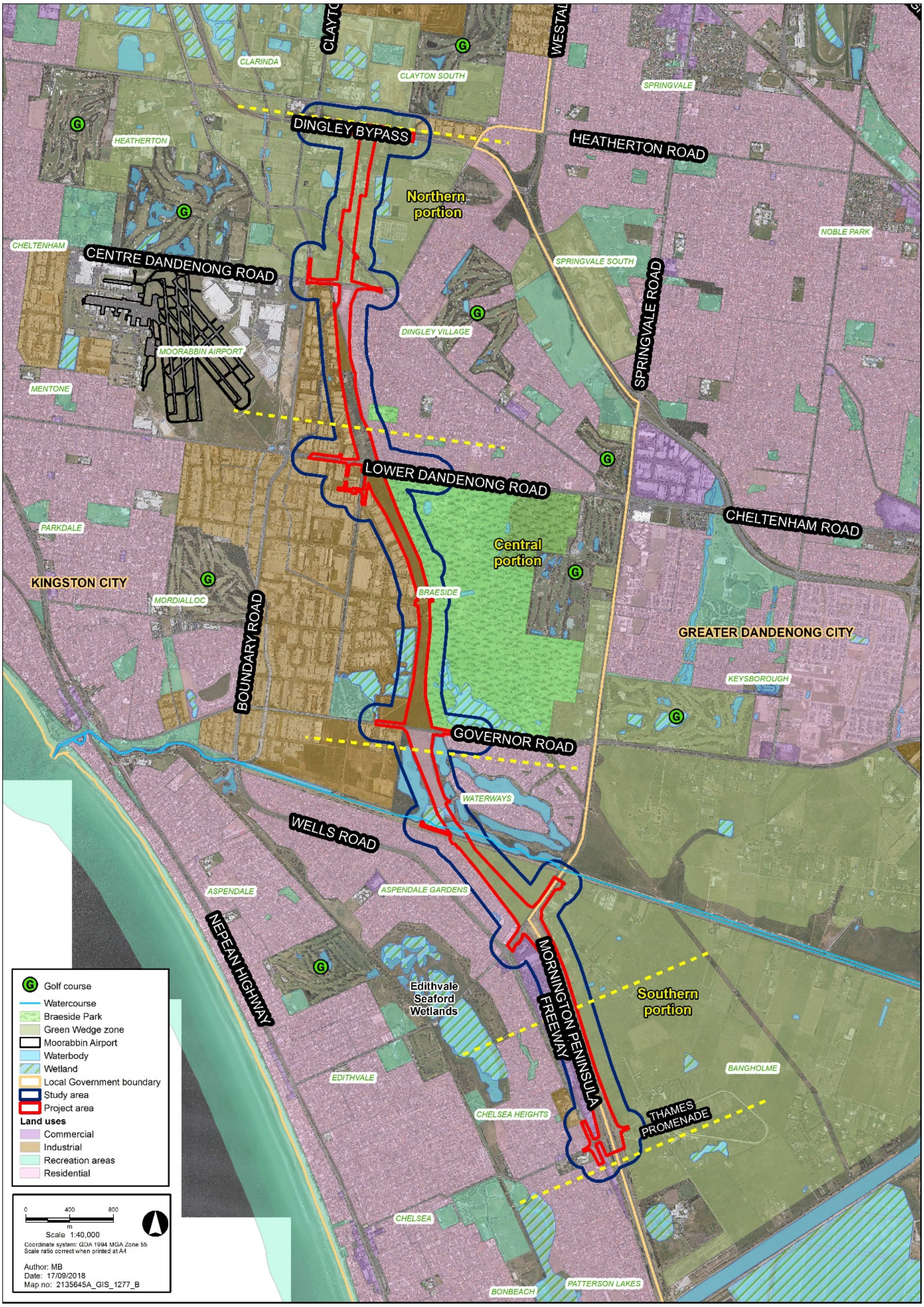



**Figure 18.1 Study area**

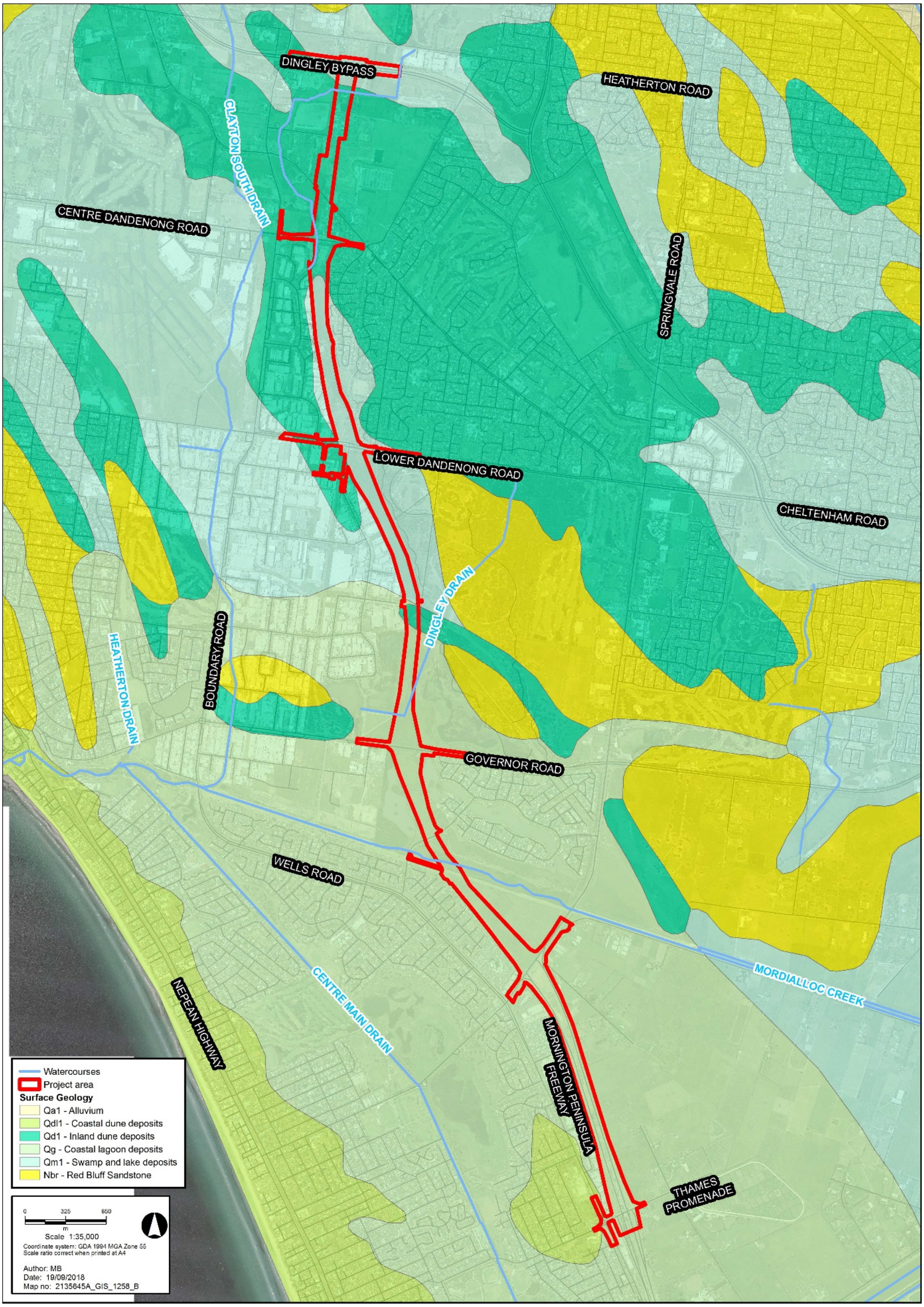



**Figure 18.2 Regional geology**

### 18.6.2 Land contamination

Existing and former industrial and commercial properties in the study area have the potential to provide a source of contamination. Between Dingley Bypass and Centre Dandenong Road, the northern portion of the study area consists of former landfills, commercial and industrial businesses, including soil processing and composting, and nurseries. The alignment passes across the top of a former landfill.

The central portion of the study area includes the large Woodlands Industrial Estate, Moorabbin Airport and Braeside Park. The southern portion comprises mostly agricultural land to the east, with commercial properties to the west.

Former and current landfills, commercial and industrial businesses, mechanical workshops, chemical and plastic manufacturers, and service stations are the most likely sources of potential contamination within the area. Figures 18.3 to 18.5 show the project alignment in relation to areas of potential contamination including the former landfill in the northern portion. One EPA priority site was identified in the northern portion of the study area at 370 Old Dandenong Road, which is understood to be the former Din San Landfill. EPA Victoria licenced activities were identified at:

- Lot 1 and 2 Grange Road, Dingley Village (composting)
- 370–418 Old Dandenong Road, Dingley Village (landfill).

Further details of all potentially contaminating land uses are provided in Appendix L: *Contaminated land impact assessment.*

**TYPICAL LAND CONTAMINATION DEFINITIONS**

**Landfill gas**

Landfill gas is made up of carbon dioxide, methane and trace gases such as hydrogen sulphide, hydrogen cyanide and ammonia. It is formed from wastes degrading in a landfill. When landfill gas remains in a landfill it is of little risk to humans. However, it can migrate from a landfill, and under specific conditions there can be a risk of explosion, fire, or asphyxiation (when oxygen levels become so low that breathing becomes difficult or impossible).

**Acid sulfate soils (ASS)**

ASS are natural sediments occurring in soil that contain metal sulfides. When ASS are undisturbed, they do not present a risk to human health or the environment. When exposed to air, the metal sulfides react with the oxygen in the air and create sulfuric acid. Sulfuric acid can have a range of impacts on human and environmental health, including impacting waterways, aquatic life and vegetation, creating corrosion and toxic water by acidification and leaching of metals and dust that can irritate skin and eyes.

**Leachate**

Leachate is the liquid that forms when waste breaks down, and water filters through the waste. Like liquid residue that forms in residential bins in the home, leachate is a large-scale version of waste mixing with water (rainwater, and liquid created through the process of decomposition). Leachate is highly toxic and can pollute land, waterways and groundwater systems.

**EPA priority site**

A priority site is a site that the EPA has issued a clean-up notice pursuant to section 62A or a pollution abatement notice pursuant to section 31A or 31B of the Environment Protection Act, 1970.

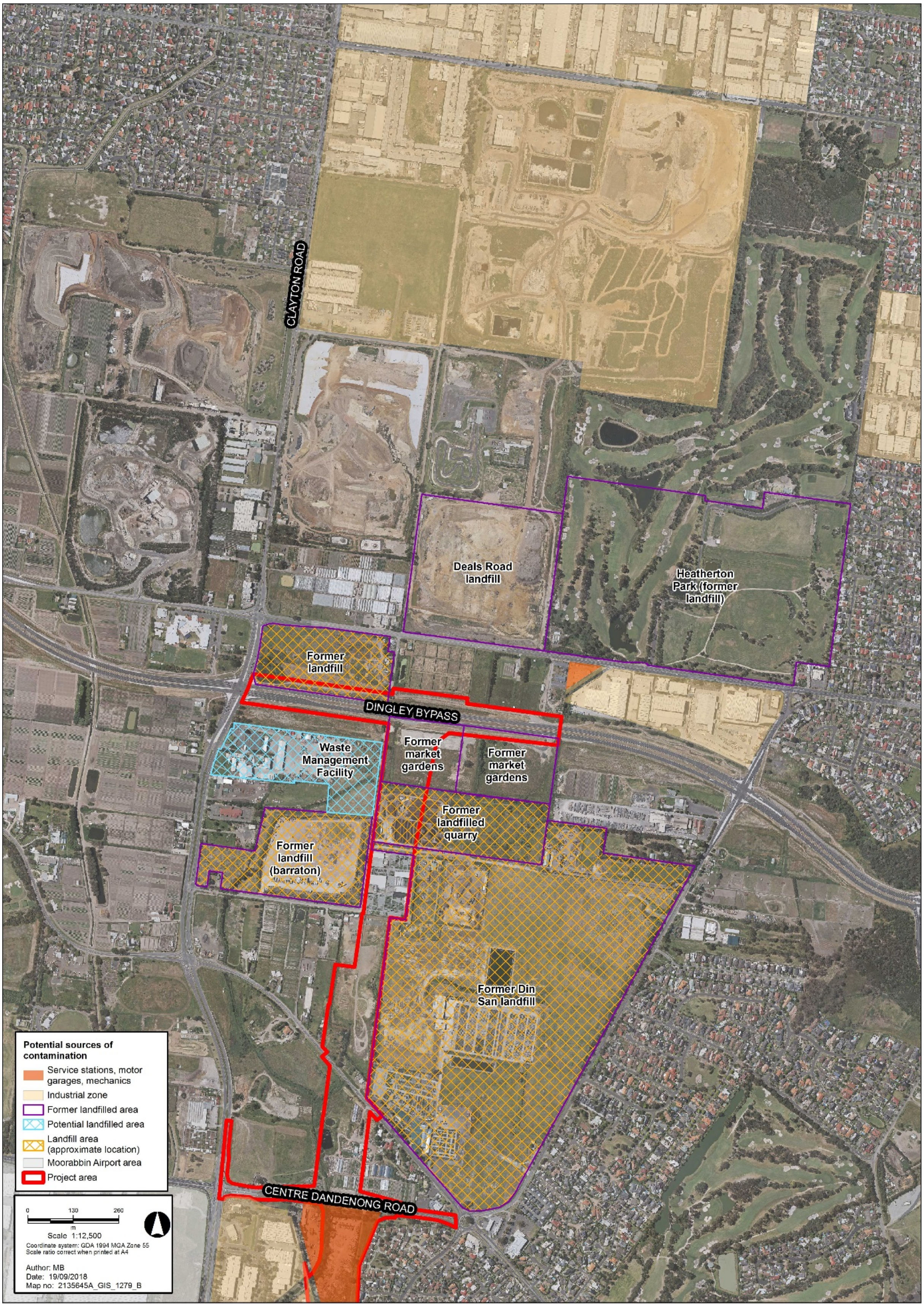



**Figure 18.3 Areas of potential contamination (northern portion)**

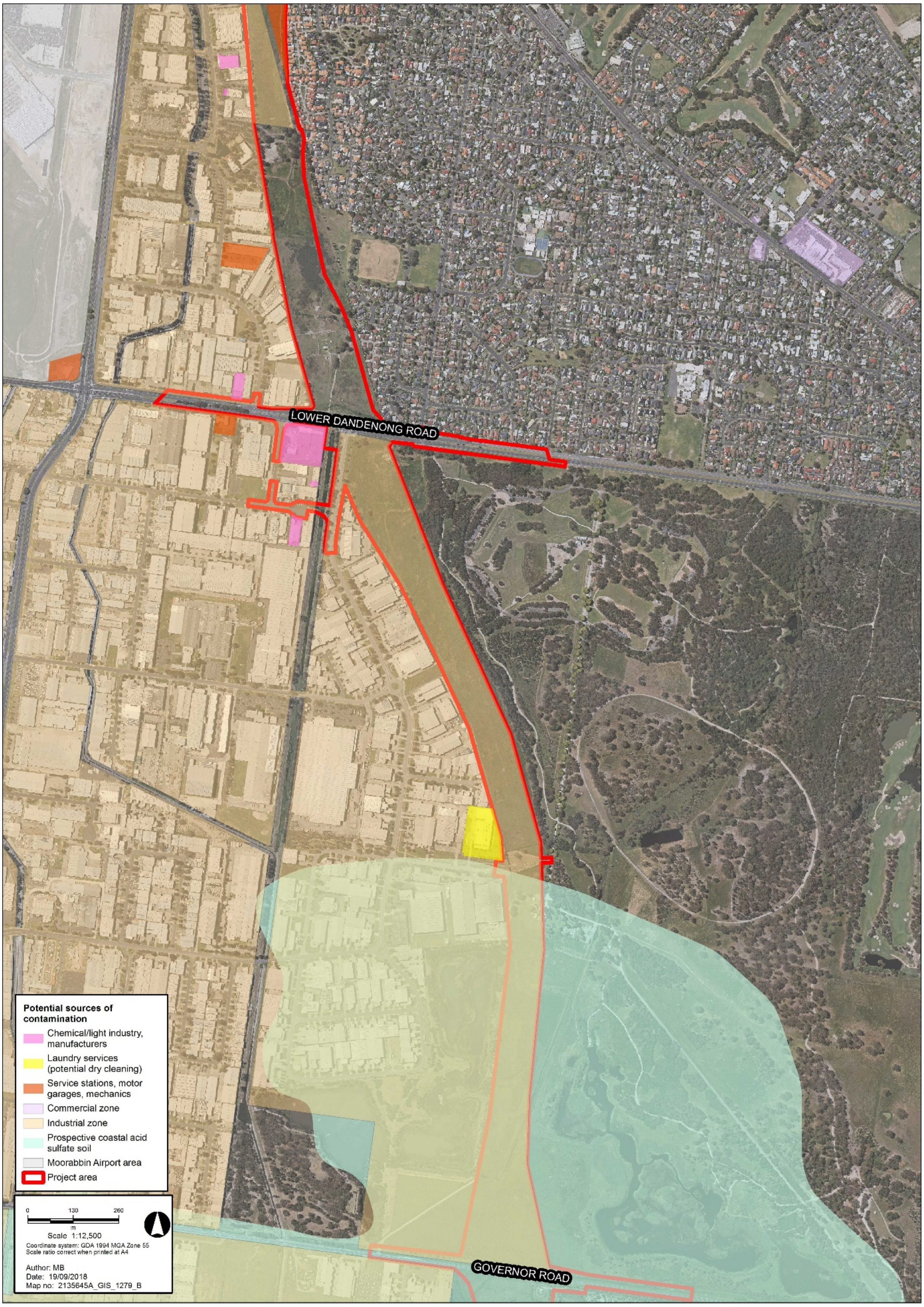
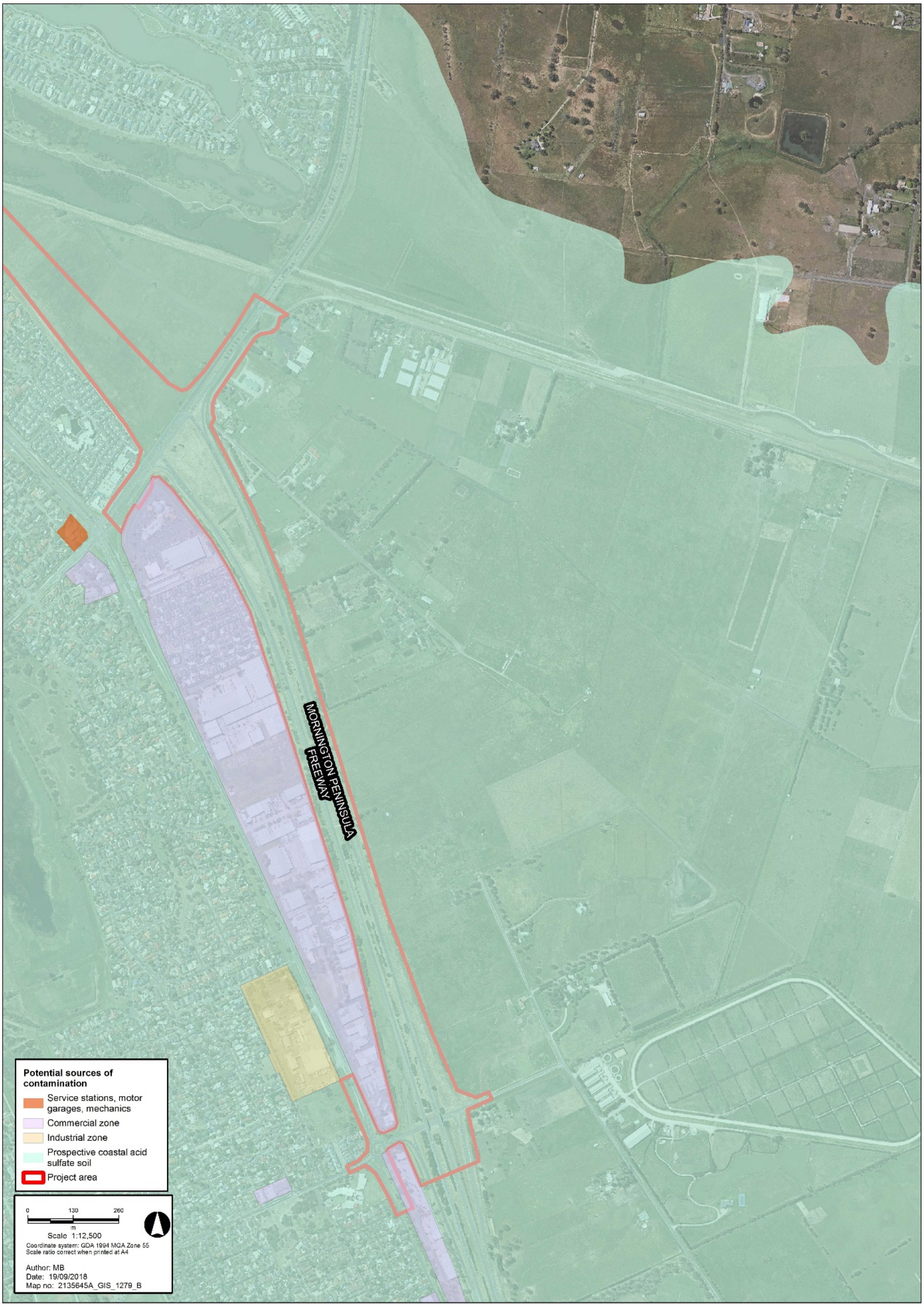



**Figure 18.4 Areas of potential contamination (central portion)**




## Figure 18.5 Areas of potential contamination (southern portion)

### Soil sampling results

Desktop and targeted field investigations were undertaken in areas of potential contamination. Soil samples were collected from 17 shallow soil boreholes and 35 soil excavation test pits. The results of the soil sampling were compared against NEPM 2013 criteria applicable to the project area's current and proposed future open space land use (i.e. roadway). Table 18.3 outlines the key findings of the soil sampling program and the soil classification. Figure 7.3 in Attachment III: *Maps and figures* shows where elevated levels of contamination, above adopted criteria, were measured. The maps also show the relevant criteria.

**Table 18.3 Key findings of the soil sampling program**

| Portion | Key findings | Soil classification |
|---|---|---|
| Northern | • Former Din San Landfill and several other former landfills.<br>• Contaminated soil, groundwater, landfill gas and leachate were identified associated with these sites.<br>• Elevated lead levels above the adopted human health criteria and hydrocarbon level above the adopted ecological criteria within the landfill site on Grange Road.<br>• Waste mass in the Grange Road landfill at approximately 2.5–10m depth below ground. | Fill material or Category C waste soil |
| Central | • Asbestos containing material, likely from illegal dumping, was identified at a depth of 80cm below ground at one borehole adjacent to Lower Dandenong Road.<br>• All soil results were below human and ecological criteria.<br>• PFAS contamination measured below adopted criteria in the vicinity of Moorabbin Airport. | Fill material or Category C waste soil |
| Southern | • Coastal ASS were identified within and around the project alignment related to the geology of the southern portion (coastal lagoon, swamp and lake deposits).<br>• All soil results were below human and ecological criteria. | Fill material |

In accordance with EPA Victoria's *Industrial Waste Resource Guidelines*, Category C is the lowest classification of prescribed industrial waste soil, these estimated locations of Category C soil are shown on Figure 7.4 in Attachment III: *Maps and figures*.

### Groundwater sampling results

Groundwater investigations focussed on the landfilled area in the northern portion of the project area. Two groundwater monitoring wells and one leachate well were installed and sampled. These locations, and the levels measured, are displayed in Figure 7.6 of Attachment III: *Maps and figures*. The landfill investigation showed:

- copper and zinc levels above the level required to maintain function of ecosystems
- nickel levels at the same location were high, and were above the level allowed for ecological and human health criteria
- acidic conditions (pH<5.5) which can potentially effect buildings and structures.

The leachate investigation within the landfill area found:

- elevated levels of benzene and metals (boron, nickel and zinc)
- benzene and boron levels were above the potable water, recreation, agriculture, parks and gardens and stock watering beneficial use criteria
- nickel levels were above the potable water beneficial use level, while zinc was above the level required to maintain ecosystem function.

A separate investigation was undertaken around the Edithvale Wetlands in the central and southern portions of the project area, including the installation and sampling of 38 bores. The water quality results showed:

- salinity and acidity levels varied more in the Quaternary (shallow) aquifer than the Brighton Group (deeper) aquifer
- BTEX (benzene, toluene, ethylbenzene and xylene), hydrocarbon and pesticide levels were not present (all below the laboratory detection limit in both aquifers).

**Landfill gas**

Investigation of the former landfill sites was undertaken to assess the potential presence of landfill gases. A total of 10 soil gas bores were installed to intercept any potential landfill gas which had migrated into the project area and to identify the location of potential sources and pathways. The location and measurements taken can be found in Figure 7.7 of Attachment III: *Maps and figures*.

The location of the former landfills is shown in Figure 18.6 and in Figure 7.1 of Attachment III: *Maps and figures*. The environmental status of the former Din San Landfill, currently a nursery, is documented in available audit reports and is known to have landfill gas present. A portion of the Din San Landfill extends into the northern section of the project area.

The results of the investigation found that:

- the former landfill area currently occupied by Enviromix contained methane and carbon dioxide levels above EPA *BPEM* action levels
- there is carbon monoxide at a level above the *SEPP (Air Quality Management)* level near the Din San Landfill
- hydrogen sulfide, hydrogen cyanide and ammonia were all below criteria across all bores
- volatile organic compounds were detected at one bore location opposite Din San Landfill and the Dingley Bypass.

**PFAS results**

Per and Polyfluoro-alkyl substances (PFAS) are a group of manufactured chemicals that have been used for over fifty years in fire-fighting foams, textile treatments, pesticides and stain repellents. PFAS are becoming contaminants of concern, because of evidence showing it is highly resistant to degradation and very persistent in the environment, as well as being highly soluble and mobile. PFAS also bio-accumulates in the food chain and in recent years, it has been found to be harmful to the environment and to human health.

Major sources of PFAS contamination are fire training grounds including airports, military bases and depots, relevant manufacturing facilities, landfills and wastewater treatment facilities.

Former landfill sites have been identified in the northern portion of the project area as shown on Figure 18.6 and there is potential for PFAS to be present in the leachate and groundwater beneath this portion of the project area. Moorabbin Airport is located to the west of the central portion of the project area. This is another potential source of PFAS contamination in soils and groundwater.

Three soil samples were collected from west of the landfill at Grange Road, Dingley Village. Three samples were collected in the central portion east of Moorabbin Airport. Groundwater samples were also collected in the northern portion and one in a down-gradient well of the landfilled areas and Moorabbin Airport. The environmental guideline values for soil, groundwater and surface water in the PFAS NEMP (HEPA, 2018) were adopted to assess the potential human health and ecological risks posed by PFAS.

In the northern portion, PFAS compounds were detected in groundwater samples at concentrations below the adopted investigation levels, and at a leachate well at the landfill at concentrations above the adopted investigation levels. PFAS compounds were also detected in sediment and surface water samples collected from Dunlop Drain immediately north of the landfill site at concentrations below the investigation levels.

In the central portion, PFAS compounds were detected in the groundwater samples at concentrations below investigation levels.

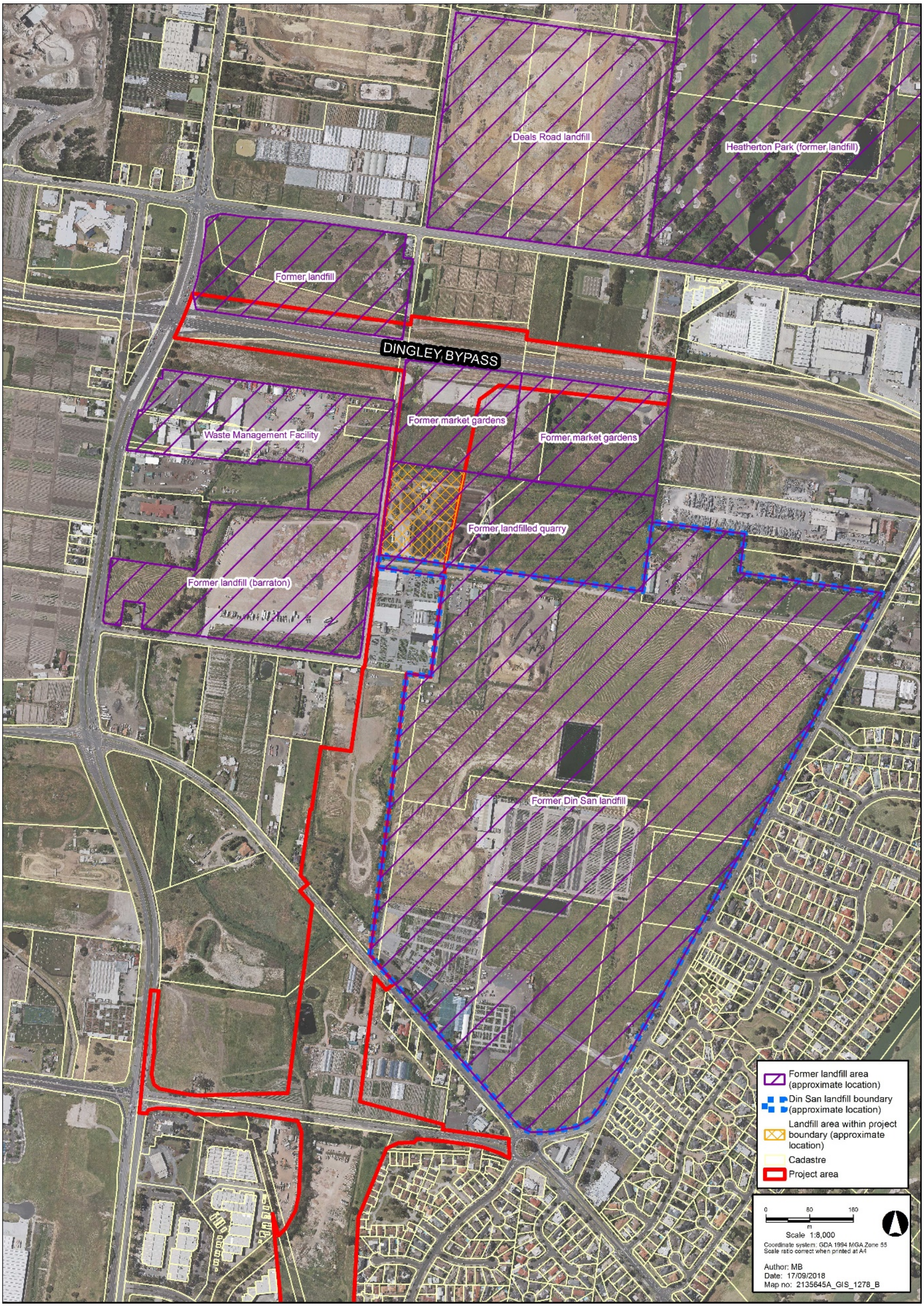



**Figure 18.6 Areas used as landfills in the northern project area**

### 18.6.3 Potential acid sulfate soils (PASS)

Coastal acid sulfate soil (CASS) mapping shows there is the potential for ASS extending to Braeside Park, between Governor Road and Lower Dandenong Road. No signs of PASS were identified during the site inspection except for the presence of common reeds in water logged areas.

Intrusive samples were taken in the central and southern portion of the project area to further investigate the presence of PASS. A total of 252 samples from 43 soil bores were taken for field pH measurements. Sampling density was higher in the areas identified as higher risk through the desktop assessment. Based on the field screening results, 55 samples were submitted for detailed laboratory analysis. The laboratory results showed PASS is present at depths between 0.5m and 20m from Mills Road, in the central portion of the study area, to the southernmost project boundary. The analytical results are consistent with the CASS mapping (Figure 18.4 and Figure 18.5). The PASS sampling location and locations levels were measured above the PASS action levels can be seen in Figure 7.5 of Attachment III: *Maps and Figures.*

Groundwater chemistry was also measured in the project area. Elevated sulfate and salinity levels were identified at monitoring wells adjacent to the Waterways wetlands suggesting CASS disturbance has occurred in the past.

## 18.7 RISK ASSESSMENT

An environmental risk assessment (ERA) was undertaken to identify environmental risks associated with the construction and operation of the project. Where initial risks were rated as 'medium' or higher (with standard controls in place) these issues were further assessed and investigated in the Groundwater Impact Assessment Report (Appendix L). Where necessary, additional controls were identified as part of the Impact Assessment to reduce the identified risks to acceptable levels. These controls have been incorporated into the environmental performance requirements (EPRs) for the project. The initial risks were then re-assessed following application of the EPRs to derive the residual risk ratings. The methodology for the risk assessment has been described in Chapter 4: *EES assessment framework and approach*.

Table 18.4 provides a summary of the key land contamination related risks identified. Only risk R-CL5 (exposing contaminated soil) had an initial risk rating of high. A range of other potential impacts were investigated and were determined to have an initial risk rating of medium. With additional mitigation in place the residual risk rating of R-CL5 is medium and all other risks are reduced to low.

The risk exposing ASS (Risk R-CL2) and encountering contamination during construction (Risk R-CL9) have an initial risk rating of low. As discussed in the *Impact Assessment* (Section 18.8) ASS and contaminated material has been identified during site investigations and is expected during construction, it can be managed through the implementation of standard management controls. Other potential impacts were found to be of low or negligible risk. These include the potential impacts from fuel and chemical spills due to loss of containment during construction and operation. For a full list of all contaminated land related primary risks, refer to Appendix L: *Contaminated land impact assessment*.

**Table 18.4 Contaminated land and PASS risk**

| Risk | Impact pathway | Primary impact | Project phase | Initial risk rating | EPR ref. | Residual risk rating |
|---|---|---|---|---|---|---|
| R-CL1 | Expose ASS — Inadequate characterisation of areas of ASS. | Structures inadequate designed (e.g. material durability) reduced lifespan.<br>Inadequate allowance for ASS management and disposal during construction. | D | Medium | CL2 | Low |
| R-CL2 | Expose ASS – ASS disturbed during construction. | Construction and excavation activities results in exposing ASS requiring management and specific off-site disposal requirements. Inferred piling construction methods therefore minimal waste soil generated. | C | Low | CL2 | Low |

| Risk | Impact pathway | Primary impact | Project phase | Initial risk rating | EPR ref. | Residual risk rating |
|---|---|---|---|---|---|---|
| R-CL5 | Contaminated land uncovered — Contaminated land exposed during construction. | Construction workers and/or members of the public exposed to contaminated material, and inadequate provision for the handling and disposal of contaminated material. | C | High | CL1<br>EM2 | Medium |
| R-CL6 | Landfill waste uncovered — Landfill waste (including PFAS) and gases uncovered during construction in northern project area. | Inadequate characterisation results in exposure and health and safety risks to construction workers, inadequate allowance for the management of landfill and contaminated materials. | C | Medium | CL3<br>CL6 | Low |
| R-CL7 | Landfill waste uncovered — Uncovering landfill waste that requires management and/or disposal.<br>Areas of existing groundwater contamination encountered causing migration of contamination. | Pre-construction investigations encounter landfill waste including leachate and landfill gas and PFAS. | D | Medium | CL3<br>CL4<br>CL6<br>W5 | Low |
| R-CL8 | Contaminated land uncovered — Investigations encounter contaminated soil and or groundwater. | Large volumes of contaminated waste soil requiring management and/or disposal encountered.<br>Areas of existing groundwater contamination encountered causing migration of contamination. | C | Medium | CL1<br>CL2<br>CL6<br>CL8 | Low |
| R-CL9 | Contaminated land uncovered – encountering contamination during construction. | Previously unidentified contamination encountered during construction process requiring management. Potential exposure and health and safety risk to construction workers. Potential exposure to third parties. | C | Low | CL1<br>CL2<br>CL4<br>CL6 | Low |
| R-CL12 | Landfill waste uncovered — Landfill wastes and leachate (including PFAS) and gases uncovered during maintenance works. | Ongoing management of contaminated waste or soil repositories, management of existing landfill, including gases and PFAS impacted leachate.<br>Potential health and safety risk to maintenance workers due to vapour and landfill gas accumulation in service pits and drains. | O | Medium | CL3<br>CL4<br>CL5<br>CL6<br>W5 | Low |

## 18.8 IMPACT ASSESSMENT AND MITIGATION

### 18.8.1 Construction

**Acid sulfate soil (Risk R-CL1 and R-CL2)**

Disturbance of ASS during construction could introduce oxygen and cause production of sulfuric acid. This could potentially impact the environment, in-ground structures and human health. The potential for environmental and health impacts from exposure of ASS is considered low.

The main activities during construction phase which have the potential to activate ASS would be during piling works proposed for the elevated structures in the bypass (within the central and southern portions) and during excavation of trenches.

Site investigations have identified the presence of potential and actual ASS in the central and southern portions of the project area. The estimated volume of ASS is not known at this stage but inferred to be over 1,000 tonnes. Given the nature of construction works, disturbance of ASS cannot be totally avoided. However, construction methods, such as driven piles can assist in minimising disturbance and oxidation of materials. A detailed sampling program was undertaken for the ASS investigations and, therefore, the existence and location of PASS is well understood. This understanding is adequate to develop a suitable management plan to manage the handling, storage and disposal of this material.

Prior to construction commencing, a Soil Management Plan (SMP) in accordance with relevant regulations, standards and best practice guidelines would be prepared and implemented (EPR CL1). The Soil Management Plan would include sub-plans as appropriate, including an Acid Sulfate Soil Management Plan (EPR CL2).

The Acid Sulfate Soil Management Plan would be prepared to the satisfaction of the EPA in accordance with the *Industrial Waste Management Policy (Waste Acid Sulfate Soils) 1999*, EPA Publication 655.1 Acid Sulfate Soil and Rock, and relevant EPA regulations, standards and best practice guidance (EPR CL2). The sub-plan would:

- identify locations and extent of PASS that could be disturbed or otherwise affected by the project
- assess potential impact on human health, odour impacts and environmental impacts
- identify and implement measures to prevent oxidation of ASS wherever possible
- implement construction material durability specifications where required
- identify suitable sites for management, reuse or disposal of ASS.

Soil predicted to be ASS should be immediately removed from the project area and transported to a facility licensed to accept such material. It is not recommended that ASS is stockpiled in the project area. A maximum of 18 hours' exposure to air without treatment is considered an acceptable timeframe according to the *Victorian best practice guidelines for assessing and managing coastal ASS*.

**Soil contamination (Risk R-CL5 and R-CL9)**

In the northern portion of the project area, available data indicates the likelihood of encountering contaminated soil in landfilled areas is high. There is also a potential to encounter waste mass, odorous material and PFAS. Asbestos material was found in the central portion of the project area, which may be a result of uncontrolled or illegal dumping, and PFAS is present near the Moorabbin Airport. Exposure to contaminated soil is known to be associated with a potential risk to human health and the environment.

The risk of impacts to human health and the environment resulting from exposure of contaminated soil during construction was initially rated as being high. This risk can be reduced through construction methods to minimise disturbance of contaminated land and the development and implementation of a CEMP and a SMP (EPR CL1).

The existing reference design indicates a negative cut/fill balance suggesting that excavated spoil should be reused onsite where possible. Spoil material would be categorised prior to excavation through an in-situ sampling program in accordance with relevant EPA guidelines and Australian Standards. This will further reduce uncertainty about the nature and extent of soil contamination and provide waste soil classifications prior to excavation.

It is anticipated that the project will need 1,120,000 cubic metres of imported soil. This estimate is preliminary only and based on the assumption that all excavated spoil is useable. Further information on the project's cut/fill balance is provided in Appendix L: *Contaminated land impact assessment*.

If soils are unsuitable for reuse, due to soil classification or geotechnical consideration, off-site disposal may be required. For excavated spoil that needs to be disposed of off-site, EPA Industrial Waste Resource Guidelines (IWRG) apply. Based on the limited assessment completed so far, and estimating quite conservatively, excavated spoil from the northern and central portions of the project area indicate Category C Contaminated Soil, and excavated spoil from the southern part of the project area indicates Fill Material, as defined by IWRG621. These estimates indicate that the volume of potential Category C Contaminated Soil is between 50,000 cubic metres and 65,000 cubic metres.

If off-site disposal of contaminated spoil is required, it must be to a landfill that is licensed to receive Category C Contaminated Soil. EPA does not regulate the off-site disposal of Fill Material. It is important to note that the assessment completed to date is preliminary and indicative only and further assessment is needed before any excavation spoil is disposed of off-site. The extra assessment will need to include investigation into PFAS (which EPA does not currently allow to be disposed of off-site to landfill). In addition, ASS and any asbestos containing materials will require specific management requirements.

Should on-site reuse of contaminated materials be preferred (including encapsulation of contaminated soil in the road embankments), further assessment in accordance with NEPM 2013 would be required to mitigate human health and ecological risks posed by contaminants in the fill. Where PFAS is present, assessment and management in accordance with the PFAS NEMP (HEPA, 2018) would be required.

Prior to construction commencing, a SMP in accordance with relevant regulations, standards and best practice guidelines would be prepared for inclusion in the CEMP. The SMP would be developed in consultation with the EPA and address the management requirements associated with the handling, storage, reuse and/or disposal of soils and asbestos containing material (EPR CL1). The SMP would outline the extent of known contamination, assign roles and responsibilities and provide guidance on materials tracking, monitoring and reporting.

The SMP will ensure that any contaminated material removed from site will be handled in line with *Environment Protection (Industrial Waste Resource) Regulations 2009,* including covering material during transportation. In addition, EPR B4 (outlined in Chapter 10: *Biodiversity*) restricts heavy construction vehicle use along Edithvale Road – further limiting the risk of contaminated soil from impacting the Edithvale-Seaford Wetlands.

#### PFAS (Risk R-CL6 and R-CL7)

PFAS is present in soil and groundwater in the targeted areas of potential contamination. PFAS is present in leachate and has the potential to migrate to groundwater and surface water where there is hydraulic connectivity. Exposure would only occur if the waste mass is disturbed during the construction phase for the road alignment, or if PFAS-impacted groundwater and/or leachate is encountered during construction. Application can be made to the EPA for classification to dispose PFAS impacted material to landfill if no suitable alternative is available.

Prior to construction commencing, a site-specific PFAS management plan would be prepared in accordance with EPA Publication 1669.1 Interim position statement on PFAS (EPA Vic 2017) and the Heads of EPAs Australia and New Zealand PFAS National Environmental Management Plan (PFAS NEMP) (HEPA 2018).

If PFAS contamination is identified at concentrations that warrant remediation, it would need to be treated in accordance with the PFAS NEMP (HEPA, 2018). Measures for leachate management and landfill monitoring in accordance with the PFAS NEMP (HEPA, 2018) would be adopted in a PFAS Management Plan as part of the CEMP (EPR CL6).

#### Groundwater and leachate contamination (Risk R-CL7 and R-CL8)

The available data indicates there is low pH-, metals- and methane-impacted groundwater in the northern portion of the project area due to former landfill sites. In addition, metals-, benzene- and methane-impacted leachate is also present. PFAS impacts are also present in leachate and groundwater in this portion.

The project area contains shallow groundwater (less than 5m Below Ground Level), which has the potential to ingress into road excavations. This is most likely to occur during the construction of embankments. The volume of inflow will depend on the construction methods and the extent of excavation. Piling works proposed for the elevated structures would also interfere with groundwater flow patterns and could create preferential pathways for contamination to migrate, including shallow contaminated soil being washed into underlying aquifers, leachate flowing directly into underlying aquifers, and by connecting the shallow and deeper aquifers. The transfer mechanism will depend on the piling method applied.

Exposure to contaminated groundwater presents a potential risk to human health and to the environment. A potential linkage between source, pathway and receptor has been identified in the northern portion (within former landfilled areas).

Deep excavations such as piling may result in preferential migration pathways between leachate, and the shallow and deep aquifers. Structures must be designed to avoid additional preferential pathways (EPR CL7). This can be achieved by driven pile which push aside material and leachate and sealing around the pile as it progresses into groundwater. Piling should be completed in accordance with existing standards and guidelines, including *AS2159-2009 Piling – Design and installation* and the UK guideline *Piling into Contaminated Sites*.

During and following construction, groundwater management and monitoring would be required to ensure that leachate and other contamination does not impact the groundwater because of the project. Chapter 16: *Surface water* outlines the requirements for a Water Management and Monitoring Plan (WMMP) (EPR W5).

The WMMP would be implemented for the project, requiring groundwater to be monitored for potential impacts throughout the construction phase and for a period of five years following construction (EPR W5). The WMMP would specify trigger levels (water quality in surface water bodies and groundwater) and detail contingency plans in the case trigger levels are exceeded.

Groundwater conditions in the southern portion of the site (specifically around Edithvale-Seaford Wetlands) have been investigated and a detailed discussion is provided in Chapter 17: *Groundwater* and Appendix K: *Groundwater impact assessment*. The outcome of the groundwater assessment shows that the project will have negligible impacts on groundwater levels or flow outside the embankment footprints.

#### Landfill gas (Risk R-CL6)

As discussed in Section 18.6.2, landfill gas has been identified in the northern portion of the site. The project would have an impact on the landfill gas migration if left unmitigated. The key risks identified at this location include:

- risk to construction workers
- gas accumulation beneath planned roadways presenting a fire and explosion risk for users and workers
- migration of gas into service trenches, voids and conduits increasing the potential for long-distance migration of gas away from site and risk to workers accessing those conduits
- dissolution of methane and carbon dioxide into groundwater impacting the water quality of Dunlop’s Drain and potentially migrating further downgradient and impacting off-site receptors.

The reference design shows the road passing on top of the former landfill (currently occupied by Enviromix) in the northern portion of the project. The cap of this former landfill is currently allowing gas to vent through to the atmosphere, and by covering the cap with the proposed roadway, the passive ventilation would be blocked. By blocking the current ventilation pathway, the gases would be redirected to an unknown location and subsequent unknown impact on the environment. A basic bridge structure, including a passive land fill gas capture and ventilation system, was assessed as the most suitable means of crossing the landfill. This structure would be at (or close to) ground level. Although the construction method is yet to be determined, it is expected that piles would be installed through the waste mass, using a specialised boring technique (displacement bore) that avoids bringing waste or soil to the surface. The piles would reinforce a concrete slab, forming the carriageway.

Landfill gas monitoring locations were installed to the north and south of the former landfill (currently occupied by Enviromix), along the alignment, to determine the extent of landfill gas impacted land. The monitoring locations indicated that sub-surface landfill gas concentrations within the project footprint, (but outside of the former landfill site) are below relevant action levels except for carbon monoxide and volatile organic compounds at one location beside the former Din San landfill. The presence of carbon monoxide and volatiles indicates there is the potential for landfill gas in this area and mitigation measures need to be taken to ensure accumulation does not occur.

Prior to construction commencing, a passive landfill gas capture and ventilation system must be developed for the landfill area to minimise accumulation of landfill gas below the roadway and minimise the potential for the roadway to alter the gas emission regime (EPR CL3).

The passive landfill gas capture and ventilation system must meet the landfill gas management requirements of the EPA's guideline *BPEM: Siting, design, operation and rehabilitation of landfills (EPA VIC 2015)* and *Workplace Exposure Standards for Airborne Contaminants (Safe Work 2013)*. Possible passive landfill gas capture and ventilation systems include:

- a coarse rock drainage layer and gas proof high density polyethylene liner (HDPE) would be installed on the surface below the concrete slab to provide a preferential gas flow path for the gas to flow to the environment
- the captured gas would be discharged to the environment through dedicated pipe or through bioremediation trenches.

Both of the above options would provide the landfill gas with a method to vent to the environment, and ensure that there is no accumulation of landfill gas beneath the roadway. An assessment will be made whether an elevated gas diffuser is required. In both situations, any services including power or surface drainage would be within the structure, above the surface of the landfill. However, to the north and south of the landfill, measures must be taken to ensure that landfill gases could not build up in underground services.

During detailed design, provision must be made for gas protection measures to be provided at all underground services, pits and other voids within the road reserve in locations where landfill gas is, or has the potential to be emitted (EPR CL3). The most effective measure of ensuring build-up of landfill gas does not occur in underground services is to seal all services with geomembranes.

In addition to the mitigation measures, a Landfill Gas Management Plan will be developed for both construction and operation of the project to monitor and manage the risks to service trenches (EPR CL4). The plan must be developed in consultation with the EPA and detail specific monitoring and risk mitigation requirements that are to be implemented during the construction phase to reduce landfill gas-related risks to neighbouring land users, site workers, plant and equipment.

#### Other waste streams (Risk R-CL5 and R-CL8)

Other waste streams that may be applicable to the project include:

- groundwater encountered during excavation works
- rainwater or surface water (as run-off) which come into contact with potentially contaminated excavated soils
- construction wastes.

Where excavation and interaction with groundwater would be required as part of the construction process, a Trade Waste Agreement (TWA) with the relevant water authority may be appropriate for managing waste groundwater. Where a TWA is not granted, waste waters can be stored, characterised and treated (if required) prior to off-site disposal or discharge to stormwater.

Solid, inert, liquid, organic and other chemical wastes generated are likely to be generated during the construction process and managed in line with the project CEMP (EPR EM2). The CEMP will outline specific strategies for waste management, listing the preferred treatment for each type of waste. For example, metal wastes produced on site will be either re used on site or recycled. No metal wastes can be disposed of to landfill.

#### Occupational health and safety impacts (Risk R-CL5 and R-CL6)

Construction activities in contaminated land may lead to impacts on worker health and safety through direct contact, inhalation or ingestion. Most of the road works would happen in natural soils, however, there is the potential for workers to interact with contaminated material, including soil and, potentially, landfill waste. The level of interaction is dependent on the tasks being undertaken, such as piling, which may remove contaminated soil or intersect groundwater requiring management. Additionally, digging a trench through potentially contaminated soils may cause contamination to become airborne via dusts. Where works are being undertaken in areas of contamination identified in the impact assessment, measures will be put in place and managed through the adoption of an occupational health and safety (OH&S) plan.

The OH&S plan will specify areas of potential hazard and appropriate level of control, for example, when excavating in areas of potentially contaminated soil, ensure correct Personal Protective Equipment is used, such as respirators and face masks.

In addition to the OH&S plan, measures to manage stockpiles are covered in the SMP within the CEMP (EPR CL1).

### 18.8.2 Operation

**Maintenance activities uncovering landfill waste (Risk R-CL12)**

The risk assessment identified the potential for impacts arising from maintenance activities, such as re-laying road surface and drainage works, uncovering landfill waste (including PFAS and gases). This risk was initially rated as medium.

The risk of impacts to human health and the environment can be minimised through the preparation and implementation of an operations phase environmental management plan (OEMP) for the project (EPR CL5). The OEMP would include requirements for an ongoing monitoring program including perimeter monitoring to assess landfill gas risk and ensure that there is no migration of gas to the north or south of the former landfill.

Implementation of these requirements through the EPRs would reduce this to a low risk.

## 18.9 ENVIRONMENTAL PERFORMANCE REQUIREMENTS (EPRs)

Table 18.5 lists the EPRs developed to avoid, manage and mitigate potential impacts from contaminated land and ASS, reducing residual risks to acceptable levels.

**Table 18.5 Environmental performance requirements**

| EPR number | Environmental performance requirements | Project phase |
|---|---|---|
| CL1 | **Soil Management Plan (SMP)**<br>Prior to the commencement of works (other than preparatory works referred to in the Incorporated Document), a Soil Management Plan (SMP) must be prepared and implemented in accordance with relevant regulations, standards and best practice guidelines. The plan must be developed in consultation with EPA Victoria and address the management requirements associated with the handling, storage, reuse and/or disposal of soils (clean fill and contaminated spoil).<br>The SMP must make provision for additional assessments to be conducted, where required, to more accurately locate sources of contamination and to refine management measures.<br>The SMP must follow published EPA guidance on contaminated soil management and reuse on major infrastructure projects.<br>The SMP must include an Acid Sulfate Soil Management Plan (EPR CL2) and management requirements for PFAS contaminated soils (see EPR CL6). | Pre-construction, Construction |
| CL2 | **Acid Sulfate Soil Management Plan**<br>Prior to the commencement of works (other than preparatory works referred to in the Incorporated Document), prepare an Acid Sulfate Soil Management Plan in consultation with EPA Victoria in accordance with the *Industrial Waste Management Policy (Waste Acid Sulfate Soils) 1999,* EPA Publication 655.1 *Acid Sulfate Soil and Rock*, and relevant EPA regulations, standards and best practice guidance. This plan must include:<br>• locations and extent of potential acid sulfate soils that could be disturbed or otherwise affected by the project<br>• assessment of potential impact on human health, odour and the environment<br>• measures to prevent oxidation of acid sulfate soils wherever possible, and<br>• suitable sites for management, reuse or disposal of acid sulfate soils. | Pre-construction, Construction |

| EPR number | Environmental performance requirements | Project phase |
|---|---|---|
| CL3 | **Passive landfill gas capture and venting**<br>A passive landfill gas capture and ventilation system must be developed where the roadway traverses the landfill area to facilitate the emission of landfill gas to the atmosphere so as to minimise accumulation of landfill gas below the roadway.<br>The passive landfill gas capture and ventilation system must meet the landfill gas management requirements of the EPA's guideline *Best Practice Environmental Management: Siting, design, operation and rehabilitation of landfills* (EPA Victoria 2015) and *Workplace Exposure Standards for Airborne Contaminants* (Safe Work 2013).<br>During design, provision must be made for gas protection measures to be provided at all underground services, pits and other voids within the road reserve in locations where landfill gas is emitted, or has the potential to migrate to.<br>The passive landfill gas capture and ventilation system(s) must be maintained for the operational life of the project except where otherwise agreed to by EPA Victoria. | All |
| CL4 | **Landfill Gas Management Plan (Construction)**<br>Prior to the commencement of works (other than preparatory works referred to in the Incorporated Document), a Landfill Gas Management Plan (Construction) must be prepared (EPR EM2). The plan must be developed in consultation with EPA Victoria and in accordance with relevant regulations, standards and best practice guidelines including, but not limited to, *Best Practice Environmental Management: Siting, design, operation and rehabilitation of landfills* (EPA Victoria 2015) and *Workplace Exposure Standards for Airborne Contaminants* (Safe Work 2013).<br>The plan must detail specific monitoring and risk mitigation requirements that are to be implemented during the construction phase to reduce landfill gas-related risks to neighbouring land users, site workers, plant and equipment.<br>The Landfill Gas Management Plan must:<br>• reference applicable regulatory requirements<br>• detail the nature and extent of contamination<br>• include details of design and construction requirements for passive landfill gas and venting systems<br>• define roles and responsibilities<br>• detail landfill gas monitoring and reporting requirements<br>• include monitoring requirements for explosive atmospheres and fire risks during construction<br>• include guidelines for work areas which constitute confined spaces, and<br>• include requirements for use of spark and flame emitting equipment, tools or plant during construction works. | Construction |
| CL5 | **Landfill Gas Management Plan (Operation)**<br>Prior to the completion of construction of the passive landfill gas capture and venting system (EPR CL3) a monitoring and management program for surface, sub-surface and internal/underground voids, pits and service trenches will be specified within a Landfill Gas Management Plan (Operation). The plan must assess ongoing risk associated with landfill gas generated by the former landfill(s) in the northern portion of the project area.<br>The plan must outline procedures for any future works within the project area, means of protection of in-ground gas protection/mitigation systems and monitoring and management requirements. | Operation |

| EPR number | Environmental performance requirements | Project phase |
|---|---|---|
| CL6 | **PFAS Management Plan**<br>Prior to the commencement of works (other than preparatory works referred to in the Incorporated Document), a site-specific PFAS management plan must be prepared in accordance with EPA Publication 1669.2 *Interim position statement on PFAS* (EPA Victoria 2018) and the Heads of EPAs Australia and New Zealand PF*AS National Environmental Management Plan* (PFAS NEMP) (HEPA 2018). | Construction |
| CL7 | **Landfill material**<br>Structures that penetrate the landfill must be designed and constructed to avoid the creation of additional pathways for contaminants to move from leachate to surrounding groundwater and minimise the need for landfill material to be removed. | Design, Construction, Operation |

## 18.10 CONCLUSIONS

The existing conditions were established through site history investigations which identified that the area had been used for various uses including former quarrying, landfilling, agricultural purposes and market gardening. Surrounding land uses have become predominantly industrial.

Key contaminants included landfill gases, inorganics (including ammonia, sulphides, nitrates), pesticides and herbicides, metals, phenolics, hydrocarbons and asbestos. There is also the potential for PFAS chemicals from the former landfill and nearby Moorabbin Airport. PASS have also been identified in the area.

EPRs have been developed to avoid, manage and mitigate potential impacts from contaminated land and ASS, reducing residual risks to acceptable levels. The former landfill in the northern portion of the site will require specific design treatments to ensure that landfill gas impacts are appropriately managed.

In all but one instance, the residual risk ratings following application of the EPRs is negligible to low. The exception is the residual risk rating of medium for the exposure of workers or members of the public to contamination from unidentified/unknown areas during construction activities. This risk will be managed through the development and implementation of a CEMP (EPR EM2), a SMP (EPR CL1) and a PHAS management plan (EPR CL6) containing processes and measures to manage contaminated soil in accordance with relevant standards, guidelines, statutory requirements and best practice. Through implementation of the EPRs the project would prevent adverse environmental or health effects from disturbing, storing or influencing the transport/movement of contaminated or acid-forming material.