16 Surface water and hydrology

Tables

Figures

16.1 OVERVIEW

This chapter provides an assessment of the potential impacts from construction and operation of the Mordialloc Bypass (Freeway) (the project) on surface water catchment values, specifically water quality and flooding. It is based on the impact assessment prepared by WSP and presented in Appendix J: *Surface water impact assessment*.

The project is located in the Dandenong major catchment area within the Mordialloc Creek waterway system, largely within the designated Braeside West, Waterways Wetlands and Smythes Drain surface water catchment areas. These catchments contribute tributary runoff flow to the larger Mordialloc Creek drainage system. The surface water impact assessment assessed the potential impacts of the project on flooding and the health of the waterways and wetlands that would receive runoff from the project.

This catchment supports multiple and varied uses and values, including residential, agricultural, industrial and recreational land uses. Existing water quality in Mordialloc Creek is classified as poor to very poor under the State Environment Protection Policy (SEPP) (Waters of Victoria). In addition, existing water quality in the Edithvale Wetlands is characterised by high turbidity, salinity and nutrients and is generally fed from stormwater runoff from neighbouring suburban streets.

There is the potential for water quality to be impacted during construction of the project. Erosion of areas of disturbed land could contribute to an increase of suspended solids. There is also potential for runoff to contain pollutants including contaminated sediments, oils and/or chemicals. Potential construction impacts will be mitigated through standard controls.

Construction activities also have the potential to temporarily worsen flooding due to the presence of temporary works in the floodplain. To reduce the impact, construction works would, wherever possible, occur outside the extent of the existing 1% Annual Exceedance Probability (AEP) floodplain. This is the area affected by a storm event with a one percent chance of occurring or being exceeded in any given year. Due to the extensive nature of the floodplain, some construction works would occur within the floodplain.

During operation, the assessment found that the reference design could achieve the required Water Sensitive Road Design (WSRD) targets for the project area as a whole. Exceedances of the target levels outlined in the Urban Stormwater: Best Practice Environmental Management Guidelines (BPEMG) occur at two outfall locations (at the project boundary. The BPEMG guidelines allows for a slight increase in pollutant levels as a result of a development, however due to the sensitive nature of the surrounding wetlands, the project has been designed to avoid increasing the pollutant load at Braeside Park Wetlands, Woodland Wetlands, Waterways Wetlands and Edithvale Wetlands. To maintain the existing ('no project') pollutant levels, both standard grassed swales and bio-retention systems have been incorporated. This ensures the existing surface water dependent ecological character is maintained during operation of the project.

A spill risk assessment was conducted for the operation phase to identify risks to waterway health associated with spills of fuels and oils during operation of the road. It was found that the highest risk areas were near outfalls which drain to the Edithvale Wetlands, Waterways Wetlands and Woodlands Industrial Estate Wetlands. These risks would be managed through the provision of spill containment at the stormwater discharge outfalls. Braeside Park Wetlands occur upstream of the project and will not be impacted.

To minimise the risk of flooding impacts, the project must be designed to achieve operational compliance with the requirements set out in *Melbourne Water standards for infrastructure in flood prone areas*, unless otherwise agreed with Melbourne Water. Flood impact mitigation measures have been adopted in the design to meet the key requirements of the Melbourne Water standards.

Through the implementation of the Environmental Performance Requirements (EPRs), the project would have minimal impact on surface water and floodplain environments and would minimise effects on water quality and beneficial uses, including the ecological character of the Ramsar-listed Edithvale-Seaford Wetlands.

16.2 EES OBJECTIVES AND REQUIREMENTS

The draft evaluation objective for water, catchment values and hydrology is defined in the *Scoping Requirements for Mordialloc Bypass Environment Effects Statement* (scoping requirements) (DELWP 2018).

Table 16.1 summarises key issues for water, catchment values and hydrology as identified in the scoping requirements. It should be noted that this chapter only addresses requirements related to surface water aspects. Groundwater aspects, including the interaction between surface water and groundwater are addressed in Chapter 17: *Groundwater*, and potential effects on biodiversity values are addressed in Chapter 10: *Biodiversity*.

DRAFT EVALUATION OBJECTIVE

To minimise adverse effects on groundwater, surface water and floodplain environments and minimise effects on water quality and beneficial uses, including the ecological character of the Edithvale-Seaford Wetlands Ramsar site.

Table 16.1 EES key issues – surface water, catchment values and hydrology

Key issues
The potential for adverse effects on the functions, values and beneficial uses of surface water environments (including Braeside West and Mordialloc Creek Wetlands, Waterways wetlands, Woodlands Industrial Estate wetlands, and associated Mordialloc Creek drainage system) due to the project, such as interception or diversion of flows or changed water quality or flow regimes during construction and operation.
The potential for adverse effects on the functions, values and beneficial uses of groundwater due to the project, in particular on groundwater dependent ecosystems (GDEs) and the ecological character of the Edithvale-Seaford Wetlands due to changes in groundwater levels, behaviour or quality.
The potential for adverse effects on nearby and downstream water environments (including the Mordialloc Creek catchment and Edithvale-Seaford Wetlands) due to changed flow regimes, floodplain storage, run-off rates, water quality changes, or other waterway conditions during construction and operation.
The potential for adverse effects on biodiversity values of the Edithvale-Seaford Wetlands Ramsar site including, but not limited to: • Australasian Bittern; and • Sharp-tailed Sandpiper.

16.3 LEGISLATION AND POLICY

Key legislation and policies relevant to surface water considerations for the project are outlined in Table 16.2. Full details are provided in Appendix J: *Surface water impact assessment.*

Table 16.2 Legislation and policy – water, catchment values and hydrology

Legislation/policy	Description
Commonwealth:	
National Water Quality Management Strategy (NWQMS), 1994	NWQMS is the Australian and New Zealand governments joint approach to improving water quality in waterways. The objective of the NWQMS is to achieve sustainable use of water resources by protecting and enhancing their quality, while maintaining economic and social development. The NWQMS provides a framework for the community and government to develop and implement management plans for catchment, aquifer, coastal waters and other water bodies. The NWQMS includes guidelines covering water quality benchmarks, groundwater management, diffuse and point sources, sewerage systems, effluent management, and water recycling.

Legislation/policy	Description
Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act)	Prescribes the Commonwealth's role in environmental assessment, biodiversity conservation, and managing protected areas and species, population and communities and heritage items. The Act is the Commonwealth's principal environmental protection and biodiversity conservation legislation. It provides for the conservation of biodiversity and the protection of the environment, particularly the nine Matters of National Environmental Significance (MNES), which including World Heritage Properties, National Heritage Places, Ramsar wetlands, nationally listed threatened species and ecological communities and listed migratory species. The Act states that 'controlled' actions, i.e. actions that are determined as likely to have a significant impact on a MNES, are subject to assessment and approval under the Act.
State:	
Environment Protection Act 1970 (Vic)	The *Environment Protection Act 1970* aims to prevent pollution and environmental damage by setting environmental quality objectives and establishing programs to meet them. The Act establishes the powers, duties and functions of the Environment Protection Authority (EPA). These include the administration of the Act and any regulations and orders made pursuant to it, recommending SEPPs, issuing works approvals, licences, permits, pollution abatement notices and implementing National Environment Protection Measures (NEPM).
State Environment Protection Policy (SEPP) (Waters of Victoria), 1988	The SEPP (Waters of Victoria) sets the framework for the protection of the uses and values of Victoria's surface water environments. The policy: • sets out the uses and values of water environments that communities want to protect (known as beneficial uses) • establishes objectives and indicators that describe the environmental quality required to protect beneficial uses (known as environmental quality objectives) • provides guidance to authorities, agencies, businesses and communities to protect and rehabilitate environmental water to levels to meet the environmental objectives (known as the attainment program).
Draft State Environment Protection Policy (SEPP) (Waters), 2018	A proposed new SEPP is expected to replace the existing SEPP (Waters of Victoria) and SEPP (Groundwaters of Victoria) sometime in 2018. The draft SEPP is currently at public consultation stage. The new SEPP's key change is combining the surface waters and groundwaters SEPPs into a single SEPP. The new SEPP also contains a proposed new 'urban' segment and corresponding water quality objectives.
Water Act 1989 (Vic)	The *Water Act 1989* provides the legal framework for water management and use in Victoria, including the issuing and allocation of water entitlements and the provision of water services by state-owned water corporations and catchment management authorities. Under the Act, Melbourne Water Corporation (Melbourne Water) is the designated waterways, regional drainage and floodplain management authority for the Port Phillip and Westernport catchment region.
Urban Stormwater: Best Practice Environmental Management Guidelines (BPEMG), 1999	The BPEMG was developed in 1999 by the CSIRO, and outlines best practices for managing urban stormwater. It defines the acceptable limits for pollutant loading and defines what measures should be taken to minimise impacts. The BPEMG forms the basis of the VicRoads, City of Kingston and Melbourne Water guidelines.

Legislation/policy	Description
Melbourne Water Corporation By-Law No.2: Waterways, Land and Works Protection and Management (2009)	The objectives of Melbourne Water By-Law No. 2, made under the *Water Act 1989*, are: • the management, protection and use of lands, waterways and works under the management and control of Melbourne Water • preventing or minimising interference with or obstruction of the flow of water • preventing or minimising the silting up of a designated waterway or designated land or works or any injury to or pollution of it or them, including prohibiting the deposit of material in or near it or them • prohibiting or regulating the removal of any material from land forming part of a designated waterway or designated land or works • regulating activities carried out on land forming part of a designated waterway or designated land or works; and • the general management and control of any designated waterways or designated land or works. The By-Law prohibits works and certain activities on designated waterways or designated lands or works without a permit issued by Melbourne Water.
VicRoads Integrated Water Management Guidelines (2013)	VicRoads has developed the Integrated Water Management Guidelines (IWMG) to set the direction for the management of water resources during road construction, operation and maintenance activities. The development of the IWMG is in response to current and emerging issues that are impacting on the management of water resources, including: • climate change – reduced availability of potable water supplies and added pressures on the stormwater system • population growth – higher demand for limited water supplies and pollution pressures • regulatory and policy – water restrictions and regulated water management requirements • economic – increasing charges for the purchase and use of water resources • knowledge and technology – developments in water recycling, stormwater reuse and water sensitive road design
Local:	
Kingston and Greater Dandenong Planning Scheme, 2018	These planning schemes are statutory document which set out objectives, policies and provisions for the use, development and protection of land. Project works need to be carried out in areas subject to planning scheme flooding overlays, meaning that planning permits would be required. Further details are set out in Chapter 4: *Land use and planning*.
Kingston's Integrated Water Cycle Management strategy (IWCM), 2012	The IWCM strategy sets out a process for managing stormwater runoff quantity and quality. The stormwater design for this project needs to be consistent with the objectives of this strategy.

16.4 METHODOLOGY

The surface water impact assessment methodology included:

- desktop assessment of existing water assets in the study area, including drainage assets, waterways and floodplains
- investigations of the existing condition of water assets, including water quality and flow regime
- water quality and flood conditions assessment and modelling
- a risk assessment consistent with the methodology outlined in Chapter 4: *EES Assessment framework and approach*
- assessing the impacts of the project during construction and operations
- identifying any additional measures (over and above standard surface water management practice) to be taken for the project to minimise potential impacts, and incorporating these within the environmental protection requirements (EPRs)
- assessing the residual risks following implementation of the EPRs.

The extension of the project to include new ramps at Thames Promenade required the impact assessment, including water quality and flood modelling, to be updated to cover this area. Appendix J: *Surface water impact assessment* includes further details on methodology.

16.4.1 Water quality assessment

The water quality assessment involved a desktop review of water quality reports and previous study reports and modelling to establish the existing pollution flowing into nearby wetlands, including Edithvale Wetlands, Woodlands Industrial Estate Wetlands and Waterways Wetlands. Modelling (using the MUSIC software program) compared surface water pollution in the existing environment to that with the project in place. The modelling considered total suspended solids, nutrients (total phosphorus and total nitrogen), litter and water flows.

Each of the catchments were modelled and compared to the BPEMG and the Integrated Water Management Guideline, which outlines specific requirements for Water Sensitive Road Design (WSRD). The total pollutants from the project's reference design drainage system were assessed to ensure the proposed mitigation measures could achieve the pollutant reduction targets for the overall catchment. The drainage outfall locations with the potential to impact on sensitive receptors were individually assessed and targeted environmental controls and mitigation measures were identified.

In addition, a spill risk assessment was completed to assess the potential for water quality to impacted by major spills caused by traffic accidents. The spill risk assessment looks at the likelihood of and where an accident would happen, the location of the outfalls and the distance to the receiving waterbody. If there is a high chance of impact, additional mitigations need to be implemented by the project.

SENSITIVE RECEPTOR

A sensitive receptor, for water quality purposes, is an environment, community, or place that is sensitive to changes in water quality. A sensitive receptor could be a downstream water user that requires a specific quality of water for food production, or in the case of the project, an important ecological habitat that is sensitive to water quality such as the Edithvale Wetlands Ramsar site.

OUTFALL LOCATION

An outfall location is where the water leaves the project area. Outfall locations can be to council drains, Melbourne Water drains or directly to waterbodies like the Waterways Wetlands.

16.4.2 Flow regime assessment

The project will change catchment ground cover characteristics and, possibly, redistribute the flow in waterways downstream of the project. It is important to understand the magnitude of such changes on these waterways, especially those waterbodies sensitive to the surface water inflow. Stream flow data was reviewed to understand existing water flows for waterways within the study area. A water balance model was also developed to assess combined surface water and groundwater impacts on Edithvale Wetlands. The water balance model is discussed in Chapter 17: *Groundwater* (Section 17.4.2 and 17.7).

Flows at other water sensitive receptors were simulated by rainfall runoff modelling (using the MUSIC software program). The model was calibrated in accordance with recommendations in the Melbourne Water guideline; *Input parameters and modelling approaches for MUSIC users in Melbourne Water's service area* (Melbourne Water, 2018).

16.4.3 Flooding assessment

Flood modelling was undertaken to define existing flood conditions in the study area, focussing on the project area itself. This was followed by a detailed flood impact analysis and an investigation of mitigation options.

Modelling software was used to establish flood and stormwater flow estimates, and to estimate flood levels and extents. A range of design flood events were assessed under the existing scenario, specifically the 20%, 5% and 1% annual exceedance probability (AEP) events, however, only the largest event, 1% AEP, has been reported and discussed within the impact assessment and this chapter. Other events are assessed to refine drainage system design and to satisfy Melbourne Water's requirements outlined in *Melbourne Water standards for infrastructure projects in flood-prone areas* (2018).

ANNUAL EXCEEDANCE PROBABILITY (AEP)

The AEP is the likelihood of occurrence of a flood of given size (or larger) occurring in any one year. A 1% AEP is equivalent to a 1 in 100 year storm event.

16.4.4 Climate change

The potential effect of climate change on the water quality and flow regime in the study area was assessed based on the *Guidelines for Assessing the Impact of Climate Change on Water Supplies in Victoria* (DELWP 2016). The flooding assessment of the project under a climate change scenario used the 1% AEP event for the 2100 climate prediction. In accordance with *Melbourne Water standards for infrastructure projects in flood-prone areas* (2018), the 2100 climate scenario incorporates a 19 percent increase in rainfall intensity and a 0.8m increase in sea level.

16.5 STUDY AREA

The study area for the surface water impact assessment, including flood (hydrologic and hydraulic) modelling includes the project area and its contributing catchments (Figure 16.1). The study area covers the areas over which surface water flows before reaching the project area, as well as surface water flows within and leaving the project area. Surface water that flows through, or rainfall that falls upon, the project area will enter Port Phillip Bay, unless it evaporates or seeps into the ground before reaching the bay.

Existing surface water characteristics (including observational data) within the study area are used to model and predict the impacts of the project.

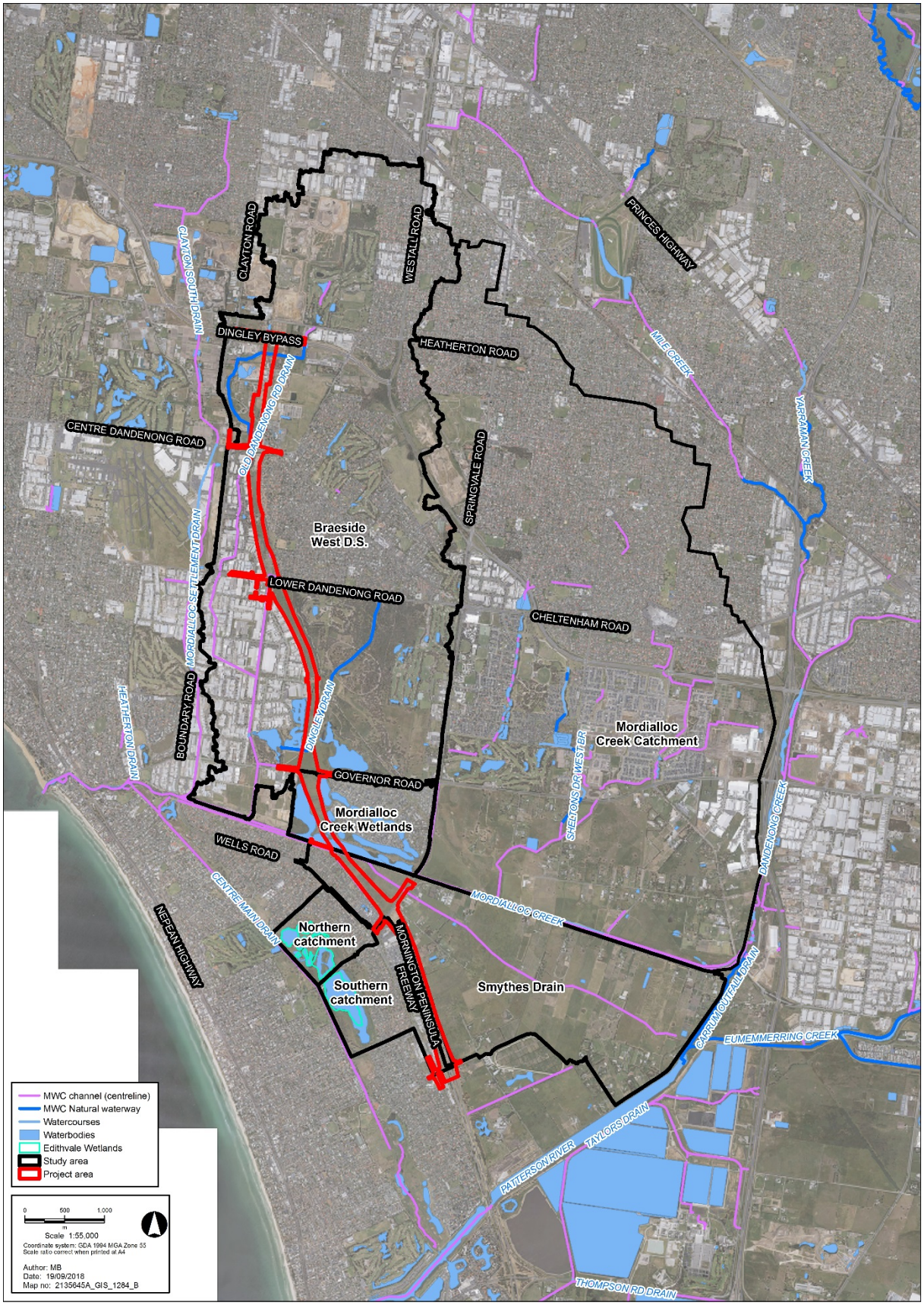

Figure 16.1 Study area and catchments that interact with the project area

16.6 EXISTING CONDITIONS

16.6.1 Regional context

The project is located within the Dandenong catchment area and Mordialloc Creek waterway system (Figure 16.1), both of which eventually drain to Port Phillip Bay. This assessment has focused on sensitive receptors and associated outflows near the project.

The Lower Dandenong Creek, Patterson River and Mordialloc Creek were all created to drain the once extensive Carrum Carrum Swamp that existed before European settlement. Dandenong Creek flows into Mordialloc Creek and the Patterson River via diversion structures upstream of Perry Road in Dandenong South. The main tributaries of Mordialloc Creek include the Haileybury Drain, Keysborough South Drain, Smythes Drain, Heatherton Drain, Mordialloc Settlement Drain and Braeside West Drain.

Key sites within the catchment include Woodlands Industrial Estate Wetlands, Braeside Park Wetlands, Mordialloc Creek Wetlands (also known as Waterways Wetlands) and several retarding basins.

The Edithvale Wetlands are remnant ecosystems in the southern part of this system. They have cultural significance as the last and deepest remnant of the once extensive Carrum Carrum Swamp. These wetlands provide important habitat for various birds and wildlife and have been identified as internationally significant under the Ramsar Convention. This is explained in more detail in Chapter 22: *Matters of national environmental significance*.

16.6.2 Catchment description

Figure 16.1 shows the major surface water catchments that occur within the project area. These are the catchments that interface with the project. They are:

- Braeside West catchment
- Mordialloc Creek Wetlands catchment
- Smythes Drain catchment.

These catchments contribute tributary runoff flow to the larger Mordialloc Creek drainage system.

The Braeside West catchment is consistently flat and covers an area of approximately 21km^2 within the municipalities of Kingston and Greater Dandenong. This is the largest catchment in the project area. It consists of residential, industrial, special use and green wedge zones. The Braeside West Drain is the main drainage asset for this catchment, and it discharges to the Mordialloc Main Drain about 1km east of the Wells Road Bridge. The project crosses the Braeside West Drain and several tributary drains.

The Mordialloc Creek Wetlands catchment is also very flat and covers an area under 2km^2 within the municipality of Kingston. The catchment includes topographical low points (micro-depressions) which act as hydraulic pathways that allow plants (such as the Aquatic Herbland EVC) to flourish due to the increased availability of water (refer to Chapter 10: *Biodiversity*). It contains the medium- to high-density residential suburb of Waterways surrounding a wetland and lake system. Drainage occurs through the network of constructed wetlands, with eventual discharge into the Mordialloc Creek Main Drain.

A southern section of the project crosses the Smythes Drain catchment area, which is separated from Mordialloc Creek by a levee bank. Smythes Drain is within the municipalities of Greater Dandenong and Kingston and has a catchment area of approximately 7km^2. The catchment consists mostly of green wedge zone. The catchment area is very flat and no external stream or drain flow enters across its boundaries.

16.6.3 Wetlands

Edithvale-Seaford Wetlands

The Ramsar-listed Edithvale-Seaford Wetlands is a significant waterbody receiving water mainly from the regional drainage system. The key functions of the wetlands, with respect to surface water, include:

- receiving, retaining and diverting stormwater and other surface runoff
- providing critical flood storage capacity that protects surrounding and downstream properties from flooding
- helping protect Port Phillip Bay's water quality by retaining and treating stormwater and other runoff (Ecology Australia 2016).

The wetlands also provide important habitat to significant migratory bird species as outlined in Chapter 10: *Biodiversity* and Chapter 22: *Matters of national environmental significance.*

Only the Edithvale component of the Edithvale-Seaford Wetlands are relevant to the project. Figure 16.2 shows the extent of surface water catchment areas for the northern and southern portions of the Edithvale Wetlands. The sections are described as:

- Edithvale south wetlands comprises a natural depression on the south side of Edithvale Road with its lowest point at 0.3m below sea level (GHD 2006). The south wetlands are predominantly fed by three drains from catchments to the east via sediment ponds at the edge of the water plant zone. Surface water from a small part of the project area drains into the Edithvale south wetlands; the area on the western side of the Mornington Peninsula Freeway between Thames Promenade and Springvale Road.
- Edithvale north wetlands predominantly comprise a series of constructed wetlands within the former floodplain on the north side of Edithvale Road. Stormwater enters the wetlands from stormwater drains to the east, via two sediment ponds and from Edithvale south wetlands via a pipe under Edithvale Road. A series of weirs control water flow between different wetland cells (meaning different individual pools or ponds of water within the wetlands) and limit total drawdown during prolonged dry or drought conditions. A series of drains and overland flow provide the stormwater that supplies these cells. No surface water flows from the project area into the Edithvale north wetlands, except that which has first passed through the Edithvale south wetlands.

Other key wetlands

Other key wetlands near, or within, the project area include:

- Braeside Park Wetlands – a constructed wetland that forms part of Braeside Park upstream of the project. Flood modelling indicates stormwater does not flow into the Braeside Park wetlands from the project area; therefore, no water quality impacts are expected to occur because of the project. Also, there is an existing levee protecting the wetland from floodwater in the surrounding area.
- Waterways Wetlands – these comprise two systems – Mordialloc Creek system at the southern edge of the wetlands and four constructed wetland cells, forming a treatment system for stormwater from the 2720ha urban area that drains into it. These wetlands are replenished by diverted flow from Dandenong Creek and backwater from Mordialloc Creek during flooding periods. The project area passes through a strip of land between the overflow wetland cell and the other three wetland cells.
- Woodland Industrial Estate Wetlands – these constructed wetlands are located downstream of the project among the gum trees and open area of the Woodlands Industrial Estate.

Surface water-groundwater interaction

The Edithvale Wetlands and other key wetlands are primarily fed by surface water, not groundwater. Geochemical analysis of water samples taken at the wetlands indicate they are predominantly comprised of rain water rather than groundwater. The Edithvale Wetlands experience greater surface water-groundwater interaction, but this varies significantly between the different wetland cells.

Surface water-groundwater interaction is discussed in more detail in Chapter 17: *Groundwater* (refer to Section 17.6.6, 17.7.1 and 17.7.3).

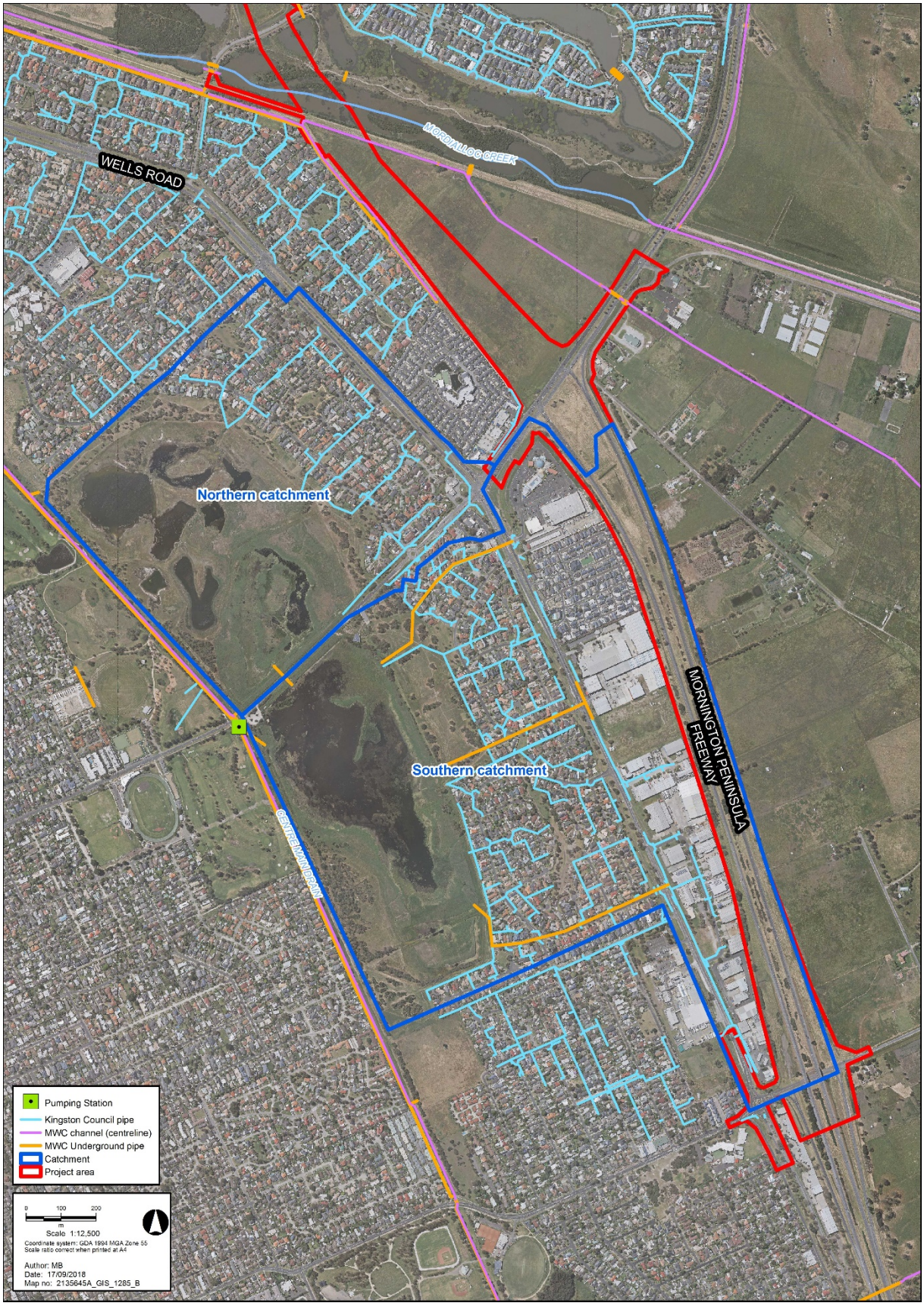

Figure 16.2 Catchment area of the Edithvale Wetlands

16.6.4 Water quality and flow regime

Watercourses and wetlands within project area

Both the Braeside West catchment (including Woodlands Industrial Estate Wetlands) and Waterways Wetlands contribute tributary runoff flow to and bounded by Mordialloc Creek to the south. Mordialloc Creek can be described as an artificial estuarine waterway which discharges to Port Phillip Bay and is bounded by levee embankments.

Water quality investigations used available data from Mordialloc Creek at Wells Road for understanding the existing environment and assessment of potential project impacts. The Wells Road site is located downstream of the project.

Despite showing a general improvement since 2000, water quality in Mordialloc Creek at the Wells Road site is still classified as very poor. Figure 16.3 shows that all water quality parameters in 2016 were classified as very poor or poor, except for pH. The Water Quality Index (WQI) is an aggregate of the ratings from the different parameters shown in the graph.

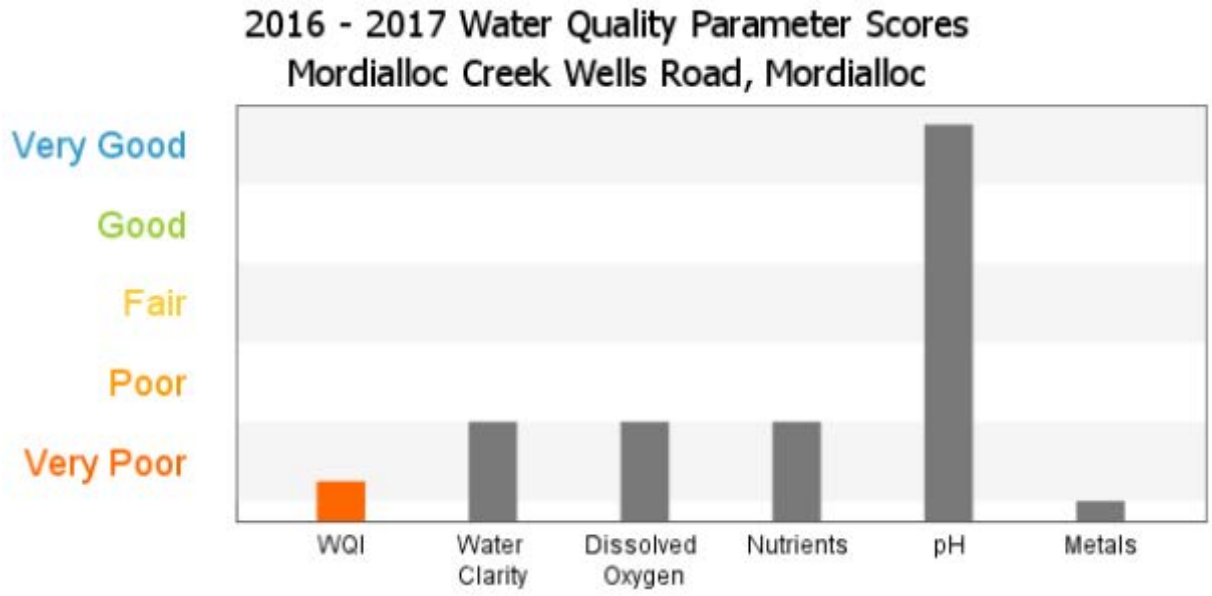

Figure 16.3 Details of water quality index (WQI) of Mordialloc Creek at Wells Road 2016–2017

Water quality data within the wetlands was also collected for the groundwater study as part of this EES to coincide with the groundwater monitoring events. Table 16.3 summarises the surface water sampling results for the three sampling events, between August 2017 to March 2018. Edithvale Wetland cell naming is shown in Figure 16.5. Refer to Section 17.4.1 of Chapter 17: *Groundwater* for more information on sampling at surrounding wetlands.

Water types of each samples can be graphically represented by plotting relative concentrations of major ions on a Piper trilinear diagram (Figure 16.4). The results from the baseline sampling program show two distinctive water types within the surface water samples. Samples collected from the northern Edithvale Wetlands show a similarity in water chemistry while samples collected from all the other wetlands including the southern Edithvale wetlands show distinctively different chemical signature.

Further water chemistry analysis also indicates that Edithvale Wetland cells, EN2, EN3, EN3a and the “Dog pond” are chemically similar to the groundwater samples, whilst all Edithvale Wetland cells ES1 and EN1 and samples collected from the other wetlands and creeks are chemically similar to Melbourne rainfall. Detailed geochemical analysis concluded that Edithvale Wetlands cells EN2, EN3, EN3a and the ‘Dog Pond” are in connection (i.e. interact) with groundwater. Whilst the remaining waterways and wetlands are sustained by rainfall and run off.

Table 16.3 Summary of surface water quality sampling for the project

Location	Woodlands Industrial Estate and Braeside Park Wetlands	Waterways Wetlands and Mordialloc Creek (within project area)	Edithvale Wetlands
Field electrical conductivity	Fresh; 375 µS/cm (Braeside Park) and 450 µS/cm (Woodlands Industrial Estate).	Fresh to marginal; field EC values ranging from 293 µS/cm to 954 µS/cm.	Wetland cells ES1, EN1, EN3, and EN3a: marginal to brackish salinity; EC ranging from 1,151 µS/cm (ES1) to 4,016 µS/cm (EN3). EN2 is saline (EC 20,954 µS/cm to 23,386 µS/cm) and Dog Pond hypersaline (81,644 µS/cm Feb 2018). Seasonal variation apparent.
Field pH	Circumneutral; 7.46 (Braeside Park) and 7.52 (Woodlands Industrial Estate).	Neutral to slightly alkaline (7.40 to 8.21).	Circumneutral to alkaline (pH 7.22 to 8.49).
Major ions	Na-HCO3-Cl	Na-Cl-HCO3	ES1 and EN1 – Na-Cl-HCO_3; EN2, EN3, EN3a and the Dog Pond -Na-Mg-Cl-SO_4.
Dissolved metals	No exceedances above ANZECC 2000 FW 95% guidelines.	Minor exceedances of dissolved metals concentrations were reported for Al, Cu, and Zn above the ANZECC 2000 FW 95% guidelines.	Some exceedances of ANZECC 2000 FW 95% guidelines: B at EN2 (1.57 mg/L to 1.61 mg/L); Ni at Dog Pond (17 µg/L); Zn (9 µg/L) and Cu (4 µg/L) at ES1.
Nutrients	Nutrient concentrations were close to or below the limit of reporting with the exception of reactive phosphorus (0.33 mg/L) at Braeside Park Wetlands.	All nutrients were typically at low concentrations close to the limit of reporting.	Nitrate (as N) detected at ES1 (<0.01 mg/L to 0.06 mg/L) and EN3 (<0.01 mg/L to 0.04 mg/L). Reactive phosphorus (as P) detected in most wetland cells with highest concentration at EN1 (0.39 mg/L). Ammonia (as N) was detected in all wetland cells with the highest concentration detected at ES1 (5.66 mg/L).
BTEX compounds	Total BTEX below limit of reporting (1 µg/L).	Total BTEX below limit of reporting (1 µg/L).	Total BTEX below limit of reporting (1 µg/L).
Petroleum hydrocarbons	Low level of heavy fraction hydrocarbons detected at Braeside Park Wetlands.	Below limit of reporting.	Detected in all wetland cells.
Pesticides	Not analysed.	Below limit of reporting.	Below limit of reporting.

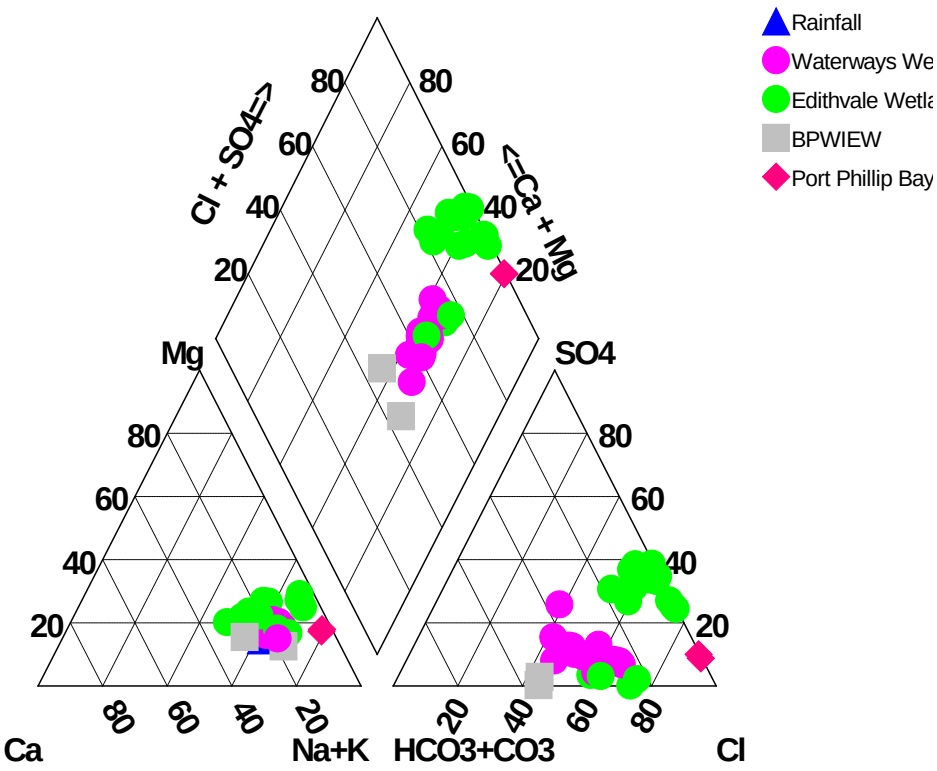

Figure 16.4 Piper diagram showing major ion chemistry for wetland surface waters (BPWIEW = Braeside Park and Woodlands Industrial Estate Wetlands)

Edithvale-Seaford Wetlands

The Edithvale-Seaford Wetlands are managed by Melbourne Water under the Edithvale-Seaford Wetlands Management Plan (Ecology Australia, 2016). The plan does not include criteria for water quality management, as recommended in the National Framework and Guidance for Describing the Ecological Character of Australian Ramsar Wetlands (Department of the Environment, Water, Heritage and the Arts, 2008).

Water quality has been monitored at Edithvale-Seaford Wetlands since 2009, and water levels monitored since 2008 (Ecology Australia, 2016). Figure 16.5 shows historic water quality monitoring locations within the Edithvale Wetlands.

Water quality data collected shows that, while the water quality varied from cell to cell, the Edithvale Wetlands were characterised by high turbidity, high salinity and high nutrient levels. One monitoring site (wetland cell EN2) north of Edithvale Road had high salinity and may also be impacted by acid sulfate soils. Chapter 17: *Groundwater* (Table 17.4) outlines that the high salinity levels are attributed to high salinity groundwater inflow into this cell. As the surface water is lost to the atmosphere through evaporation, the water becomes increasingly saline.

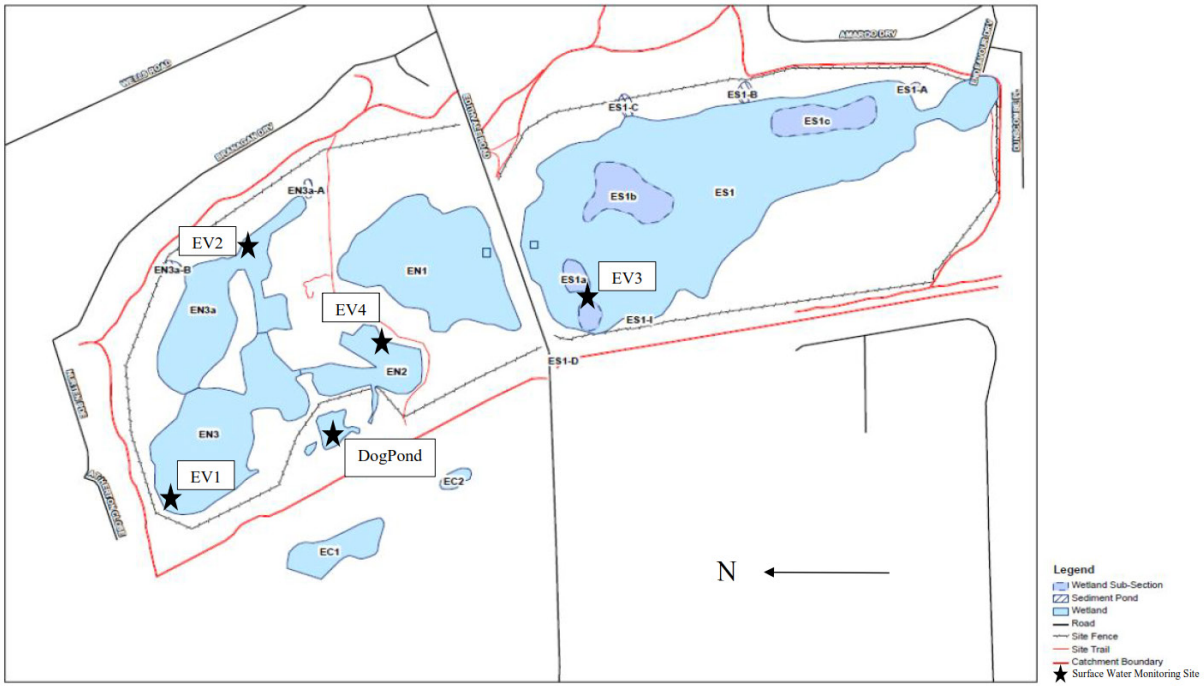

Figure 16.5 Water quality monitoring locations and wetland cell names

Modelled pollutant loadings

Data were generated by modelling simulation to help understand the annual pollutant loading entering the Edithvale Wetlands, Waterways Wetlands and Woodlands Industrial Estate Wetlands from catchments affected by the project (Table 16.4). These modelled pollutant estimates for the existing conditions (i.e. without project) were compared to modelled estimates with the project, including bio-retention swales at specific outfall locations. Resultant pollution reductions are presented in Section 16.8.2 (Table 16.7).

Table 16.4 Music model simulated annual pollutants loadings from the catchments affected by the project entering wetlands under existing conditions (based on 1952–1961 rainfall)

Indicator	Edithvale Wetlands	Waterways Wetlands	Woodlands Industrial Estate Wetlands
	Existing pollutant loadings in kg/year		
Suspended solids	687	384	1160
Total phosphorus	6.38	2.67	6.21
Total nitrogen	70.2	31.7	72.8
Litter	0	0	1.78

Flow regime conditions

Figure 16.2 and Figure 16.6 show the catchments of Edithvale Wetlands and Woodlands Industrial Estate Wetlands, respectively. As discussed in Section 16.6.3, Braeside Park Wetlands are located upstream of the project and will not experience changed flow regime conditions because of the project.

To understand existing flows in the waterways within the vicinity of the project, a review of available stream flow data was conducted. A flow gauge on Dunlops Road Drain at Citus Street was used to provide a baseline for the flow regime assessment. This is the only identified flow-gauging station within or near the catchment. This gauge covers the catchment area of the northern parts of the project. The gauge is considered to provide a suitable record for flow regime analysis to inform the baseline assessment and impact assessment of the project. The flow record at this gauge was used to calibrate the rainfall runoff parameters of the MUSIC model.

Table 16.5 summarises the flow conditions in Dunlops Road Drain, and flow entering the Woodlands Industrial Estate Wetlands without the project. Flow of less than 0.1 ML/day represents conditions when the waterway runs dry. Climate change adjustments were performed based on the "Guidelines for Assessing the Impact of Climate Change on Water Supplies in Victoria" (DELWP, 2016). These flow conditions were compared with modelled flows for the impact assessment (refer to Section 16.8.2 - Flow regime (Risk R-SW5)).

Table 16.5 Flow conditions – Dunlops Road Drain and Dingley Drain

Location	Date range	% of time that flow is less than 0.1ML/day	Median (ML/day)	Mean daily flows (ML/day)	Mean daily flows (ML/day) with climate change in 2065
Dunlops Road Drain	1952–1961	3%	1.20	5.6	5.0
	1975–2017	20%	0.50	5.0	4.5
Dingley Drain at Woodlands Industrial Estate wetlands	1952–1961	5%	0.98	3.4	2.9
	1975–2017	21%	0.52	3.0	2.7

For Waterways Wetlands, modelling estimated that from 1952 to 1961, project-affected catchments contributed 16.3ML/year of annual flow. This represents less than 0.4% of the total flow entering the Waterways Wetlands. Due to the complexities of modelling flow conditions for such a small component of the catchment, and the predicted insignificant change in flow conditions, no flow modelling was performed for Waterways Wetland.

The flow regime for Edithvale Wetlands is not expected to change significantly because there will be relatively minor changes to the existing conditions within the relevant catchment area due to the project. The significant distance between the project and the Edithvale Wetlands is also expected to limit the potential impacts.

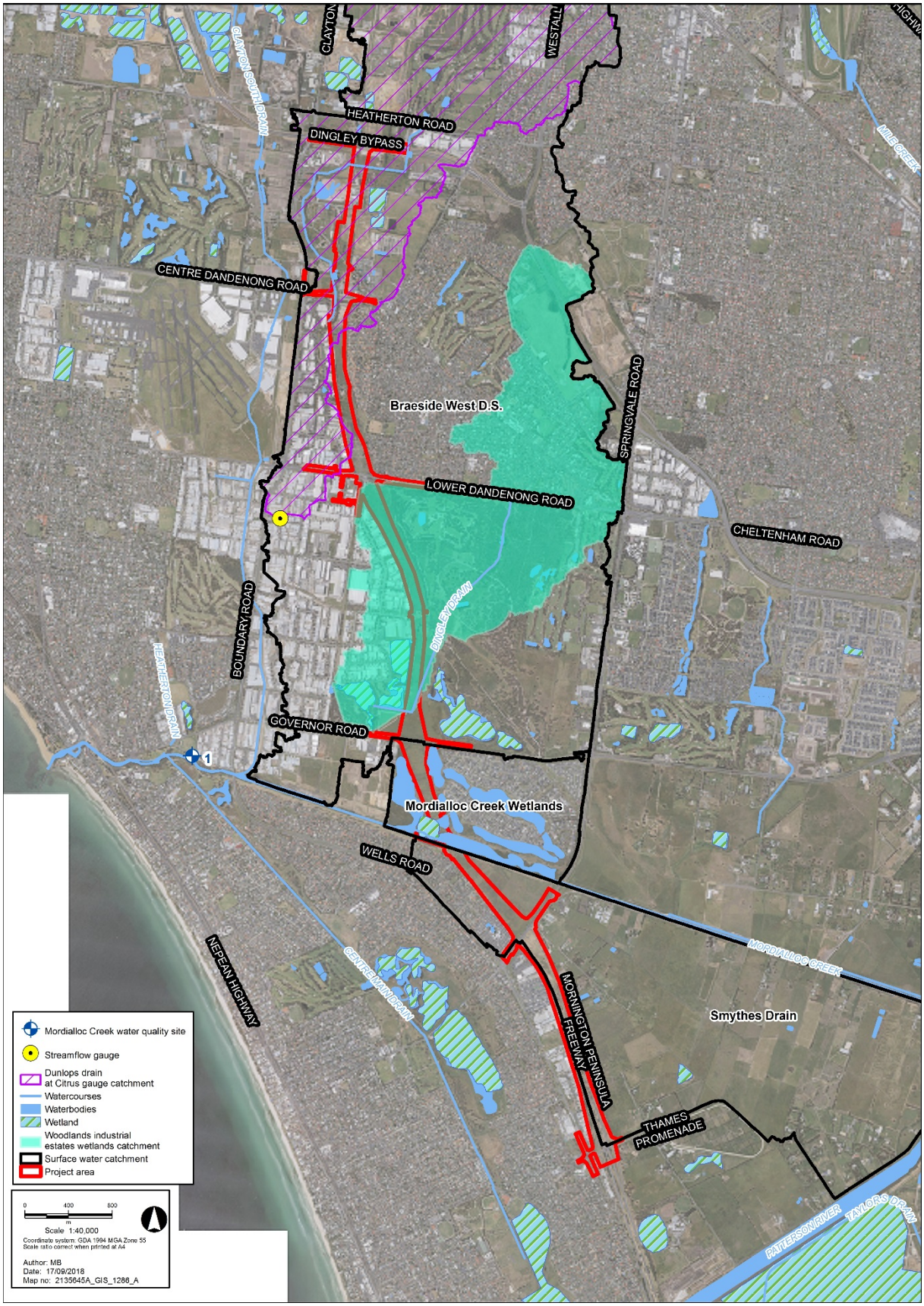

Figure 16.6 **Catchment areas of Dunlops Road Drain Gauge (228358A) and Woodlands Industrial Estate wetland**

16.6.5 Flooding impact

Flood conditions

Existing flood conditions modelling found that the project crosses existing flood extents at six locations. These locations are:

- Old Dandenong Road Drain at Dingley Bypass
- Old Dandenong Road Drain at Centre Dandenong Road
- Gartsides D.S. at Lower Dandenong Road
- Dingley Drain at Braeside Park
- Dingley Drain near Woodlands Industrial Estate wetlands
- Waterways wetlands area.

Figure 16.7 shows the alignment project boundary in relation to the 1% AEP flood event. A more detailed set of maps is located in Attachment III: *Maps and figures*. The impact assessment described in Section 16.8.2 (Flooding impact (Risk R-SW4)) compares these modelled flood extents without the project to flood extents once the project has been completed.

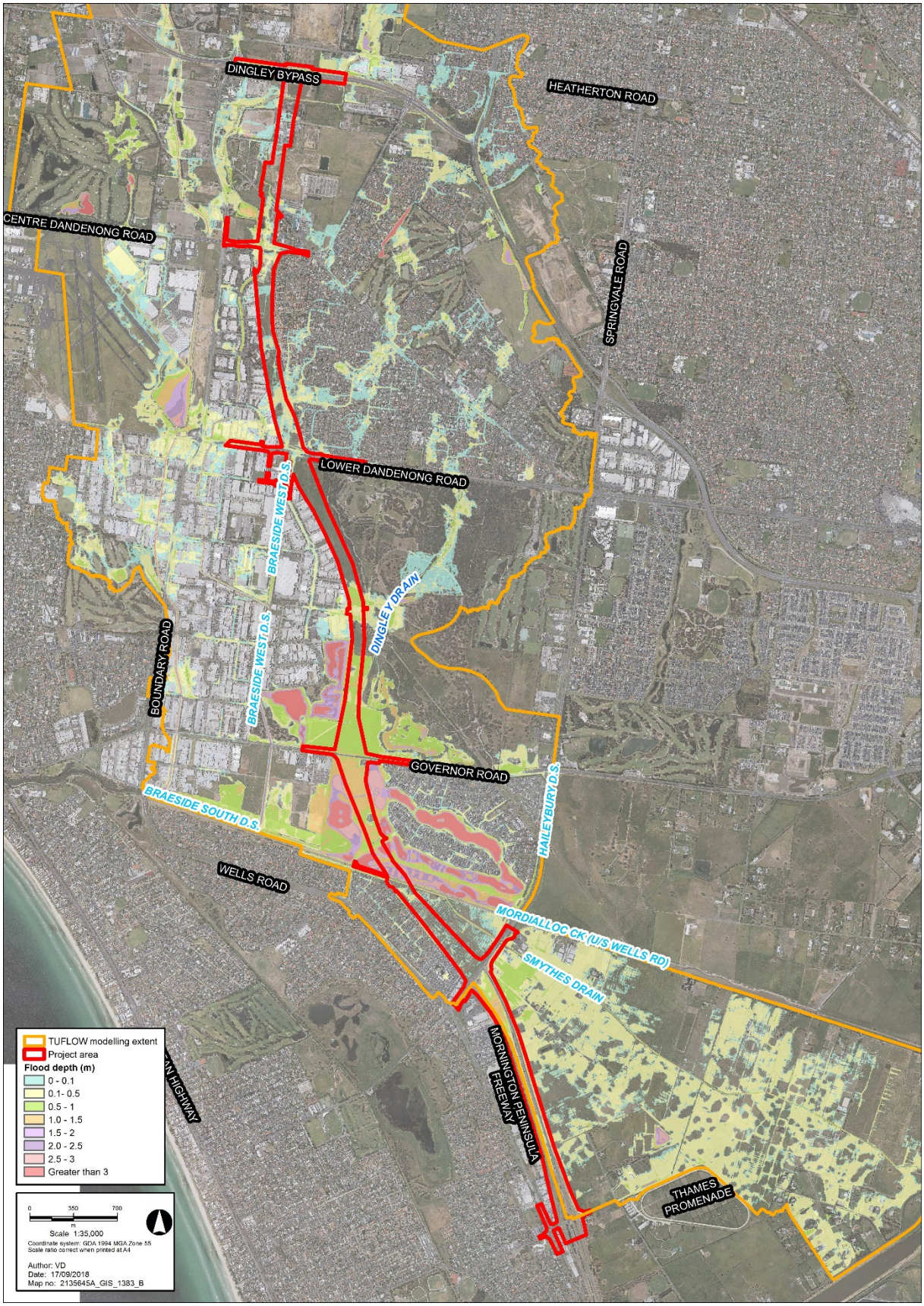

Figure 16.7 Existing condition (without project) extent of flooding in the 1% AEP flood event

16.7 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 Surface Water Impact Assessment report. 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 environmental performance requirements to derive the residual risk ratings. The methodology for the risk assessment has been described in Chapter 4: *EES assessment framework and approach*.

Table 16.6 provides a summary of the key surface water related risks. The risk assessment identified three key surface water risks during the operational phase of the project. Flooding impacts are predicted outside the project boundary (Risk R-SW4). Potential impacts are predicted on water quality from accidental spills of fuels and chemicals (Risk R-SW6) and increased pollutant loading because of impervious roads surfaces (Risk R-SW7).

Risk R-SW6 has been assessed as a medium initial risk due to the major consequence but the unlikely nature of the risk. This risk rating remains at medium when additional mitigation is applied, however, the likelihood of the risk eventuating is reduced to rare. Further controls are not likely to reduce the risk rating because the consequence if the risk eventuates would still be major.

A range of other potential impacts were identified for the construction phase, all of which were assessed to be low risk. These risks include the potential for reduced water quality from pre-construction geotechnical investigations, fuel and chemical spills and sedimentation of waterways, and impacts on local hydrology during construction works due to temporary diversion of overland flows and reductions in floodplain storage.

A full list of all surface water related primary risks and further information on potential impacts determined to be low risk, are contained in Appendix J: *Surface water impact assessment* and Attachment I: *Environmental risk assessment report*.

Table 16.6 Water, catchment values and hydrology risk

Risk	Impact pathway	Primary impact	Project phase	Initial risk rating	EPR ref.	Residual risk rating
R-SW2	Changes hydrology	Placement of temporary works, stockpiles, equipment and plant results in a reduction in flood conveyance or floodplain storage, potentially leading to increases to flood levels, flow velocities and flood frequency.	C	Low	W3 W4 W5	Low
R-SW3	Erosion/ soil instability	Erosion from construction sites contributes to sediment loads or hazardous spills impacts in downstream waterways.	C	Low	W3	Low
R-SW4	Flooding impacts during operation of the project	Changes to ground levels or other permanent works result in changes to flooding conditions such as frequency and duration of flooding, increases in flood levels or flow velocities or flooding extents.	O	Medium	W2	Low
R-SW5	Changes hydrology	Changes to ground levels, ground surface imperviousness or other permanent works result in changes to stormwater surface runoff and hence the hydrological regime of the creeks and waterways downstream of the project area.	O	Low	W1	Low

Risk	Impact pathway	Primary impact	Project phase	Initial risk rating	EPR ref.	Residual risk rating
R-SW6	Water quality impacts due to oil and fuel spillage along the bypass	Traffic accidents and resultant fuel/chemicals spills and chemicals (from firefighting activities) contaminate surface water.	O	Medium	W1 W5	Medium
R-SW7	Water quality impacts due to change in land uses	Increase to the storm water pollutant loads entering the environment as a result of the increase of impervious areas.	O	Medium	W1 W5 W6	Low

16.8 IMPACT ASSESSMENT AND MITIGATION

16.8.1 Construction

Water quality (Risk R-SW2)

Water quality has the potential to be impacted during construction through the erosion of disturbed or cleared land, stockpiles and haulage routes, potentially increasing the amount of suspended solids in the water bodies. In addition, runoff from storage areas may also impact on water quality. Both potential sources of runoff have the potential to contain pollutants including contaminated sediments, oils or chemicals.

Construction activities must comply with the surface water requirements in the *Environment Protection Act 1970* and SEPP (Waters of Victoria). Standard management techniques would be used to reduce the risk of contaminated runoff entering the stormwater drainage system, including minimising land disturbance, soil erosion and discharge of sediment and other pollutants to surface waters. This would be achieved through stormwater management, which would be developed before construction begins and in accordance with the EPA publications *Construction Techniques for Sediment Pollution Control 1991* and *Environmental Guidelines for Major Construction Sites 1996* (EPR W3).

A Water Management and Monitoring Plan (WMMP; EPR W5) and Storm Water Management Plan (EPR W3) would be prepared. These plans would indicate how potentially contaminated runoff will be characterised, treated and disposed of. If runoff from site occurs, it must meet the requirements of SEPP (Waters of Victoria) (EPR W3). The WMMP will include requirements to establish baseline conditions including water quality, water sampling duration and frequency, trigger levels and contingencies if the trigger levels are exceeded.

Flooding (Risk R-SW1)

Project construction and the presence of temporary works (such as access tracks, piling platforms and stockpiles) has the potential to impact flooding by changing flood water movement or reducing floodplain storage.

The following works must be minimised or managed when occurring within the 1% AEP flood extents: stockpiles of excavated materials, location of equipment and plant, temporary works, temporary diversions, working platforms and modifications to levees and banks.

Prior to construction, a CEMP must be developed and will outline how the contractor will maintain existing flow paths, drainage lines and floodplain storage. In addition, a Soil Management Plan will be developed and should include the approximate location of stockpile fill materials (EPR CL1).

During construction, the requirements of the *Melbourne Water standards for infrastructure projects in flood-prone areas* must be met. Measures must be implemented to the satisfaction of Melbourne Water and in consultation with any other relevant drainage authority, to ensure that temporary construction activities do not increase flood risks (including flood levels, flows and velocities) to the surrounding areas (EPR W4).

16.8.2 Operation

Water quality (Risk R-SW5 and R-SW6)

IMPACTS FROM AN INCREASE IN IMPERVIOUS AREA

An increase of impervious surface (such as road surface and shared use path) will increase the stormwater runoff in the downstream waterway system and is expected to increase the amount of pollution to the surrounding environment unless mitigation measures are implemented. Flow duration curves were generated using daily flow simulated by the MUSIC model to provide an understanding of the impact of the proposed road on the overall flow regime.

Flow duration curves show how often the flow rate is expected to exceed a particular rate; for example the duration curve might show that 10% of the time water flow may exceed 10 megalitres per day and 50% of the time water flow may only exceed 1 megalitre per day. Modelling showed insignificant changes are expected in the flow duration curves (i.e. flow regime) for Mordialloc Creek (at Dunlops Road Drain) and Woodlands Industrial Estate Wetlands, indicating that the project will have no impact on the downstream flow regime (Figure 16.8). The duration curves for the existing and proposed scenarios are almost identical.

Climate change could cause a notable decline in water availability for 80% of the time; however, this is solely due to the change in climate conditions and not related to changes to the catchments caused by the project

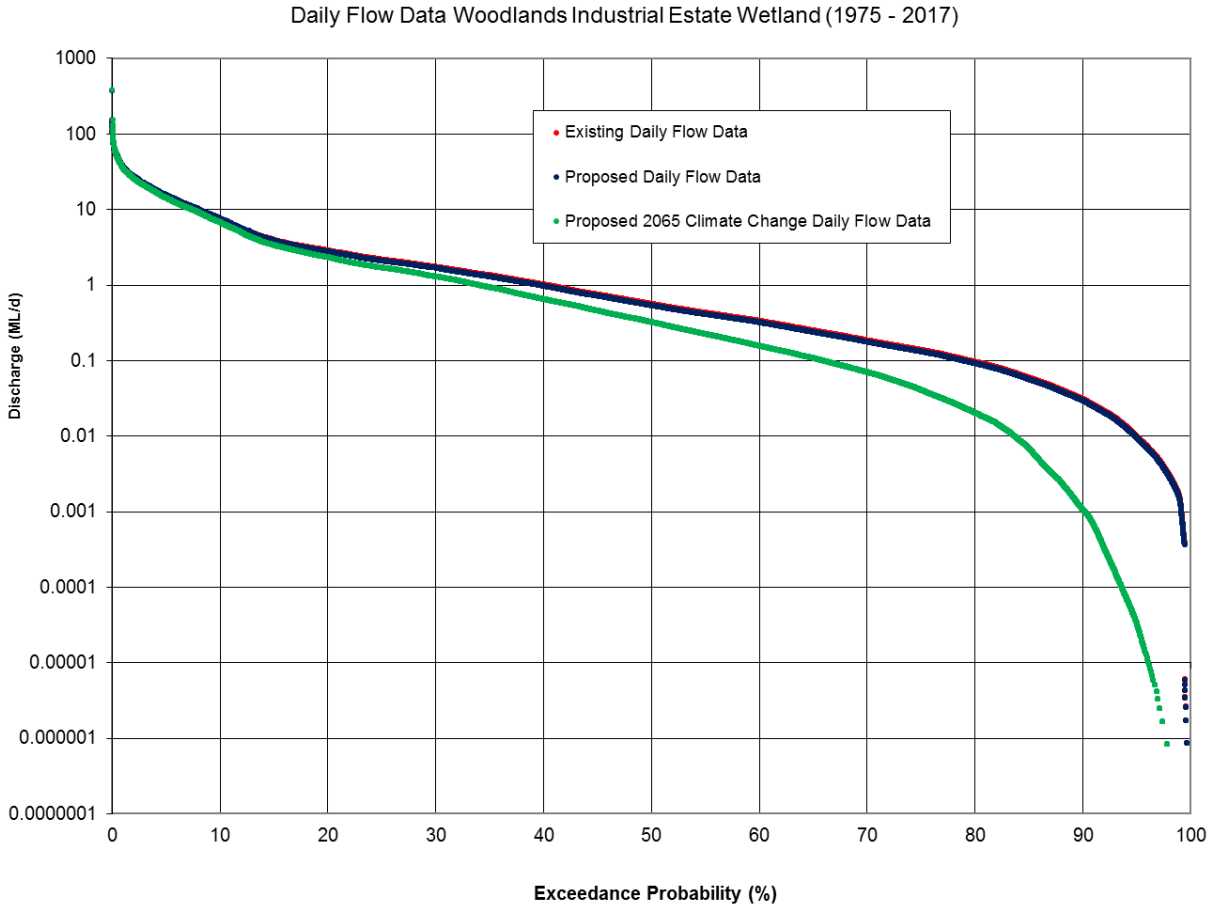

Figure 16.8 Flow duration curve for flow entering Woodland Industrial Estate Wetlands (1975–2017)

As part of the road design, grassed swales have been included to treat stormwater runoff prior to discharge to the receiving environment. Surface water modelling has indicated that the proposed mitigation method can decrease the pollutant load to below the BPEMG WSRD targets for most outfall locations, except for Lower Dandenong Road (outfall E) and Centre Dandenong Road (outfall D) which discharge to Melbourne Water drains and eventually to Mordialloc Creek (Figure 16.9).

Modelling showed pollutant loadings for these two outfalls would be above the BPEMG WSRD targets. Outfall E would be only marginally non-compliant for Total Nitrogen (fall short of reduction rate by 2% to 3%) while outfall D would not be able to achieve the targets due to physical constraints in intercepting and treating the stormwater runoff from the project. The treatment reduction rates at Outfall D fall short by 18% to 61% of the targeted reduction rate; however, the catchment area of this outfall only contributes 3% to the overall catchment of the project-affected area. The impact is expected to be localised.

The target exceedances at these two locations are not expected to have a negative impact on the environment as there are no sensitive receptors between these outfall locations and where discharge from these outfalls joins discharge from other outfalls. The project overall combined surface water contaminant levels are below the BPEMG WSRD targets.

In addition to the BPEMG WSRD targets, the project would target no increase in pollutant loading at sensitive wetland receptors including:

- Edithvale Wetlands
- Waterways Wetlands
- Woodlands Industrial Estate Wetlands.

Modelling results indicated increased pollutant loading to the three wetlands when compared to existing conditions when only standard grassed swales are in place. As such, further mitigation measures, including adoption of WSRD and implementation of bio-retention systems, are necessary to ensure that water body health is maintained (EPR W1). In addition, the design would incorporate spill containment at the outfalls which pose a high risk to sensitive receptors, including Waterways Wetlands, Woodlands Wetlands and Edithvale Wetlands (EPR W1).

Bio-retention systems are proposed at outfalls F, J and M shown on Figure 16.9. An example of a bio-retention system is a depression which slows the flow of, and treats, stormwater. Bio-retention systems generally include filtration sands and some coarse aggregates to filter out pollutants and suspended solids and vegetation to consume the nutrients in the stormwater.

As discussed in Section 16.6.3, the Braeside Park Wetlands are located upstream of the project. While flood waters are likely to enter Braeside Park land during flood events (both with and without the project), the wetlands are protected by the existing levee. As shown in Figure 16.10, hydraulic modelling confirmed that the proposed works does not result in change in flood level in the wetland. Water quality is not expected to be influenced by the project.

Figure 16.9 **Outfall locations where bio-retention systems will be implemented (green) and where criteria exceedances occur (orange)**

The bio-retention systems are sized based on model outcomes and would be implemented in addition to the swales in the proposed drainage design. Modelling shows that the proposed mitigation measures would reduce the annual average loadings entering the three wetlands compared to existing conditions. Table 16.7 shows the percentage improvement compared to existing conditions for pollutants presented in Table 16.4.

Table 16.7 MUSIC model simulated reduction in annual pollutants loading for sensitive wetland receptors affected by the project

	Edithvale wetlands	Waterways wetlands	Woodlands industrial estate wetlands
	Reduction achieved		
Suspended solids	4%	35%	48%
Total phosphorus	15%	18%	15%
Total nitrogen	3%	8%	2%
Litter	0%	0%	0%

The effectiveness of treatment was found to be reduced under 2065 climate change scenarios, but still met the WSRD targets overall. Ecological impacts from water quality aspects of the project are anticipated to be insignificant (refer to Chapter 10: *Biodiversity*).

IMPACTS FROM OIL AND FUEL SPILLS

The project introduces traffic through the road corridor, which will increase the risk of oil and fuel spillage due to traffic incidents. If oil and fuel spills are discharged to the downstream water bodies, the health of these water bodies will be impacted. The spill risk assessment found that spills occurring near the outfalls discharging to Woodlands Industrial Estate Wetland, Waterways Wetlands and Edithvale Wetlands posed moderate to high risk of pollution impacts to the wetlands.

To mitigate spill risk at the outfall to the north of Governor Road, swales would be extended and widened to provide additional storage and increase the travel time for any spill to reach the outfall. This would allow additional time for emergency crews to block the drainage system and additional volume for the spill to be contained within the road drainage system.

For the high spill risk areas discharging to Edithvale Wetlands, the Waterways Wetlands and Woodlands Industrial Estate Wetlands, more rigorous mitigation measures are required. The provision of spill containment structures with a minimum capacity of 20,000 litres will mitigate the potential impact to these outfall locations (EPR W1). The spill containment could be integrated as part of the bio-retention systems design.

As far as practicable, the design of surface water control measures would comply with the VicRoads *Integrated Water Management Guidelines (2013)* and the CSIRO's *BPEMG for Urban Stormwater (1999)*.

FUTURE WATER MANAGEMENT

Surface and groundwater monitoring for water quality would be managed through the implementation of a Water Management and Monitoring Plan (WMMP; EPR W5). Monitoring aims to validate that the project did not have significant impact on the water environment. The plan would include contingency measures if water quality trigger levels are exceeded.

By combining surface water and groundwater monitoring and management within the WMMP, MRPA would more easily be able to adopt the combined SEPP (Waters of Victoria) and SEPP (Groundwaters of Victoria) when it is released by DELWP later in 2018 (refer to Table 16.2).

The WMMP would be developed in consultation with EPA Victoria and other relevant water authorities, and be implemented during construction and for five years following the opening of the project to the public. Additional monitoring beyond this period would be contingent on demonstrating the success of mitigation measures implemented, including any contingency measures, against relevant performance criteria, and developing the scope of such monitoring in consultation with the above stakeholders.

Flooding impact (Risk R-SW4)

Flood impacts have been assessed by completing a detailed model of the proposed design, including associated surface water drainage elements such as culverts, pipe works and swales.

The modelling predicted that the reference design would lead to an increase in flood levels in the 1% AEP flood event at three locations. The impacts have been assessed against floodplain management performance criteria set out in Melbourne Water's guideline *Melbourne Water standards for infrastructure projects in flood-prone areas*. The key requirements that relate to the project can be summarised as follows:

- Key principle:
  - Risk to people and property must not increase as a result of the development.
- Key standards that guide flood risk assessments to meet the key principle:
  - Works or structures should not affect floodwater flow capacity
  - Works or structures should not reduce floodwater storage capacity
  - Works or structures should not create new hazards or increase existing hazard.

In order to address increased flood levels, the project design has incorporated standard swales and additional flood storage areas next to Braeside Park and Woodlands Wetlands. These measures were incorporated into the reference design to decrease the change in flood behaviour and level caused by the project. The additional flood storage consists of wide shallow depressions to store floodwater and compensate for existing floodplain storage lost because of the project. Figure 16.10 shows the change in 1% AEP flood levels with all these design features incorporated. More detailed maps are provided in Attachment III: *Maps and figures*.

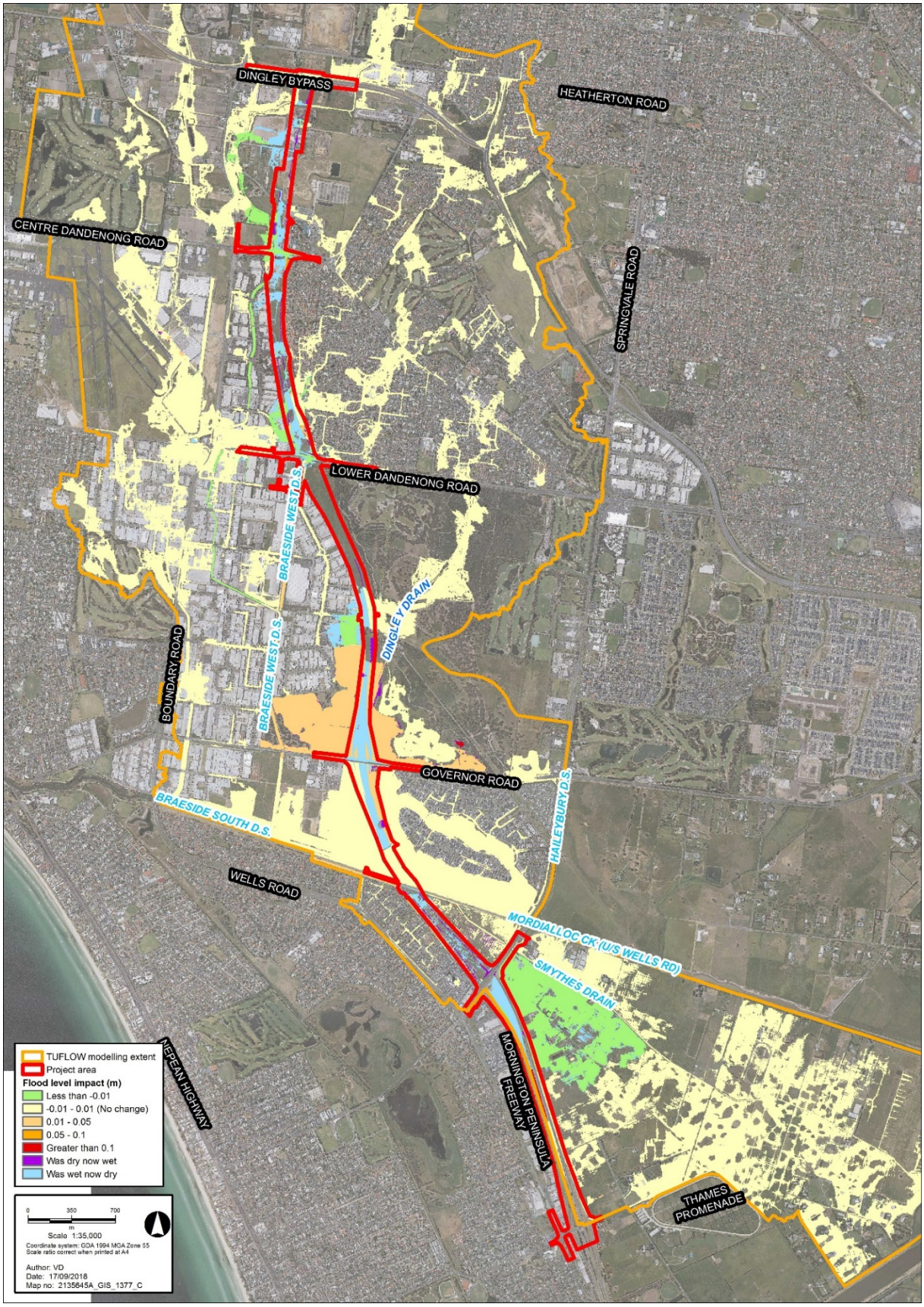

Figure 16.10 Change in 1% AEP flood levels with design features incorporated

A general assessment of the flooding impacts of the project against the key Melbourne Water requirements listed above is as follows, demonstrating that the project mostly meets these key requirements:

- Requirement: Risk to people and property must not increase as a result of the development
  - Impact assessment: Impacts do not increase flood risk to people (i.e. no change to flood hazard) or property (i.e. no change to flood damage and use of the affected land).
- Requirement: Works or structures should not affect floodwater flow capacity
  - Impact assessment: the new infrastructure does not obstruct or divert flood flows as sufficient hydraulic capacity has been provided in the cross drainage design to pass flow.
- Requirement: Works or structures should not reduce floodwater storage capacity
  - Impact assessment: Some infrastructure elements need to be located within the floodplain, which displaces some of the floodwater. This has been offset as far as possible by introducing compensatory flood storage measures (swales and flood storage areas) into the design within the project boundary. The remaining loss of flood storage is minor and results in minor localised increases in flood level that do not contravene the other key principles and standards of Melbourne Water.
- Works or structures should not create new hazards or increase existing hazard
  - Impact assessment: The impacts do not create new flood hazards or increase the existing hazard categories within the areas experiencing a minor increase in flood level.

The areas where flooding impacts do not meet the requirements are immediately south of Lower Dandenong Road, the Braeside Park and Woodlands Industrial Estate Wetlands area, and east of Bowen Parkway.

At Lower Dandenong Road (Figure 16.11), the reference design does not fully restore base case flow behaviour and future mitigation measures, would be required. In accordance with EPR W2, detailed design for the project would be required to meet the requirements set out in "*Melbourne Water standards for infrastructure projects in flood-prone areas*", unless otherwise agreed with Melbourne Water.

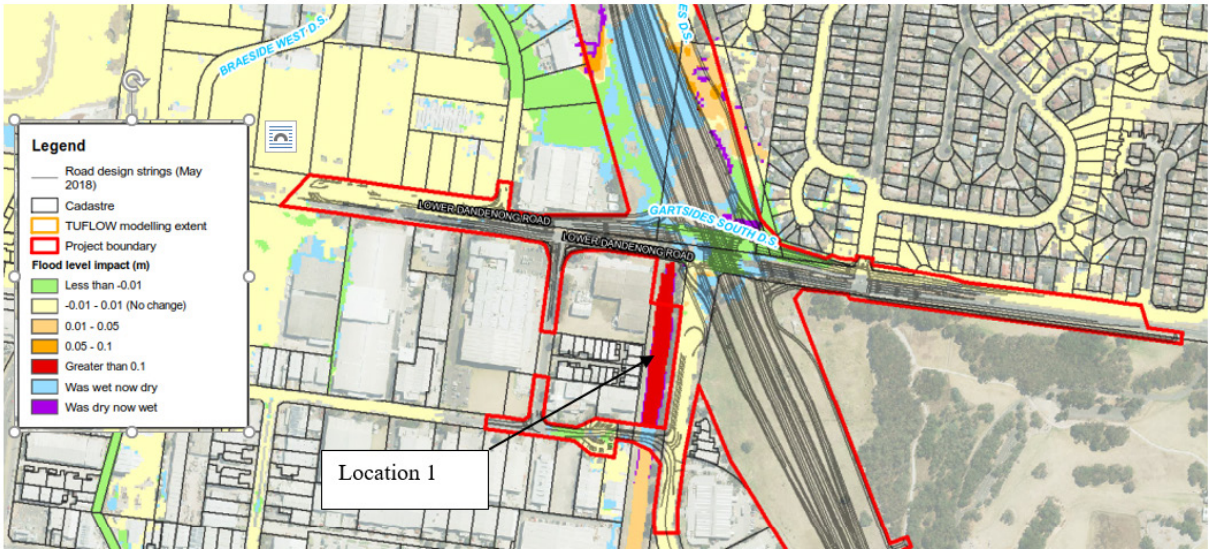

Figure 16.11 Flooding impact south of Lower Dandenong Road (Location 1)

At Braeside Park and Woodlands Industrial Estate Wetlands, the proposed design has incorporated mitigation measures in the form of compensatory flood storage within the project boundary, however an increase to flood levels is still expected (Figure 16.12). The additional increase in flood levels (up to 0.046m) is mostly within parklands and grasslands, and would not change the flood risk to people or property. Where the floods do impact on infrastructure (footpath), the increase of flood level is 0.01m, which will not introduce a new flood hazard or change the existing hazard.

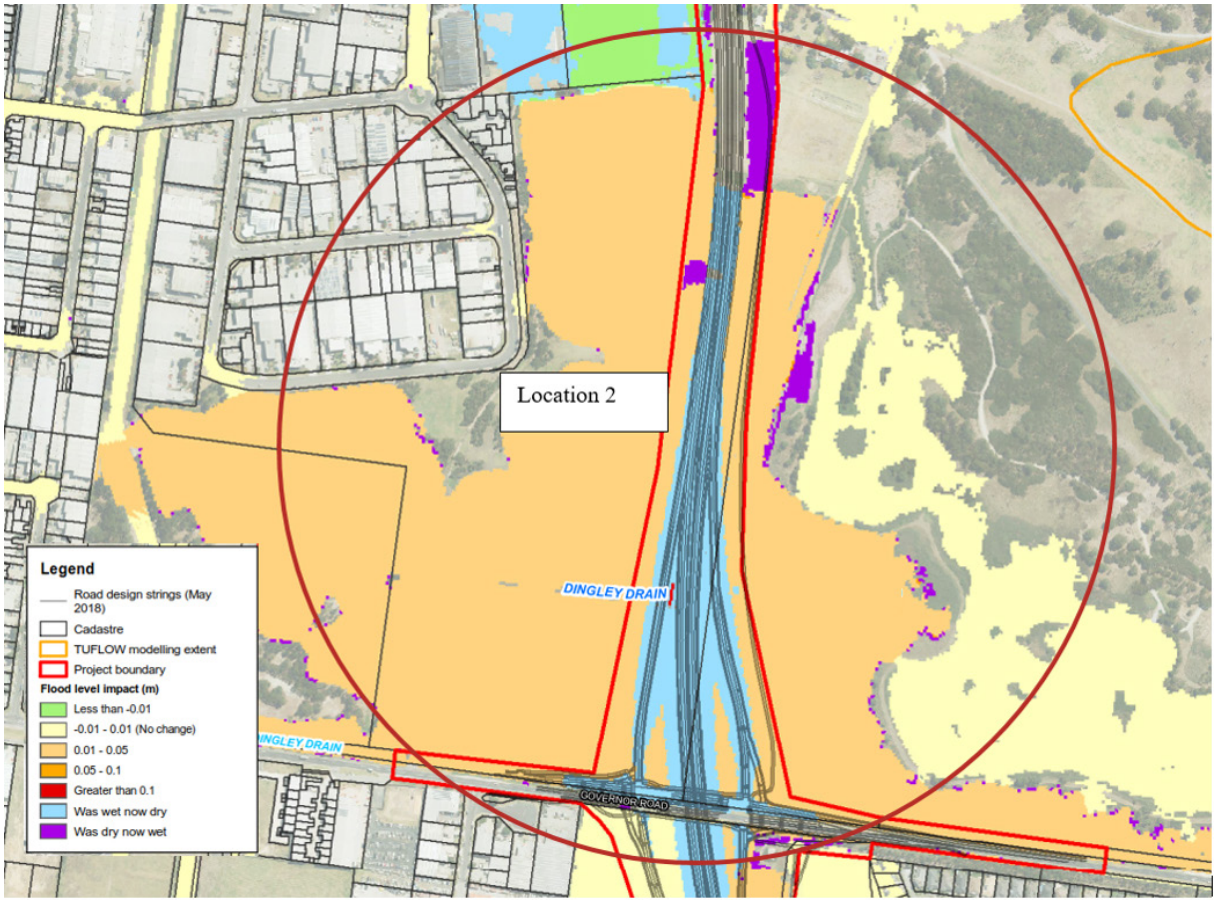

Figure 16.12 Flooding impact in the Braeside Park and Woodlands Industrial Estate area (Location 2)

Further mitigation measures (e.g. flood gates) are likely to result in undesirable side effects. Therefore, the current design is considered to provide the best overall outcome, balancing flood risk with cost and ecology impacts, and no further mitigation is recommended. Major Road Projects Authority (MRPA) would continue to consult with Melbourne Water and Parks Victoria to advise of design changes and seek approval for flood impacts associated with the detailed design.

East of Bowen Parkway (Figure 16.13), Smythes Drain is covered by the Melbourne Water Bowen Road Drainage Scheme, which is the master plan for drainage infrastructure in the catchment to allow for future urban development. While there is a minor increase in flood levels downstream of the project, the culvert and downstream channel are designed for the larger ultimate flow rate (provided by Melbourne Water). As such, floodwater would be contained within the Bowen Road open channel and no further mitigation is recommended.

Discussions have occurred between MRPA and Melbourne Water throughout the development of this EES. Melbourne Water are aware of the locations where key requirements have not been met and will continue to work with MRPA to achieve acceptable outcomes relating to flooding, as well as water quality.

A WMMP is outlined in EPR W5 for the management and monitoring of water. The WMMP would specify trigger levels (water quality in surface water bodies and groundwater) and detail contingency plans if trigger levels are exceeded (EPR W5).

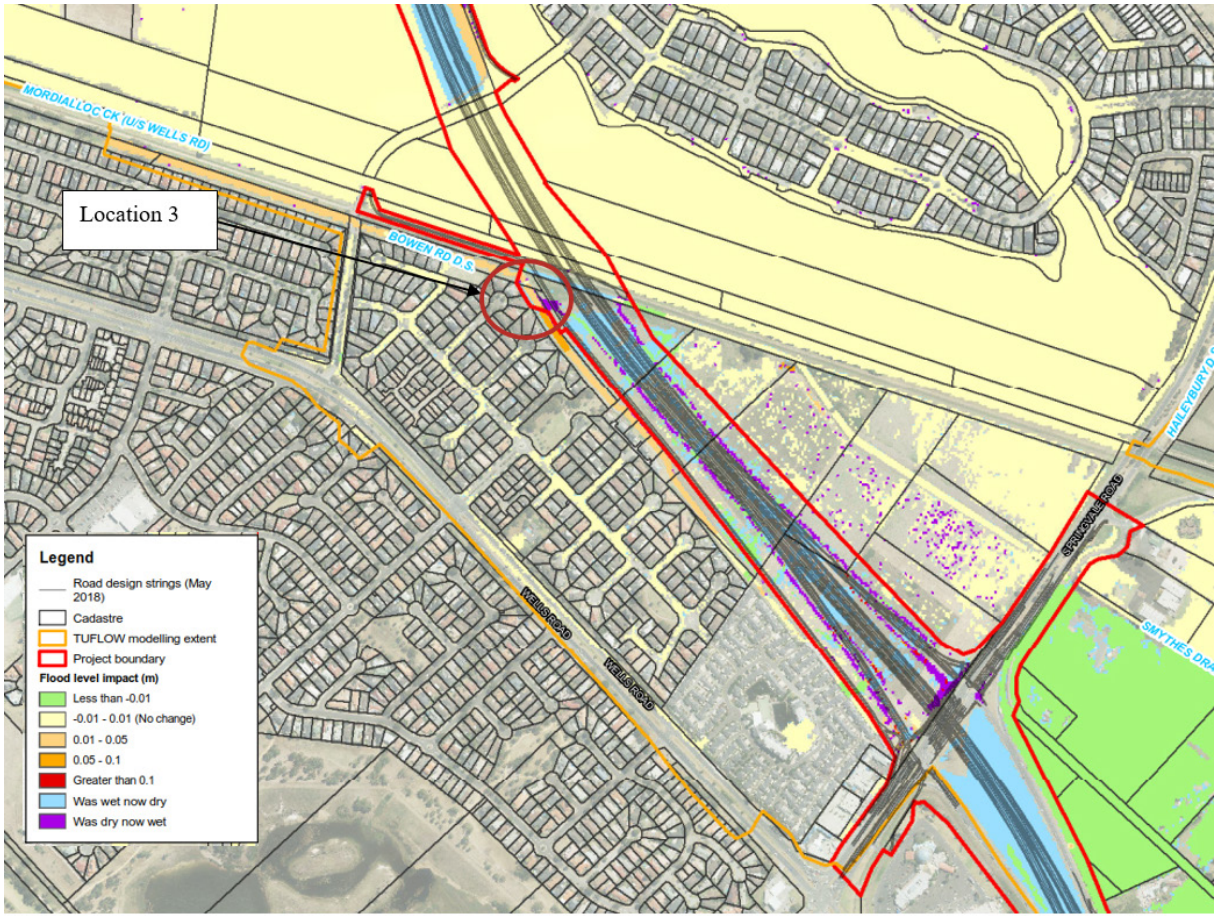

Figure 16.13 Flooding impact east of Bowen Parkway (Location 3)

Flow regime (Risk R-SW5)

The increase in impervious pavement areas with the proposed project would increase the stormwater runoff in the downstream waterway system. This increase has the potential to impact on the downstream drainage system during major flooding events, and during regular wet weather events. The assessment showed insignificant changes in the flow for Mordialloc Creek (at Dunlops Road Drain) and Woodlands Industrial Estate Wetlands, indicating that the project would have no impact on the downstream flow regime.

The inflow from the sub-catchments affected by the project into the Waterways Wetlands increases from 16.3ML/yr to 27.8ML/year (only increasing to 24.3ML/year under the climate change scenario). While this flow increase seems significant, 16.3ML/year represents less than 0.4% of the total flow entering the Waterways Wetlands. This means that the increase in flow from the affected sub-catchments is insignificant, only representing an increase in flow of less than 0.3% of the total inflow to the Waterways Wetlands.

The project is anticipated to have minimal impact on the waterways and wetlands system and receptors, including industry and agriculture water users and aquatic plants and animals. No mitigation measures are considered necessary for the minimal flow increases caused by the project. Ecological impacts from hydrology and hydraulic aspects are anticipated to be insignificant (refer to Chapter 10: *Biodiversity*, Section 10.8.2).

Impacts on Edithvale Wetlands

In addition to the water quality impacts identified above, the groundwater assessment identified that the combined effects of surface and groundwater from the project would have an insignificant hydrology and hydraulic effect on the wetland (refer to Chapter 17: *Groundwater*). As for other wetlands, ecological impacts from hydrology and hydraulic aspects are anticipated to be insignificant at Edithvale Wetlands. Beyond the bio-retention systems and spill containment for outfalls discharging to Edithvale Wetlands, no further mitigation measures are proposed.

16.9 ENVIRONMENTAL PERFORMANCE REQUIREMENTS (EPRs)

Table 16.8 lists the EPRs developed in relation to potential surface water impacts.

Table 16.8 Environmental performance requirements (EPRs)

EPR number	Environmental performance requirement	Project phase
W1	**Water body health** During design and operation, impacts on surface water quality and flow must be minimised through adoption of measures to avoid an increase in discharge of pollutant loading (to higher than existing conditions levels) on beneficial uses due to the construction of the project in accordance with *Best Practice Environmental Management Guidelines for Urban Stormwater* and Water Sensitive Road Design (WSRD). In addition, the project must incorporate spill containment at the outfalls which pose a high risk to sensitive receptors, including Waterways Wetlands, Woodlands Wetlands, Braeside Park Wetlands and Edithvale Wetlands. The design of surface water control measures for the project as a whole must comply with the VicRoads *Integrated Water Management Guidelines (2013)* and CSIRO *Best Practice Environmental Management Guidelines for Urban Stormwater (1999)*.	Design and operation
W2	**Flood protection (operation)** Changes to flood behaviour resulting from the project must meet the requirements of Melbourne Water's guideline "*Melbourne Water standards for infrastructure in flood prone areas*". Design-specific maintenance requirements relating to floodwater, and that do not form part of standard VicRoads maintenance requirements, must be included in the Water Management and Monitoring Plan (EPR W5).	Design and operation
W3	**Surface water management (construction)** Protect local waterways by applying best practice sedimentation and pollution control measures in accordance with EPA Victoria publication 480 *Environmental Guidelines for Major Construction Sites* and EPA publication 275 *Construction techniques for sediment pollution control* through the Construction Environmental Management Plan(s) and other plans. Implement a water collection and treatment system to ensure that stormwater discharges comply with the State Environment Protection Policy (Waters of Victoria) 2004 and Melbourne Water performance criteria. Such plans and systems should be prepared in consultation with relevant authorities before the commencement of works.	Construction
W4	**Flooding protection (construction)** During construction, the requirements of the "*Melbourne Water standards for infrastructure in flood prone areas*" must be complied with. Measures must be implemented to the satisfaction of Melbourne Water and in consultation with any other relevant drainage authority, to ensure that temporary construction activities do not increase flood risks (including flood levels, flows and velocities) to the surrounding areas. A flood management plan must be developed in consultation with and not objected by Melbourne Water for any temporary works.	Construction

EPR number	Environmental performance requirement	Project phase
W5	**Water Management and Monitoring Plan** A Water Management and Monitoring Plan (WMMP) must be prepared in consultation with EPA Victoria and relevant water authorities, and be implemented prior to construction, during construction and for five years following opening the project to the public. The WMMP must incorporate both surface and groundwater monitoring. Incorporating the baseline data collected to date, the WMMP must include: • detail of the monitoring parameters, including the frequency and location of surface water monitoring points and groundwater monitoring bores • specific trigger levels (water quality in surface water bodies and groundwater bores) and details of contingency plans in the case trigger levels are exceeded • detailed reporting requirements • roles and responsibilities, not limited to: – the owner of monitoring network assets – the manager of monitoring network assets and results – the party (or parties) undertaking monitoring (prior to construction, during construction and for five years following opening).	All
W6	**Surface water management (operation)** The volume and quality of surface water discharges during operation must be designed to have no adverse impact to the drainage network capacities in consultation with Melbourne Water, Kingston City Council and Greater Dandenong City Council, as appropriate.	All

16.10 CONCLUSIONS

The project is located in the Dandenong major catchment area within the Mordialloc Creek waterway system, largely within the designated Braeside West, Waterways Wetlands and Smythes Drain surface water catchment areas. These catchments contribute tributary runoff flow to the larger Mordialloc Creek drainage system. The surface water impact assessment assessed the potential impacts of the project on flooding and the health of the waterways and wetlands that would receive runoff from the project.

In accordance with EPR W3, construction activities would need to comply with the surface water requirements of the *Environment Protection Act 1970* and SEPP (Waters of Victoria). Standard management techniques would be used to minimise the risk of contaminated runoff entering the stormwater drainage system, including minimising land disturbance, soil erosion and discharge of sediment and other pollutants to surface waters. This would be achieved through stormwater management within the CEMP, which would be developed before construction and in accordance with the EPA publications *Construction Techniques for Sediment Pollution Control 1991* and *Environmental Guidelines for Major Construction Sites 1996*.

To minimise impacts of construction on overland flow paths and floodplain storage, works would be carried out in accordance with Melbourne Water requirements and in consultation with relevant drainage authorities, as required by EPR W4.

For the operation phase, the assessment found that the reference design could achieve the required WSRD targets for the whole project area. Localised mitigation measures are required to ensure no increase in pollutant loadings entering the three water sensitive receptors of Edithvale Wetlands, Waterways Wetlands and Woodlands Industrial Estate Wetlands. This can be achieved through the provision of bio-retention systems.

A spill risk assessment was conducted for the operation phase to identify risks to waterway health associated with spills of fuels and oils during operation of the road. It was found that the highest risk areas were near outfalls which drain to the Edithvale Wetlands, Waterways Wetlands and Woodlands Industrial Estate Wetlands. These risks would be managed through the provision of spill containment at the stormwater discharge outfalls, as required by EPR W1.

To minimise the risk of flooding impacts, EPR W2 requires that the project must be designed to achieve operational compliance with the requirements set out in *Melbourne Water standards for infrastructure in flood prone areas*, unless otherwise agreed with Melbourne Water. Flood impact mitigation measures have been adopted in the design to meet the key requirements of the Melbourne Water standards.

Through the implementation of the EPRs, the project would have minimal impact on surface water and floodplain environments and would minimise effects on water quality and beneficial uses, including the ecological character of the Ramsar-listed Edithvale-Seaford Wetlands.

Impacts on the wetlands from both surface and groundwater are discussed in Chapter 17: *Groundwater* and Appendix K: *Groundwater impact assessment* of this EES.