EDITHVALE AND BONBEACH
LEVEL CROSSING REMOVAL PROJECTS

ENVIRONMENT EFFECTS STATEMENT

EES TECHNICAL REPORT E
Surface Water Impact Assessment

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Executive summary

The Victorian Government is removing 50 of Melbourne's most dangerous and congested level crossings. The Edithvale Road, Edithvale and Station Street/Bondi Road, Bonbeach level crossing removal projects were referred to the Minister for Planning who decided an Environment Effects Statement (EES) was required.

This report addresses the Scoping Requirements of the EES in relation to potential impacts to surface water resulting from construction and operational activity as a result of removing the level crossings.

Surface water context

A surface water impact assessment has been undertaken for the Edithvale and Bonbeach level crossing removal sites. While the works would not be undertaken within existing flood extents, managing runoff from the sites is important so that surrounding flood levels and drainage infrastructure is not adversely impacted.

Stormwater interaction with groundwater and potential impacts to the Edithvale-Seaford Wetlands are discussed in:

- EES Technical Report A *Groundwater*
- EES Technical Report B *Ecology: Wetlands and Groundwater Dependent Ecosystems*
- EES Technical Report C *Acid Sulfate Soils and Contamination.*

Method

A desktop assessment of existing flooding and drainage conditions was undertaken by reviewing existing publicly available flood information and drainage infrastructure data. This data included:

- Special Building Overlays and Land Subject to Inundation Overlays from relevant planning schemes
- local government flood mapping
- VicRoads and City of Kingston drainage assets
- local topographical data.

The surface water impact assessment does not seek to specify particular solutions to manage stormwater, but identifies whether standard engineering principles can be applied to mitigate any adverse impact. Stormwater management options should be developed with the City of Kingston and Melbourne Water during the detailed design process.

Key findings – Edithvale and Bonbeach

Runoff from the rail corridor currently flows to the east from along the length of the alignment and ultimately into the City of Kingston drainage network and to the west to the Nepean Highway. There is limited existing drainage infrastructure near, or servicing both of the level crossing removal sites. The City of Kingston has advised that there can be no increase in flow to the City of Kingston's drainage network.

Existing flood planning overlays and topographic data indicate that overland flow or underground drainage does not cross the rail corridor in the vicinity of the two identified level crossings and the risk of interrupting existing stormwater networks or overland flow paths is therefore minimal.

There is the potential that the removal of the two identified level crossings may cause impacts to the surrounding drainage network and adjacent floodplain to the east of the rail corridor during both the construction and operational phase. This is predominantly because runoff currently flows away from the rail corridor uniformly along the site, while during and after construction, runoff within the trench would be concentrated and pumped to a point source single discharge location. There would also be an increase in runoff volume due to the tanked structure where groundwater is present, which will result in an increase in impervious surfaces for a portion of the trench. The City of Kingston has indicated that there is not sufficient capacity in the existing stormwater network to cater for additional flow and any increase in flow would need to be mitigated.

Potential impacts during the construction phase relate to runoff containing high sediment loads being discharged from the site due to dewatering the trench or from runoff from stockpiled material.

Construction risks can predominantly be managed by applying the EPA Victoria (1996) *Best Practice Environmental Management: Environmental Guidelines for Major Construction Sites* (EPA Publication 480).

There are a number of solutions to dispose of stormwater from the trench that do not direct additional flow to the local stormwater network which has insufficient capacity and do not result in more frequent flooding of the road network or increase local flood levels.

A stormwater quality treatment strategy is required to reduce suspended solids and nutrients to meet the *Best Practice Environmental Management Guidelines* (CSIRO) prior to discharging to a receiving pipe or waterway.

Environmental Performance Requirements

The following Environmental Performance Requirements are recommended for the Edithvale and Bonbeach level crossing removal projects:

EPR ID	Environmental Performance Requirement	Stage
EPR_SW1	**Stormwater management - construction** Protect local waterways by applying best practice sedimentation and pollution control measures in accordance with EPA publication 480 *Environmental Guidelines for Major Construction Sites* 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.	Construction
EPR_SW2	**Water quality - operation** The design must include a water collection and treatment system to ensure that stormwater discharges comply with State Environment Protection Policy Waters of Victoria and do not impact beneficial uses of that waterbody. This would include adopting water sensitive urban design and integrated urban water management principles in the stormwater management design, in accordance with the LXRA's Urban Design Framework and the specific Urban Design Guidelines for the projects, and urban stormwater EPA publication 480 *Best Practice Environmental Management Guidelines* in consultation with Melbourne	Operation

EPR ID	Environmental Performance Requirement	Stage
	Water and Kingston City Council as applicable.	
EPR_SW3	**Drainage network - construction** Design surface water discharge to have no adverse impact to the drainage network capacities in consultation with Melbourne Water and Kingston City Council as required.	Construction
EPR_SW4	**Drainage network – operation** Design surface water discharge to have no adverse impact to the drainage network capacities in consultation with Melbourne Water and Kingston City Council as required.	Operation
EPR_SW5	**Flood protection – construction** Maintain existing levels of flood protection associated with overland flow paths (considering flood levels, flows and velocities) during temporary construction works through compliance with Melbourne Water and Kingston City Council requirements for flooding and overland flows.	Construction
EPR_SW6	**Flood protection – operation** Design infrastructure to maintain existing levels of flood protection associated with overland flow paths (considering flood levels, flows and velocities) through compliance with Melbourne Water and Kingston City Council requirements for flooding and overland flows.	Operation

Abbreviations

Term	Definition
ARI	Average recurrence interval
BoM	Bureau of Meteorology
CSIRO	Commonwealth Scientific and Industrial Research Organisation
EES	Environment Effects Statement
EMF	Environmental Management Framework
EPA	Environment Protection Authority Victoria
EPR	Environmental performance requirement
JV	AECOM-GHD Joint Venture
LSIO	Land Subject to Inundation Overlay
LXRA	Level Crossing Removal Authority
mm	millimetres
NTU	Nephelometric turbidity units
RCP	Representative concentration pathway
SEPP	State Environment Protection Policy
SBO	Special Building Overlay
SS	Suspended solids
TN	Total nitrogen
TP	Total phosphorus
WSUD	Water Sensitive Urban Design

Glossary

Term	Definition
Sheet flow	An overland flow or downslope movement of water taking the form of a thin, continuous film over relatively smooth soil or rock surfaces and not concentrated into channels larger than rills
ARI	The average, or expected, value of the periods between exceedances of a given rainfall total
LSIO	Identification under state planning schemes of land in a flood storage or flood fringe area affected by the 1 in 100 year flood
NTU	Unit of measurement for turbidity
RCP	RCP is the abbreviation for Representative Concentration Pathways, and represent four greenhouse gas emission scenarios adopted by the IPCC (International Panel for Climate Change). These scenarios plot climate change trajectories based not only on warming rates, but also on behavioural changes as and a number of other factors also.
Tanked Structure	Waterproof membrane applied over a surface, preventing completely the entry of liquid water under hydrostatic (water) pressure.
SBO	Identification under state planning schemes of land in urban areas liable to inundation by overland flows from the urban drainage system.
WSUD	Integrates water cycle management into urban planning to achieve water quality and waterway health outcomes

1 Introduction

1.1 Purpose

The Victorian Government is removing 50 of Melbourne's most dangerous and congested level crossings, inclusive of the level crossings at Edithvale Road, Edithvale (Edithvale) and Station Street/Bondi Road, Bonbeach (Bonbeach).

The level crossing removal projects have three core objectives. To provide:

- improved productivity from more reliable and efficient transport networks
- better connected, liveable and thriving communities
- safer communities.

The Edithvale and Bonbeach level crossing removal projects were referred to the Minister for Planning on 9 March 2017. On 5 April 2017, the Minister issued a decision determining that an Environment Effects Statement (EES) is required for the projects due to the potential for a range of significant environmental effects.

The purpose of this report is to assess the surface water risks and impacts of both the construction and operational phases associated with the removal of these level crossings.

1.2 Why understanding surface water is important

Modification of the characteristics of an urban hydrological catchment, through processes such as land use change and development, can have a significant impact on the nature of stormwater runoff. These changes generally result in greater volumes of runoff and increased sources and loads of pollutants in runoff.

The existing stormwater network which includes underground drainage, overland flow paths and flood plains, is important to manage stormwater runoff during rainfall. The combined stormwater networks are designed with the intent to:

- manage the frequency that flow occurs at the road surface
- maintain overland flow paths to convey stormwater runoff during large storms
- protect property from flooding
- provide a safe environment for pedestrians and vehicles
- reduce stormwater pollutants.

Understanding the existing stormwater network allows us to understand the impact that changes to runoff quantity and direction may have on floodplain characteristics or the capacity of pipe networks.

1.3 Project description

1.3.1 Overview

Edithvale

The Level Crossing Removal Authority (LXRA) proposes to remove the level crossing by lowering the Frankston railway line into a trench under Edithvale Road while maintaining Edithvale Road at the current road level. The trench would be located between Lochiel Avenue and Berry Avenue. It would be up to 1,300 metres in length and 14 metres wide at its narrowest point, widening to up to 24 metres (including pile widths) at the new Edithvale station platforms.

The rail track would be approximately eight metres below ground level, and sit above the trench base slab and infrastructure to collect and divert rain water from the trench. The maximum depth of the excavation would be 15 metres. Pile depths would be a maximum of 24 metres at the deepest point of the trench.

Barriers, fencing and screening would be erected along the trench at road level to prevent unauthorised access by vehicles or people. Decking above the rail trench would provide for the new station building, car parking and a new substation required to ensure sufficient power is available for passenger services on the Frankston railway line. New pedestrian bridges would be constructed to retain pedestrian access across the railway line. A new station is to be constructed with lift, ramp and stair access to the below-ground train platforms.

Bonbeach

LXRA proposes to remove the level crossing by lowering the Frankston railway line into a trench under Bondi Road while maintaining Bondi Road at the current road level. The trench would be located between Golden Avenue and The Glade. It would be up to 1,200 metres in length and 14 metres wide at its narrowest point, widening to up to 24 metres (including pile widths) at the new Bonbeach station platforms.

The rail track would be approximately eight metres below ground level, and sit above the trench base slab and infrastructure to collect and divert rain water from the trench. The maximum depth of the excavation would be 15 metres. Pile depths would be a maximum of 24 metres at the deepest point of the trench.

Barriers, fencing and screening would be erected along the trench at road level to prevent access by vehicles or people. Decking above the rail trench would provide for the new station building and car parking. New pedestrian bridges would be constructed to retain pedestrian access across the railway line. A new station building would be constructed with lift, ramp and stair access to the below-ground train platforms.

1.3.2 Construction

The key construction activities for the Edithvale and Bonbeach level crossing removal projects include:

- site establishment including:
  - clearing of vegetation and ground levelling
  - establishment of site fencing, staff facilities and temporary construction areas
- protection and/or relocation of utility services
- excavation for piling, foundations and the rail trench
- on site waste management including removal, management and appropriate disposal of excavated soil, rock, stormwater and groundwater
- transport of spoil, excavated material and groundwater offsite
- demolition of existing stations and removal of existing rail and road infrastructure
- construction of bridge/deck structures to support Edithvale Road and Station Street/Bondi Road where they cross the rail line
- construction of base slab and waterproofing, including stormwater tanks
- construction of new station infrastructure including platforms and buildings
- construction of pedestrian overpasses and decking over the rail trench

- installation and commissioning of new rail infrastructure including ballast, overhead line equipment and rail.

In preparation for the main rail occupation, the existing Edithvale and Bonbeach train stations would be closed approximately four weeks in advance. Both projects would be constructed concurrently under the same rail closure which is anticipated to take six weeks.

During the closure of the rail corridor, construction activities would occur 24 hours per day, seven days per week. Additional periodic road closures and lane closures would be required and access along adjacent streets could be restricted. Additional weekend rail shutdowns would likely be required prior to and after the main rail occupation. Construction is expected to be completed within an 18 month period.

1.3.3 Operations and maintenance

Following the completion of the Edithvale and Bonbeach level crossing removal projects, the key operation and maintenance phase activities would include:

- operation – monitoring, controlling and operation of the assets in accordance with the rail and road network requirements
- maintenance – routine inspection and monitoring of the condition of the assets, planned routine maintenance and refurbishment work, and unplanned intervention and repair of the assets.

Operation and maintenance activities would be consistent with existing practices and subject to the evolving operational demands of the road and rail networks.

1.3.4 Surface water considerations

The surface water impact identification and assessment is based on publically available flood and infrastructure data.

Changes to catchment hydrology or the addition of pollutants to the drainage network through increased impervious surfaces and subsequently due to increased runoff, can have a detrimental effect on water quality in local waterways and Port Phillip Bay. Water Sensitive Urban Design (WSUD) should be incorporated into the stormwater network to achieve pollution reduction targets in accordance with the State Environment Protection Policy (SEPP) (Waters of Victoria) requirements.

Continued increases in global greenhouse gas emissions are projected to lead to increases in the frequency and intensity of extreme weather and their associated risks to assets and the communities they support (Arblaster et al., 2015). Climate change is also projected to lead to higher average temperatures and sea level rise based on research by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Bureau of Meteorology (BoM), (2015).

The potential increase in rainfall intensities from climate change and the effect that this might have on the standard of flood protection for the rail corridor, road assets and other properties should be included for all cross-drainage design. A 19 percent increase in rainfall intensity should be considered for the climate change scenario where cross-drainage exists. This is the upper representative concentration pathway (representative concentration pathway (RCP)) 8.5 bound of the range of rainfall intensity increases as recommended by Australian Rainfall & Runoff, and extrapolates to 2100 to align with estimates applied for sea level rise noted.

The effects of sea level rise from climate change have been evaluated for the design case. This considers a rise in sea level of 0.8 metres by 2100 (Melbourne Water, 2017, *Planning for Sea Level Rise*). It has been determined that the impact of sea level rise would not directly impact either site as the floodplain to the east of the sites is separated from the Patterson River by a levee and flows are pumped to the receiving waters. Flood levels to the east of the site are therefore independent of water levels in Port Phillip Bay.

Drainage associated with proposed grade separation infrastructure is designed to be resilient to the impacts of climate change, by considering the potential impacts of increased rainfall intensity and sea level rise and providing increased drainage capacity or freeboard if necessary. Major hydraulic structures including large diameter cross drainage pipes are also designed to cater for increased rainfall intensities. An assessment of existing flood extents and local topography indicates that while increased rainfall intensities would increase nearby flood levels, they would not significantly affect flow paths at either site to the extent that they would interact with the rail corridor. As a result, flood modelling to quantify the impacts that the works would have on drainage and flooding under a climate change scenario has not been undertaken.

1.4 Project areas

1.4.1 Edithvale

The Edithvale Road, Edithvale level crossing project investigation area (Edithvale project area) extends from Lincoln Parade, Aspendale to Chelsea Road, Chelsea. It includes the rail corridor and all of Station Street and Nepean Highway to the east and west of the rail corridor, and small sections of adjacent road reserves. Refer to Figure 1.

1.4.2 Bonbeach

The Station Street/Bondi Road, Bonbeach level crossing removal project area (Bonbeach project area) extends from Chelsea Road, Chelsea to Patterson River, Bonbeach. It includes the rail corridor and all of Station Street and Nepean Highway located to the east and west of the rail corridor, and small sections of adjacent road reserves. Refer to Figure 2.

1.4.3 Temporary construction areas

Specific construction areas have not been identified at this time. Temporary construction areas would be used for site offices, storing materials, plant and equipment, parking for construction works and construction traffic standby.

Figure 1 Edithvale project area

Figure 2 Bonbeach project area

2 Scoping Requirements

In order to meet statutory requirements, protect environmental values and sustain stakeholder confidence, the EES would include an Environmental Management Framework (EMF). The EMF would provide a transparent framework with clear accountabilities for managing and monitoring environmental effects and hazards associated with the construction and operational phases of the projects.

Section 3.5 of the Scoping Requirements (issued September 2017), states ‘Environmental Performance Requirements (EPRs) should be clearly described in the EMF’. This study will identify EPRs, including proposed objectives, indicators and monitoring requirements covering:

- surface water catchments, drainage and behaviour, and beneficial uses.

3 Legislation, policy and guidelines

Table 1 summarises the relevant primary legislation that applies to the Edithvale and Bonbeach level crossing removal projects as well as the implications and required approvals.

Table 1 Primary legislation and associated information

Legislation/policy	Key policies/strategies	Implications for this project	Approvals required
Commonwealth			
National Water Quality Management Strategy	Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000)	The policy sets the water quality objectives required to sustain current environmental values for natural or semi-natural water resources in Australia and New Zealand. The document identifies limits to acceptable change in water quality that would continue to protect the associated environmental value. Meeting the guidelines would provide a level of certainty that there would be no significant impact on waterways or beneficial users.	N/A
State			
Water Act 1989	By-law No. 2: Waterways Land and Protection and Management	Approval is required from Melbourne Water for any works on, over or under a designated waterway or within a Special Building Overlay (SBO).	Approval from Melbourne Water prior to commencing construction.
	Victorian Waterway Management Strategy (2013)	The strategy provides the policy direction for managing Victoria's waterways over an 8 year period.	The condition of rivers, estuaries and wetlands are improved or maintained to provide environmental, social, cultural and economic value for Victorians.
	Healthy Waterways Strategy (2013)	The strategy describes Melbourne Water's role in managing rivers, estuaries and wetlands in Port Phillip Bay and Westernport to improve waterway health.	The project should not inhibit Melbourne Water's ability to achieve the strategy.

Legislation/policy	Key policies/strategies	Implications for this project	Approvals required
Environment Protection Act 1970	The Act regulates the discharge of surface water or groundwater by a system of licences and works approvals.	Any discharge into a waterway or groundwater during the construction of the project must be in accordance with the requirements of the Environment Protection Act.	
	State Environment Protection Policy (Waters of Victoria) (2003)	The State Environmental Protection Policy (Waters of Victoria) identifies the beneficial uses of waterways, which must be protected and lists environmental quality objectives and indicators to measure performance. Works undertaken for the project on or near waterways would need to be managed to protect beneficial uses of the waterway, as defined by the policy. Water quality discharged to waterways would need to comply with the Policy.	Approval from Melbourne Water and EPA required if discharging to a waterway.
Planning and Environment Act 1987	Planning Schemes for the City of Kingston	Any works affected by the Special Building Overlay or Land Subject to Inundation Overlay is to be designed to the satisfaction of the relevant flood plain manager.	The projects do not intersect with these overlays.
Climate Change Act 2017	Defines a set of guiding principles to embed climate change in government decision making	Provides a foundation to manage climate change risks, maximise opportunities.	

The City of Kingston (Council) is responsible for the existing stormwater infrastructure to the east of the rail corridor and a permit would be required for any proposed connection to their stormwater assets. Council has adopted the Kingston Integrated Stormwater Cycle Management Strategy which sets a process for managing stormwater runoff quality and quantity. The project stormwater design is required to be consistent with the objectives of the strategy.

3.1 Surface water assessment criteria

3.1.1 Beneficial use and water quality

State Environment Protection Policies (SEPPs) provide a clear statutory framework of publicly agreed environmental objectives. SEPPs identify the 'beneficial uses' (indicating the environmental values) of the land, water or air environment in any particular place. They establish environmental quality objectives at levels which will ensure the protection of these uses. As legally enforceable statutory instruments, SEPPs provide the cornerstone for a wide range of environmental protection and management activities in Victoria. There are several SEPPs that include urban waterways and other urban waters. State Environment Protection Policy (Waters of Victoria) is the statewide policy. This policy contains catchment specific schedules for Port Phillip Bay. There are also some separate SEPPs for individual catchments such as Western Port. These are progressively being reviewed and included as schedules under the Waters of Victoria policy.

SEPP (Waters of Victoria) identifies a number of beneficial uses of Victoria's waterways including:

- natural aquatic ecosystems and associated wildlife
- water-based recreation
- agricultural water supply
- potable water supply
- production of molluscs for human consumption
- commercial and recreational use of edible fish and crustaceans
- industrial water use.

SEPP (Waters of Victoria) requires that run-off from urban and rural areas must not compromise the identified beneficial uses of the receiving waters. Several provisions of SEPP (Waters of Victoria) specifically refer to stormwater pollution and require that measures be implemented to control its environmental impact.

The environmental objectives of SEPP (Waters of Victoria) define the required water quality conditions of urban waterways and form the targets for stormwater management. There are several ways to estimate the level of stormwater quality improvement necessary to ensure SEPP objectives can be met and the beneficial uses protected. These are by either:

- Monitoring: actual stormwater quality can be compared with receiving water quality to establish the level of treatment necessary to protect beneficial uses, where sufficient monitoring data are available.
- Modelling: stormwater quality and its potential impact on receiving waters can be mathematically modelled to determine treatment requirements. Some monitoring data are usually required to validate such models.
- Generic values: averaged values for typical urban stormwater quality can be compared to receiving water quality and SEPP objectives to indicate the level of improvement required.

Table 2 lists the mean annual pollutant reduction objectives for stormwater runoff required under the Best Practice Environmental Management Guidelines so that the SEPP objectives are met.

Table 2 Pollutant reduction objectives

Pollutant	Receiving water objective	Current best practice performance objective
Post construction phase		
Suspended solids (SS)	comply with SEPP (e.g. not exceed the 90th percentile of 80 mg/L)[1]	80% retention of the typical urban annual load
Total phosphorus (TP)	comply with SEPP (e.g. base flow concentration not to exceed 0.08 mg/L)[2]	45% retention of the typical urban annual load
Total nitrogen (TN)	comply with SEPP (e.g. base flow concentration not to exceed 0.9 mg/L)[2]	45% retention of the typical urban annual load
Litter	comply with SEPP (e.g. no litter in waterways)[1]	70% reduction of typical urban annual load[3]
Flows	maintain flows at pre-urbanisation levels	Maintain discharges for the 1.5 year ARI at pre-development levels
Construction phase		
Suspended solids	comply with SEPP	Effective treatment of 90% of daily run-off events (e.g. <4 months ARI). Effective treatment equates to a 50%ile SS concentration of 50mg/L
Litter	comply with SEPP (e.g. no litter in waterways)[1]	Prevent litter from entering the stormwater system
Other pollutants	comply with SEPP	Limit the application, generation and migration of toxic substances to the maximum extent practicable

[1] *An example using SEPP (Waters of Victoria 1988). General surface waters segment.*

[2] *SEPP Schedule F7-Yarra Catchment-urban waterways for the Yarra River main stream.*

[3] *Litter is defined as anthropogenic material larger than five millimetres.*

3.1.2 Impacts to flood level and drainage assets

The discharge of stormwater from the sites must not result in increased flood levels where property could be impacted. Changes to flood levels within open space or waterways are subject to approval from Melbourne Water.

Modifications to the existing road drainage network were discussed with Melbourne Water during preliminary stakeholder consultation where it was agreed that interruption of overland flow paths or underground stormwater assets within the rail corridor was not significant for these sites. Council has also advised any changes must demonstrate equivalent performance and no increase in flow to the local Council drainage network and maintain existing flow behaviour. Council advised that an increase in catchment area, flows or modification to existing drainage that discharges to the foreshore is not supported or permitted using their drainage assets.

4 Method

This section describes the method that was used to assess the potential impacts of the Edithvale and Bonbeach level crossing removal projects.

A systematic risk based approach was applied to understand the existing environment, potential impacts of the projects and how to avoid, minimise or manage the risk of impact.

The iterative nature of the assessment is illustrated in Figure 3.

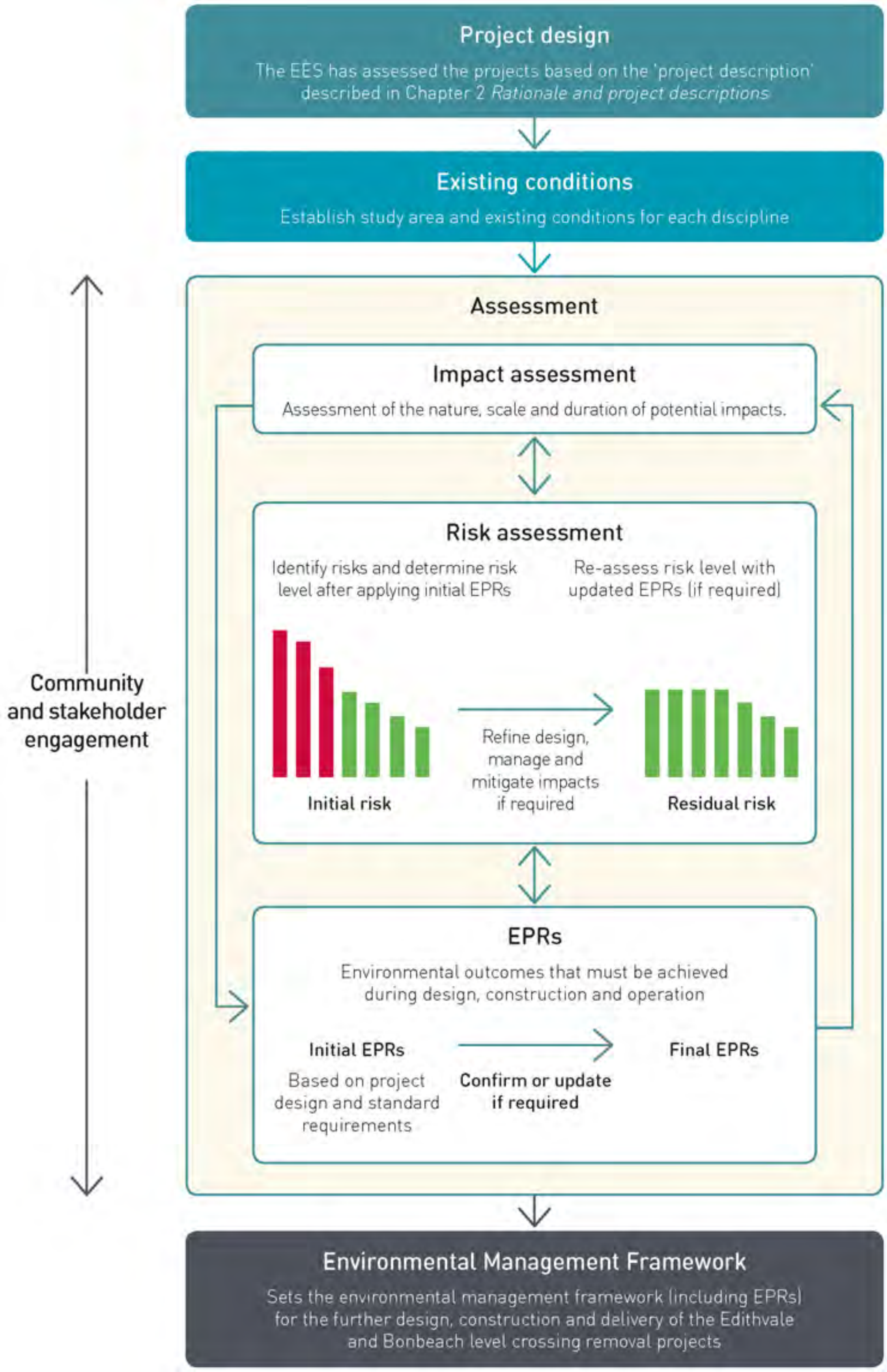


Figure 3 Overview of impact and risk assessment process

The following sections outline the methodology for the surface water impact assessment.

4.1 Existing conditions assessment

A desktop assessment of existing hydrological conditions was undertaken by reviewing existing publicly available flood information and drainage infrastructure data. This data included:

- Special Building Overlay (SBO) and Land Subject to Inundation Overlay (LSIO) planning overlays from relevant planning schemes
- City of Kingston flood modelling
- VicRoads and City of Kingston drainage assets
- local topographical data.

4.2 Risk assessment method

A risk-based approach is integral to the EES as required by Section 3 of the Scoping Requirements for the EES.

The risk management approach adopted for the Edithvale and Bonbeach EES is consistent with AS/NZS ISO 31000:2009 Risk Management Process and involves the following steps:

- establishment of the context of the risk assessment – this identifies the boundaries of the projects including the project definition, the duration of construction and operation, the design and environmental controls that would be in place (initial Environmental Performance Requirements (EPRs) – refer to Section 8), and the location of the projects
- risk identification – identification of risk pathways by specialists in each relevant discipline area
- risk analysis – assessment of risk for each risk pathway, whereby risk is a combination of:
    - the likelihood of an event and its associated consequences occurring
    - the magnitude of potential consequences of the event.
- risk evaluation – review key risks posed by the projects to focus effort in terms of impact assessment and mitigation.
- risk treatment – identification of additional management and mitigation where required to reduce risk levels where possible.

An initial risk assessment was undertaken to assess potential risks to the environment arising from the implementation of the projects. Where risks were minor or above, further mitigation was explored. Risks were re-assessed to determine the residual risk based on further mitigation.

A more detailed description of each step in the risk assessment process is provided in EES Attachment II *Environmental Risk Report*.

This technical report describes the risks associated with the projects on surface water.

4.3 Impact assessment methods

4.3.1 Construction

Likely impacts during construction have been identified by assessing the existing drainage or overland flow paths that would need to be maintained during the construction period so that the existing drainage network is not disrupted.

Consideration has also been given to how runoff within the excavated trench would be managed and disposed of during the construction period. The potential impact of a pumping system on the local stormwater network and receiving waters has been assessed by considering general stormwater management practices.

There are numerous strategies that can be applied to manage stormwater during construction. Management of stormwater during the construction phase should be based on the mitigation techniques listed in the *Best Practice Environmental Management: Environmental Guidelines for Major Construction Sites* (EPA Publication 480).

This report also provides an analysis of the likely surface water impacts that could reasonably be expected to occur from temporary laydown areas.

4.3.2 Operation

Operational impacts have been determined by assessing how the proposed works would permanently alter overland flow paths and the impact this may have on existing flood levels or extents. The potential to direct additional flow to existing underground infrastructure has also been considered.

4.4 Environmental Performance Requirements

The environmental outcomes that must be achieved during design, construction and operation of the projects are referred to throughout the EES as Environmental Performance Requirements (EPRs). EPRs must be achieved regardless of the construction methodology or design solutions adopted. Measures identified in this EES to avoid or minimise environmental impacts have formed part of the recommended EPRs for the projects.

The development of a final set of EPRs for the project has been iterative.

4.4.1 Initial EPRs

Environmental performance requirements were identified to inform the assessment of initial risk ratings (where appropriate). These initial EPRs were based on compliance with legislation and standard requirements that are typically incorporated into the delivery of construction contracts for rail projects.

4.4.2 Confirm or update EPRs

The risk assessment either confirmed that these EPRs were adequate or identified the need for further refinement.

EPRs were updated or new EPRs were developed for any initial risk that could not be appropriately managed by standard requirements. The risk and impact assessment processes confirmed the effectiveness of new or updated EPRs to determine the residual risk rating.

4.4.3 Final EPRs

The EPRs recommended for the projects are outlined in Section 8 of this report and are included in the EES Environmental Management Framework.

The EPRs are applicable to the final design, construction approach and operation and provide certainty regarding the environmental performance of the projects.

4.5 Linkage to other technical reports

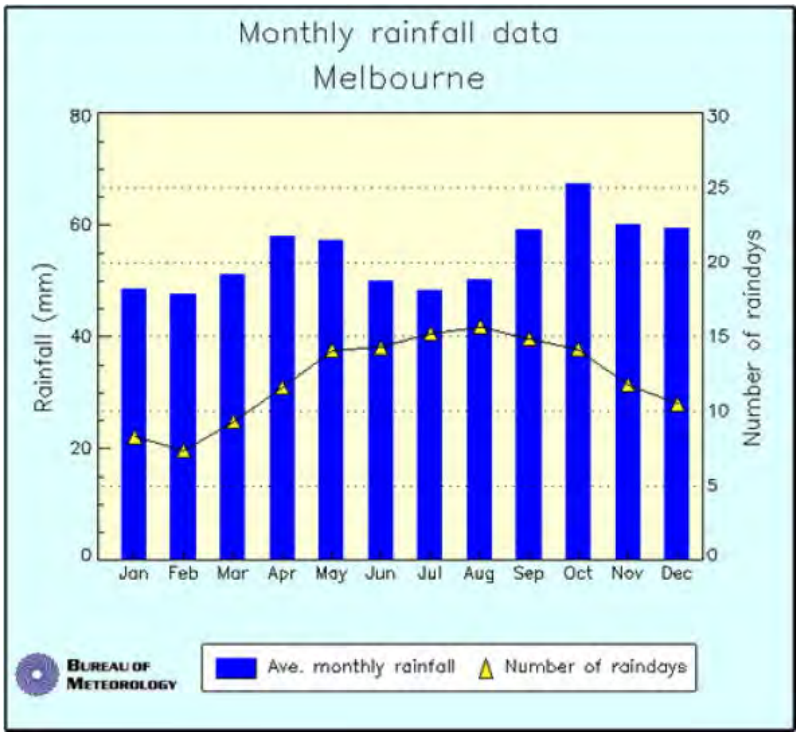
This report relies on, or informs the following technical assessments:

- EES Technical Report A *Groundwater*
- EES Technical Report B *Ecology: Wetlands and Groundwater Dependent Ecosystems*
- EES Technical Report C *Acid Sulfate Soils and Contamination*

5 Existing conditions

5.1 Regional – Edithvale and Bonbeach

Rainfall in the region is generally uniform with the wettest periods occurring in late autumn and spring however intense rainfall and flooding can occur at any time during the year. Monthly rainfall data for the Melbourne Regional Office rainfall gauge is provided in Figure 4. This illustrates the long-term representative mean rainfall.



Mean rainfall (mm) for years 1855 to 2015 http://www.bom.gov.au/

Figure 4 Monthly rainfall data for Melbourne

The Edithvale and Bonbeach sites are located between the Nepean Highway and Station Street. Run-off from land to the east of the rail corridor drains into the Centre Main Drain, which runs north-south along the western side of the Edithvale component of the Edithvale-Seaford Wetlands. Stormwater reaches the drain via overland flow or the underground stormwater system. The drain discharges stormwater collected north of Thames Promenade into Mordialloc Creek, and from south of Thames Promenade into the Patterson River, both via a stormwater pump station. Runoff is captured by the Centre Main Drain during very minor storms and does not discharge to the Edithvale-Seaford Wetlands, however runoff would combine with the floodplain when the capacity of the drain is exceeded. Run-off from the western side of the rail corridor discharges to the Nepean Highway.

There is no immediate formal drainage network to capture stormwater from the rail corridor and runoff currently flows onto the adjacent road networks and eventually flows into the existing piped stormwater system.

Both sites are located between the Nepean Highway and Station Street, which are particularly flat and have minimal longitudinal grade. Topographical survey (Lidar) data and site observations indicate that the proposed works would occur along an existing ridge which is elevated above the adjacent road; surface flows generally discharge away from the rail corridor towards Nepean Highway or Station Street.

Runoff currently produced by the Nepean Highway discharges to local stormwater drainage networks which are generally minor in scale and then to Port Phillip Bay. Runoff from the Station Street side of the rail corridor discharges to the east.

There is limited Council drainage infrastructure near the project extents and Council has advised during stakeholder consultation that the majority of local drainage assets do not have spare capacity. While the surrounding area is flat, existing flood information obtained from the Council does not indicate flooding in the immediate vicinity of the projects areas or rail corridor. There are, however, considerable areas identified as impacted by frequent surface flooding and overland flow to the east.

A project extent with surrounding contours and flood extents based on planning overlays and Council flood mapping for existing climate conditions is provided in Appendix A.

There are no existing surface flow paths or underground drainage infrastructure that cross the rail corridor that would be affected by the works proposed for the two level crossing removal sites. As the sites are at the top of the catchment, adjacent surface water characteristics at the project sites will not alter as a result of climate change, however there will be an increase in runoff from the sites due to increased rainfall intensity. As a result, further climate change analysis has not been undertaken, however management of runoff from within the rail corridor allow for the effects of climate change

There are no formal stormwater harvesting schemes from Melbourne Water assets within the vicinity of the sites, however, Rosedale Golf Course currently diverts 40 mega litres per year from the Centre Main Drain and would not be impacted by runoff from the two sites.

Council has a stormwater strategy in place and has a desire to increase stormwater harvesting and WSUD throughout the municipality. There is an existing stormwater harvesting system in Hugh’s Avenue that is used to irrigate the Edithvale Recreational Ground and a system is also planned for Bondi Road.

6 Risk assessment

A risk assessment of project activities was performed in accordance with the methodology described in Section 4.2. Risks were assessed for the construction and design/operation phases (where relevant).

The residual surface water risks associated with the projects are listed in Table 3. The likelihood and consequence ratings applied during the risk assessment process are provided in Appendix B. There was no change in the initial risk and final risk levels for surface water.

Table 3 Construction and operation risks

Risk ID	Event name	Potential impact pathway	EPR ID	Risk level
Construction risks				
SW22	Site dewatering (runoff capacity)	Dewatering of the trenches following a storm results in a reduction in capacity in the local stormwater infrastructure elsewhere and results in flooding.	EPR SW3 Drainage network - construction EPR SW5 Flood protection - construction	Negligible
SW23	Site dewatering (runoff quality)	Dewatering of the trenches following a storm results in stormwater above SEPP limits being pumped to receiving water bodies.	EPR SW1 Stormwater management - construction	Negligible
SW24	Stormwater runoff	Stormwater runoff is above SEPP limits and enters receiving water bodies.	EPR SW1 Stormwater management - construction	Negligible
Operational risks				
SW22	Site dewatering (runoff capacity)	Dewatering of the trenches following a storm results in a reduction in capacity in the local stormwater infrastructure elsewhere and results in flooding.	EPR SW4 Drainage network – operation EPR SW6 Flood protection - operation	Negligible
SW23	Site dewatering (runoff quality)	Dewatering of the trenches following a storm results in stormwater above SEPP limits being pumped to receiving water bodies.	EPR SW2 Water quality - operation EPR SW6 Flood protection - operation	Negligible

For further details refer to the EES Attachment II *Environmental Risk Report* which includes the full risk register, with initial EPRs and the final EPRs assigned to each risk.

7 Impact assessment

7.1 Edithvale and Bonbeach

The hydrological impacts from the Edithvale and Bonbeach projects would be similar and hence have been assessed in a single impact assessment.

7.1.1 Construction impacts

7.1.1.1 Water quality

Runoff from disturbed areas and stockpiled material (if stockpiling occurs) has the potential to impact water quality in receiving waters, as the runoff may contain sediment or other pollutants (**risk SW24**). Runoff from lay down areas and haulage routes may also increase turbidity of receiving water bodies resulting in reduced water quality. There is also the potential for these sediments to contain pollutants including contaminated sediments, oils and/or chemicals.

After a rain event it would be necessary to pump surface water out of the trench which may be high in sediment, turbidity and other pollutants (**risk SW23**). As a result it may not be possible to discharge directly to the local stormwater network, which would either discharge to a nearby waterway or Port Phillip Bay. Pollutants associated with contaminated soils and groundwater are discussed in EES Technical Report *Acid Sulfate Soils and Contamination*.

Management and mitigation

Water collected from within the trench would be appropriately collected and treated prior to discharging to the approved local stormwater network. A stormwater site management plan should be developed prior to construction commencing and developed in accordance with the *Best Practice Environmental Management: Environmental Guidelines for Major Construction Sites* (EPA Publication 480) (**EPR_SW1**), in order to meet the SEPP requirements. Construction management techniques to assist in managing construction runoff may include:

- minimise the extent and duration of disturbed areas
- provide a sediment basin within the excavation or at the surface to allow coarse material to settle out
- ensure the turbidity does not exceed 30 nephelometric turbidity units (NTU)
- minimise the external catchment draining to the excavated area
- regularly monitor pumped water quality
- consider carting water to a location where it can be discharged over a vegetated surface to filter out sediment.

Wherever possible, excavated material should be removed directly from site without stockpiling at the surface. If stockpiling occurs, runoff from stockpiled material would also need to be minimised and managed in accordance with the *Best Practice Environmental Management: Environmental Guidelines for Major Construction Sites* (EPA Publication 480) (**EPR_SW1**) using techniques such as:

- minimise the volume and area of stockpiled material and removing excavated material directly from site where possible
- minimising the time construction materials are stockpiled at the surface
- covering materials that may have fine particles
- preventing flow from external catchments from flowing around the base of stockpiled material
- bunding or providing silt fences around stockpiled material
- directing runoff from stockpiled material to a temporary sediment basin.

A Construction Environmental Management Plan should be prepared which indicates how potentially contaminated runoff will be characterised, treated and disposed of. If runoff from stockpiled spoil material occurs, it must meet the SEPP requirements. Other pollutants including oils, chemicals or metals used at construction sites should be managed in accordance with the EES Technical Report C *Acid Sulfate Soils and Contamination*.

With the implementation of these controls stormwater runoff from the rail corridor and stockpiled material (if stockpiling occurs) during construction is unlikely to exceed the SEPP (Waters of Victoria) limits. Therefore the risk of stormwater entering Patterson River and Port Phillip Bay above the SEPP (Waters of Victoria) limits during construction of the projects would be negligible.

7.1.1.2 Disposal of runoff from construction site

During construction, it would be necessary to dispose of runoff from the trench after a storm using temporary pumps. A suitable point of discharge would need to be identified so that there is no adverse impact to existing flood levels and the capacity of local stormwater pipe networks is not exceeded (**risk SW22**).

Dewatering of groundwater infiltration is covered in EES Technical Report A *Groundwater*.

Management and mitigation

Council has advised that the existing infrastructure has no additional capacity to cater for an increase in flow rate if the network is still conveying surface runoff. Water from the trench would need to be discharged under a delayed regime so that it does not exceed the capacity of the local drainage network or increase surrounding flood levels (**EPR_SW3**).

There are a number of measures that can be used to manage site runoff during the construction period. Trench dewatering can be managed by providing storage within the excavation to retain surface runoff which can then be pumped out at a slower rate or pumping can be delayed until the storm has ceased. A temporary alternative outfall could also be provided that does not impact on the local stormwater network. If storing water within the trench will delay works, runoff could be pumped to a temporary storage at the surface, such as a water truck, and then discharged at a controlled rate once flow in the piped network has ceased.

The trench excavation should also be managed to limit any external catchment that drains into the trench during construction.

By implementing the above controls and complying with council requirements, dewatering of the trench following a storm is unlikely to result in a reduction in capacity of the local stormwater infrastructure and result in flooding. Furthermore, the excavation provides an opportunity to further manage runoff by temporarily storing water when necessarily. Therefore, the risk of the impact would be negligible.

7.1.2 Operational impacts

7.1.2.1 Hydraulic capacity

It is intended to remove stormwater runoff collected in the rail trench via a pumped system. This would result in flows from the lowered section of the alignment being concentrated at one point and discharged to a single receiving location. There would also be increased total runoff volume as the current permeable surface below the ballast would be replaced with an impermeable barrier where the trench structure is tanked. Council has indicated that there is not sufficient capacity in the existing network to accommodate additional flows or runoff from increased catchments. Discharging to the existing network without appropriate stormwater management and mitigation measures may result in additional surface flows and increased flood levels (**risk SW22**) without the appropriate mitigation measures discussed below.

Management and mitigation

Stormwater runoff from the rail corridor must be disposed of such that there is no increase in surrounding flood levels and there is no reduction in the performance of the local stormwater network (**EPR_SW4**).

There are a range of potential options that could be assessed to provide a suitable outfall for runoff collected in the trench, which may include:

- providing an alternative outfall to the Centre Main Drain that does not utilise the existing Council network
- providing a rising main along the rail alignment to collect runoff from the Edithvale and Bonbeach sites and discharging directly to Patterson River
- utilising the two hour backup underground storage required by Metro Trains Melbourne to detain runoff and pump out after the storm has ceased at a rate agreed to by the City of Kingston. The required storage volume should make an allowance for increased rainfall intensities as a result of climate change.
- liaise with the City of Kingston and Melbourne Water in developing the stormwater strategy.

Consultation with Melbourne Water is also required if new connections to waterways are proposed in order to maintain existing flood protection (**EPR_SW6**).

With the implementation of suitable stormwater management and complying with relevant approval authority requirements for flooding and overland flows, the projects can be designed to have no adverse impact to the capacity of the drainage network or flood levels and therefore the risk would be negligible.

7.1.2.2 Water quality

Runoff from the rail corridor must meet water quality requirements and reduce pollutants in accordance with the '*Best Practice Environmental Management Guidelines'* (**risk SW23**).

Management and mitigation

SEPP (Waters of Victoria) requires that pollutants in stormwater runoff are reduced in accordance with the criteria listed in Table 2. A water quality treatment strategy is required to remove pollutants so that these targets are met (**EPR_SW2)**.

This can be achieved by providing a WSUD treatment, such as a biofilter, prior to discharging to a nominated outlet or installing a proprietary treatment device. There may also be an opportunity to combine a WSUD treatment with a future Council asset. The inclusion or utilisation of a WSUD treatment would result in a net water quality benefit as a result of the projects, as water currently discharges from this section of rail untreated.

Stormwater would be treated to meet the SEPP (Waters of Victoria) discharge limits. Therefore it is unlikely that dewatering of trenches following a storm would result in stormwater above the SEPP (Water of Victoria) limits for turbidity being pumped to Patterson River and Port Phillip Bay. A WSUD treatment can be designed and incorporated into the proposed works to meet the EPR's and therefor the risk of exceeding SEPP limits is considered negligible.

8 Environmental Performance Requirements

The EPRs required for the projects to achieve acceptable environmental outcomes are summarised in Table 4. The EPRs are applicable to the final design and construction approach and provide certainty regarding the environmental performance of the projects.

Table 4 Edithvale and Bonbeach Environmental Performance Requirements

EPR ID	Environmental Performance Requirement	Stage
EPR_SW1	**Stormwater management - construction** Protect local waterways by applying best practice sedimentation and pollution control measures in accordance with EPA publication 480 *Environmental Guidelines for Major Construction Sites* 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.	Construction
EPR_SW2	**Water quality - operation** The design must include a water collection and treatment system to ensure that stormwater discharges comply with State Environment Protection Policy Waters of Victoria and do not impact beneficial uses of that waterbody. This would include adopting water sensitive urban design and integrated urban water management principles in the stormwater management design, in accordance with the LXRA's Urban Design Framework and the specific Urban Design Guidelines for the projects, and urban stormwater EPA publication 480 *Best Practice Environmental Management Guidelines* in consultation with Melbourne Water and Kingston City Council as applicable.	Operation
EPR_SW3	**Drainage network - construction** Design surface water discharge to have no adverse impact to the drainage network capacities in consultation with Melbourne Water and Kingston City Council as required.	Construction
EPR_SW4	**Drainage network – operation** Design surface water discharge to have no adverse impact to the drainage network capacities in consultation with Melbourne Water and Kingston City Council as required.	Operation
EPR_SW5	**Flood protection – construction** Maintain existing levels of flood protection associated with overland flow paths (considering flood levels, flows and velocities) during temporary construction works through compliance with Melbourne Water and Kingston City Council requirements for flooding and overland flows.	Construction
EPR_SW6	**Flood protection – operation** Design infrastructure to maintain existing levels of flood protection associated with overland flow paths (considering flood levels, flows and velocities) through compliance with Melbourne Water and Kingston City Council requirements for flooding and overland flows.	Operation

9 Conclusion

A surface water impact assessment has been undertaken for the Edithvale and Bonbeach level crossing removal projects to determine the impacts on surface water as a result of the projects and to identify management and mitigation options in order to reduce potential risks of the projects.

Existing conditions

The eastern side of both Bonbeach and Edithvale sites are located within the larger catchment that drains towards the Edithvale-Seaford Wetlands via overland flow within the road network and an underground stormwater system. Flows within the piped system connect to the Centre Main Drain and discharge to the Patterson River via a stormwater pump station. Runoff from the western side of the rail corridor will flow into the kerb and channel along the Nepean Highway.

There is limited Council drainage in the vicinity of both sites. Council has advised that the existing stormwater system does not have spare capacity and is unlikely to be able to cater for additional flow.

The rail corridor is located on a local ridge with surface water flowing away from both sites to the west and east. Existing flood information indicates that there are no overland SBO or LSIO flood overlays that affect either location. There are no overland flow paths or stormwater infrastructure that cross the rail corridor that would be impacted by the proposed works.

Impact assessment

The removal of the two level crossings may cause impacts to the surrounding drainage network and floodplain during both the construction and operational phase.

Potential impacts during the construction phase relate to runoff containing high sediment loads being discharged from the site due to dewatering the trench or from runoff from stockpiled material.

Construction risks can predominantly be managed by applying the EPA Victoria *Environmental Guidelines for Major Construction Sites*.

Runoff from within the trenches would be pumped to the surface and discharged to a single location which differs from the existing condition where runoff is distributed and flows from the rail surface along the corridor.

There are a number of potential solutions to dispose of stormwater from the trench that does not direct additional flow to the local stormwater network where there is insufficient capacity, result in more frequent flooding of the road network or increase local flood levels.

Stormwater quality treatment would be required to reduce suspended solids and nutrients to meet the ‘*Best Practice Environmental Management Guidelines*’ prior to discharging to a receiving pipe or waterway.

Residual risk

Engineering design would be able to address the operational risks for the majority of occasions where storms are within the specified design average recurrence intervals (ARIs). Management of construction risks would require the strict implementation of an Environmental Management Framework; however, there would still be a risk of turbid water being discharged from the site during large storms. Operational risks would be managed by adopting stormwater management techniques so that SEPP requirements are met and there is no increase in flood levels that effects other property.

10 References

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Appendix A – Existing drainage infrastructure and flood overlays

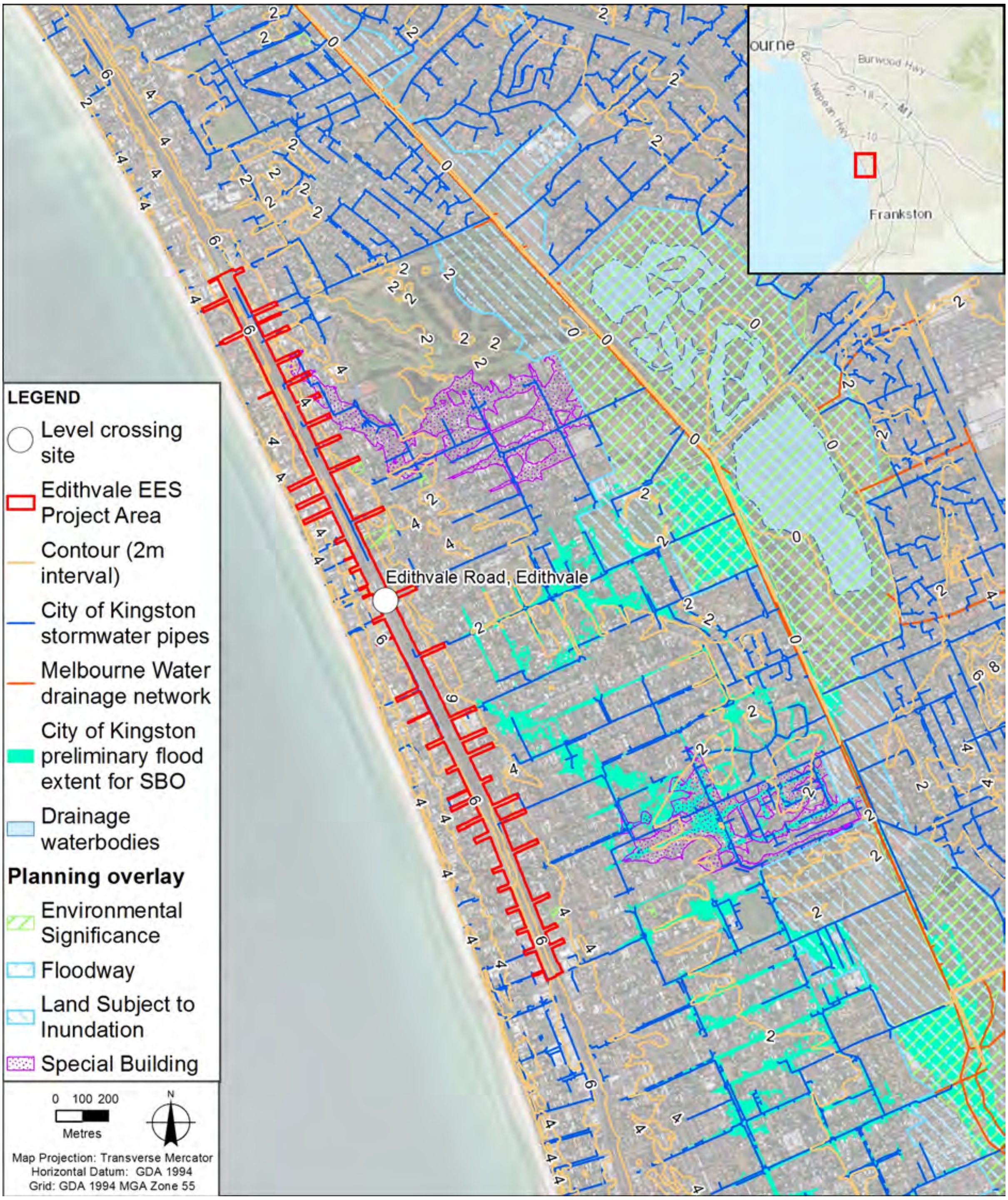

Figure 5 Existing drainage infrastructure and flood overlays (Edithvale)

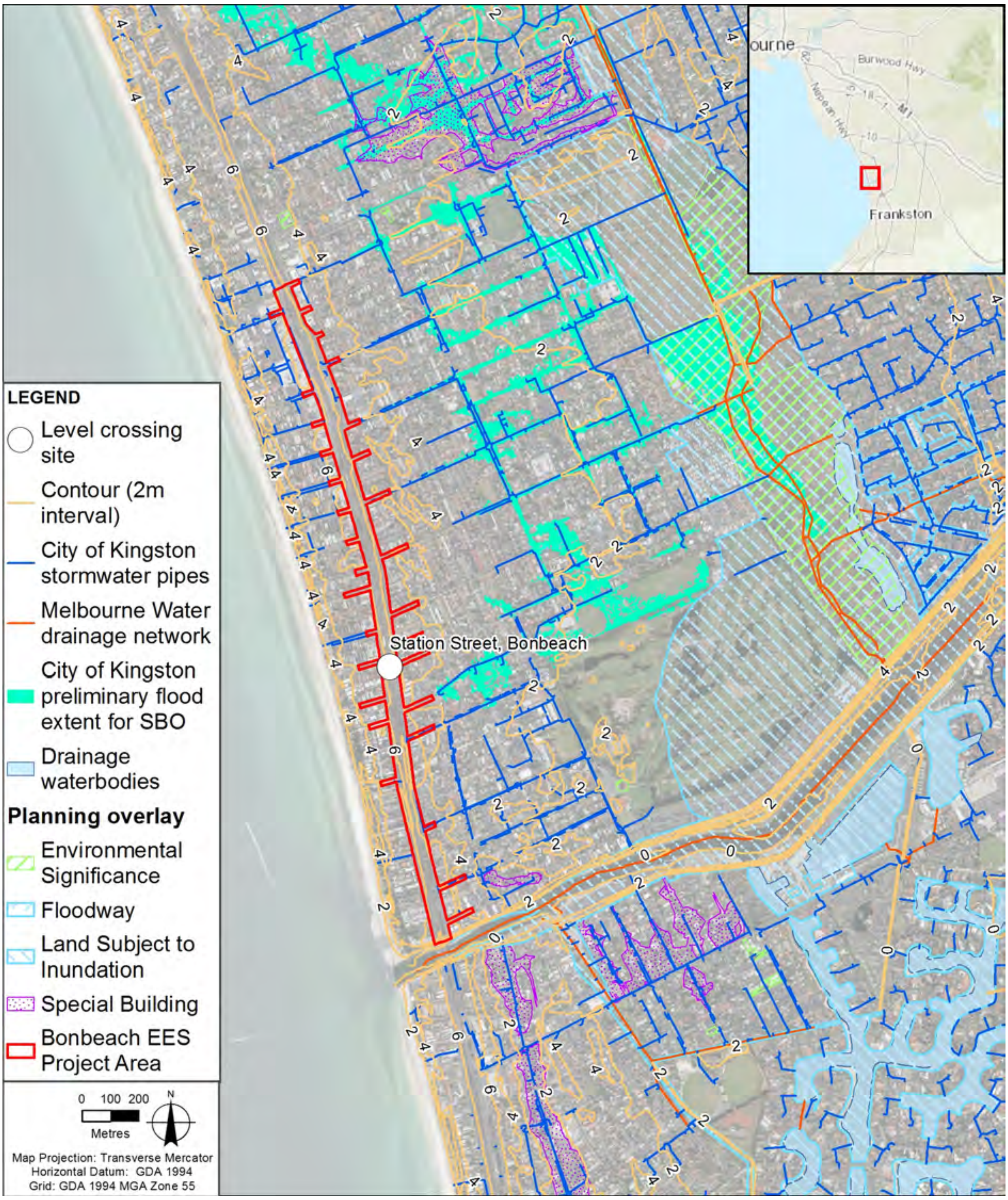

Figure 6 Existing drainage infrastructure and flood overlays

Appendix B – Risk assessment

Table B1 Guide to quantification of likelihood

Qualitative descriptions	Probability over a given time period	Basis
A. Certain	1 (or 0.999, 99.9 %)	Certain, or as near to as makes no difference
B. Almost certain	0.2 – 0.9	One or more incidents of a similar nature has occurred here
C. Highly probable	0.1	A previous incident of a similar nature has occurred here
D. Possible	0.01	Could have occurred already without intervention
E. Unlikely	0.001	Recorded recently elsewhere
F. Very unlikely	1×10^{-4}	It has happened elsewhere
G. Highly improbable	1×10^{-5}	Published information exists, but in a slightly different context
H. Almost impossible	$1 \text{ X } 10^{-6}$	No published information on a similar case

Source: Bowden, A.R., Lane, M.R. and Martin, J.H., 2001, Triple Bottom Line Risk Management – Enhancing Profit, Environmental Performance and Community Benefit, Wiley and Sons, New York, 314 pp.

Table B2 Consequence table used for surface water risk assessment

Qualitative descriptor	Negligible		Minor		Moderate		Major		Extreme
Consequence description	**Minimal, if any impact for some communities. Potentially some impact for a small number (<10) of individuals**		**Low level impact for some communities, or high impact for a small number (<10) of individuals**		**High level of impact for some communities, or moderate impact for communities area-wide**		**High level of impact for communities area-wide**		**High level of impact State-wide**
	0.1	**0.3**	**1**	**3**	**10**	**30**	**100**	**300**	**1000**
ENVIRONMENT **Surface water quality**	Applicable water quality standards met across the region.		Isolated, minor and temporary exceedance of applicable water quality standards that is short lived.		Localised exceedance of applicable water quality standards.		Major exceedance of water quality standards in a local area.		Regional and prolonged exceedance of applicable water quality standards.
ENVIRONMENT **Surface water flow**	Negligible change to waterway and flow regime.		Some change to waterway or flow regime with minor implications.		Changes to waterway or floodplain function with moderate implications.		Waterway, floodplain levels that impact project or river health significantly compromised.		Extensive impact to waterway, floodplain function or flow regime with irreversible disturbance to river health or flood levels.

Table B3 Surface water risks

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Construction risks										
SW 22	Site dewatering (runoff capacity)	Dewatering of the trenches following a storm event results in a reduction in capacity in the local stormwater infrastructure elsewhere and results in flooding.	EPR SW3 Drainage network – construction EPR SW5 Flood protection – construction	Very unlikely	Moderate	Negligible	As initial EPR	Very unlikely	Moderate	Negligible
SW 23	Site dewatering (runoff quality)	Dewatering of the trenches following a storm event results in stormwater above SEPP limits being pumped to receiving water bodies.	EPR SW1 Stormwater management – construction	Unlikely	Minor	Negligible	As initial EPR	Unlikely	Minor	Negligible
SW 24	Stormwater runoff	Stormwater runoff is above SEPP limits and enters receiving water bodies.	EPR SW1 Stormwater management – construction	Highly improbable	Minor	Negligible	As initial EPR	Highly improbable	Minor	Negligible

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Operation risks										
SW 22	Site dewatering (runoff capacity)	Dewatering of the trenches following a storm event results in a reduction in capacity in the local stormwater infrastructure elsewhere and results in flooding.	EPR SW4 Drainage network – operation EPR SW6 Flood protection – operation	Almost impossible	Moderate	Negligible	As initial EPR	Almost impossible	Moderate	Negligible
SW 23	Site dewatering (runoff quality)	Dewatering of the trenches following a storm event results in stormwater above SEPP limits being pumped to receiving water bodies.	EPR SW2 Water quality – operation EPR SW6 Flood protection - operation	Very unlikely	Minor	Negligible	As initial EPR	Very unlikely	Minor	Negligible