AJM Joint Venture

MELBOURNE AIRPORT RAIL

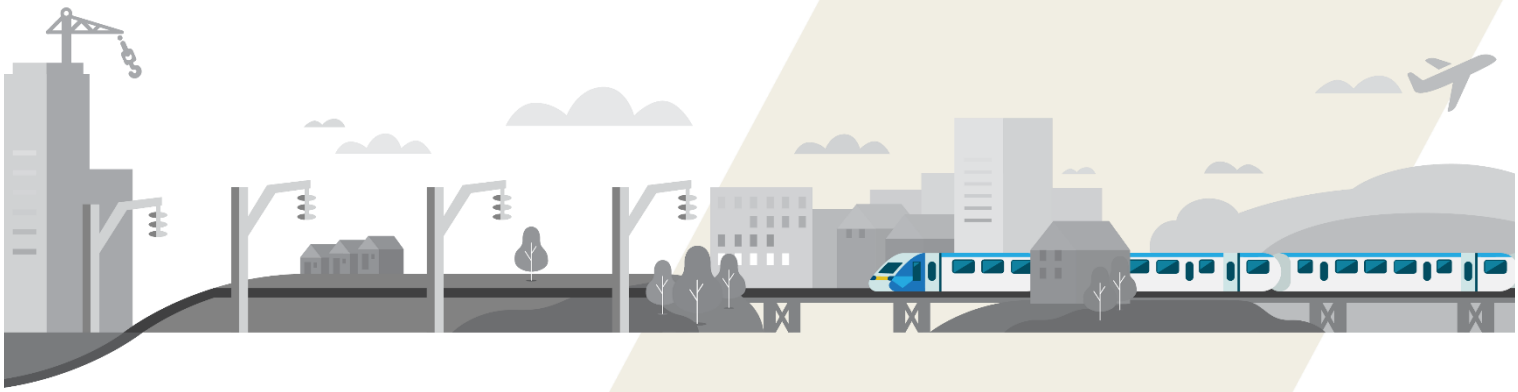
MAR STATE LAND SURFACE WATER ASSESSMENT

MAR-AJM-PWD-PWD-REP-XLP-NAP-0001723

9 September 2021

Revision C

Prepared for Rail Projects Victoria



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Appendices

1. Executive Summary

Surface water and hydrology management are important aspects that contribute to the wellbeing of Melbourne's urban creeks, river systems and floodplains and the environmental and amenity benefits they provide. It is important that the Project is designed and constructed to maintain water quality and floodplain function. Melbourne Airport Rail (MAR) is primarily located within the lower urban reaches of the Maribyrnong River, with the project sub-catchments being the Maribyrnong River, Stony Creek and Steele Creek. These catchments flow into the Yarra River before entering Port Philip Bay.

The MAR Project will intersect these catchments, including the waterways and associated floodplains, with existing structures being the Maribyrnong River Bridge; and the twin track viaduct structure crossing Steele Creek and the M80 Freeway. The surface water assessment has evaluated the potential impacts due to construction and operation of the Project within this study area. This report focuses on the assessment of potential impacts resulting from the Project interacting with waterways, overland flow paths and drainage alignments. The assessment has identified potential impacts, primarily in relation to:

- Water quality – potential for contaminated runoff or other potentially impacted water to surface or that impacts on the beneficial uses associated with these waterways, including the protection of human health, ecosystems, and amenity.
- Flood impacts – potential for the Project to affect surface water and hydrology with respect to flooding during construction and operational phases.

Base case hydrological and hydraulic flood models have been peer reviewed by Hydrology and Risk Consulting (HARC) on behalf of Melbourne Water. Impacts have been assessed using these peer-reviewed models during the reference design phases. The models are well understood and there is a well-established planning approvals process applied by the relevant statutory authorities which has been applied to a large number of similar infrastructure projects. This process will be implemented irrespective of the planning approvals pathway.

On this basis the Project will be designed and constructed to comply with the requirements stipulated by the Catchment Management Authority (Melbourne Water) and Local Council requirements. This includes compliance with the relevant design criteria to meet indicators and objectives outlined in the Environmental Reference Standard (ERS) for environmental values of waterways.

Permanent works will not have any adverse impacts on flow velocities, and any change to the flow regime must satisfy Melbourne Water and adhere to its requirements; and flood risks will be assessed by modelling of the design of works and structures. This includes no significant adverse flood impacts associated with the Project, for a range of events up to and including the '1% Annual Exceedance Probability (AEP) plus climate change' flood event.

Flood risk has been assessed by modelling of the design of works (reference design) and structures to demonstrate that the Project meets Melbourne Water (statutory authority) nominated flood level, flow and velocity requirements. Flood modelling assessed the potential for flood impacts on surrounding public safety, property and assets and indicates that with some further refinement, sufficient storage and flow control would be provided to mitigate any effects of the Project. Minimal, if any, upstream and downstream impacts are therefore anticipated to occur. It is anticipated that environmental risk management measures will be implemented in the detailed design phase to demonstrate, through modelling, that the design of permanent and temporary infrastructure, which may vary from the reference design assessed, meets the flood level, flow and velocity requirements and there are no outstanding risks. All works on the waterways will be undertaken to the requirements of Melbourne Water in consultation with relevant local councils in order to obtain 'No Objection' status required for the necessary surface water related planning approvals.

Risks associated with impacts to surface waters during construction can be managed through standard mitigation measures implemented via the Construction Environment Management Plan (CEMP), and the preparation and implementation of a Surface Water Management Plan specifying the required mitigation measures. This, along with drainage asset condition assessments before and after construction works, would mitigate or minimise adverse effects on bank stability.

2. Introduction

Aurecon Jacobs Mott Macdonald Joint Venture (AJM-JV) has been engaged by Rail Projects Victoria (RPV) to prepare the Melbourne Airport Rail (MAR) State Land Surface Water Impact Assessment (the Impact Assessment).

2.1 Purpose

This impact assessment report is a technical reference document which assesses the potential impacts for the construction or operation of the Project to influence surface water flows and/or flooding within their associated floodplains. The impact assessment will support the State land planning approvals process for the Melbourne Airport Rail (MAR) project. The key intent of the document is to:

- Inform the strategic justification needed to support planning approvals under the *Planning and Environment Act 1987* (P&E Act); and
- Inform an assessment of the Project against the Ministerial Guidelines for Assessment of Environmental Effects under the *Environment Effects Act 1978* (the Ministerial Guidelines), referred to as an *Environment Effects Act 1978* (EE Act) self-assessment.

This report is not intended to present advice in respect to 'constructability' of the project. However, it is intended to summarise the existing conditions, outline the current understanding of the potential surface water impacts due to the construction and operation of the Project, and provide recommendations on potential environmental risk management measures applicable during the planning, design and delivery phase of works.

2.2 Methodology

The preparation of the Impact Assessment included the following:

- Review of the scope of works and mapping presented in the 'MAR Corridor and Sunshine Sections Project Description for Environmental Specialists' (MAR-AJM-PWD-PWD-MEM-XLP-NAP-0001505, Revision C) (the Project Description).
- Review of the relevant policy, standards, legislation, and guidance.
- Desktop assessment to characterise the existing conditions of the surface water features, including discharge points, surface waterbodies, and floodplains.
- Where possible, use of hydrologic and hydraulic models to determine flood flows and levels for a range of flood events, including allowances for the impacts of climate change. This was then used to inform the environmental risks and potential impacts.
- Assessment of the potential surface water impacts during the construction and operation of the Project.
- Recommendation of environmental risk mitigation measures to reduce potential impacts associated with the Project in the construction, and operational phases.

2.3 Assumptions and Limitations

The following assumptions and limitations apply to this Impact Assessment:

- The Impact Assessment relates only to public and privately owned State land and does not consider Commonwealth-owned land or the 'Airport' design section, as Commonwealth land is not subject to Victoria's legislative framework. Impact Assessments associated with Commonwealth land, specifically land at Melbourne Airport, will form part of a separate suite of impact assessments.
- The Impact Assessment is based on the scope of works detailed in the Project Description and State Project Land derived from 'MAR Corridor and Sunshine Sections Project Description for Environmental Specialists' (MAR-AJM-PWD-PWD-MEM-XLP-NAP-0001505, Revision C).

- The modelling (including MUSIC, drainage and flood modelling) which forms the basis for this impact assessment has been completed on the Reference Design, which was current at the time of writing. Any future design changes will not be specifically identified in this impact assessment; the Project will have a process in place to identify and mitigate potentially significant impacts resulting from future design change.
- Impact and mitigation flood modelling undertaken for the Project was based upon previously developed Base Case (i.e. existing conditions) flood models. Base Case models were developed during the Reference Design and have been peer reviewed by Melbourne Water and were granted 'No Objection' status (including several comments deferred to the Reference Design stage). On this basis it is assumed that these Base Case models are suitable for the impact and mitigation assessment and provide a high degree of confidence in results. RPV has an ongoing consultation program with Melbourne Water to verify impact and mitigation models, however at the time of writing impact and mitigation models are yet to be verified by Melbourne Water at the time of writing; Melbourne Water approval will be sought as per Section 4.4.
- Where sufficient information is available, future development in the area adjacent the rail corridor has been integrated into the flood models, for example Gilmour Road Retarding Basin currently under construction by Melbourne Water. Where future development is proposed in the vicinity and insufficient information is available these have been excluded from consideration.

3. Background

3.1 Strategic Context

The MAR Project (the Project) is a once-in-a-generation transformation of Victoria's transport network, connecting Melbourne Airport's Integrated Terminal Precinct with a rail service for the first time.

Melbourne Airport handled more than 37 million passenger movements in 2018-19[1] and by 2038, this figure is projected to almost double to more than 67 million[2], which is an average growth of 3.2% per annum. Transport connectivity from Melbourne Airport to Melbourne's Central Business District (CBD) is currently limited to the Tullamarine Freeway, and therefore, the Victorian Government is committed to delivering an efficient, competitive alternative to cater for the ongoing increase in passenger numbers at Melbourne Airport.

In 2002, the Victorian Government considered possible corridor and alignment options for a Melbourne Airport Rail Link, ultimately selecting the Sunshine route as the preferred option. At this time, land was reserved between the Albion-Jacana rail corridor and extending through to Sharps Road, Tullamarine for the construction of a rail link.

In 2018, the Victorian Government released the Melbourne Airport Rail Link Sunshine Route Strategic Appraisal, which confirmed that the Sunshine route remains the best solution for an airport rail link. The Sunshine route would provide superior connections to regional Victoria, Melbourne's growth areas in the north and west and Melbourne's south eastern suburbs and could be delivered sooner and at a significantly lower cost than other route options.

3.2 State Project Land

The State Project Land defines the land within which the Project components and construction activities are planned to be contained. It sets out the full extent of land identified as potentially required for the delivery of the Project.

The Project Land encompasses all State land areas that would be used for permanent structures and temporary construction areas. It provides the basis for and informs the Impact Assessment

Project Land relevant to State-based approvals generally includes:

- Land between Sharps Road and the Albion-Jacana rail corridor, including land crossing the M80 Freeway
- The existing Albion-Jacana rail corridor generally between Jacana and Albion Stations
- Land around Sunshine and Albion Stations, including the existing rail corridor
- Land required for the Project from Jacana Station in the north-east to Newport Station in the south-west and Middle Footscray Station in the east. This largely includes the Albion-Jacana rail corridor via Sunshine and Albion stations and land required for a new rail corridor between Sharps Road and the Albion-Jacana rail corridor.

The extent of the State Project Land is shown in Figure 3-1.

[1] https://www.bitre.gov.au/publications/ongoing/airport_traffic_data
[2] https://www.melbourneairport.com.au/Corporate/Planning-projects/Master-plan

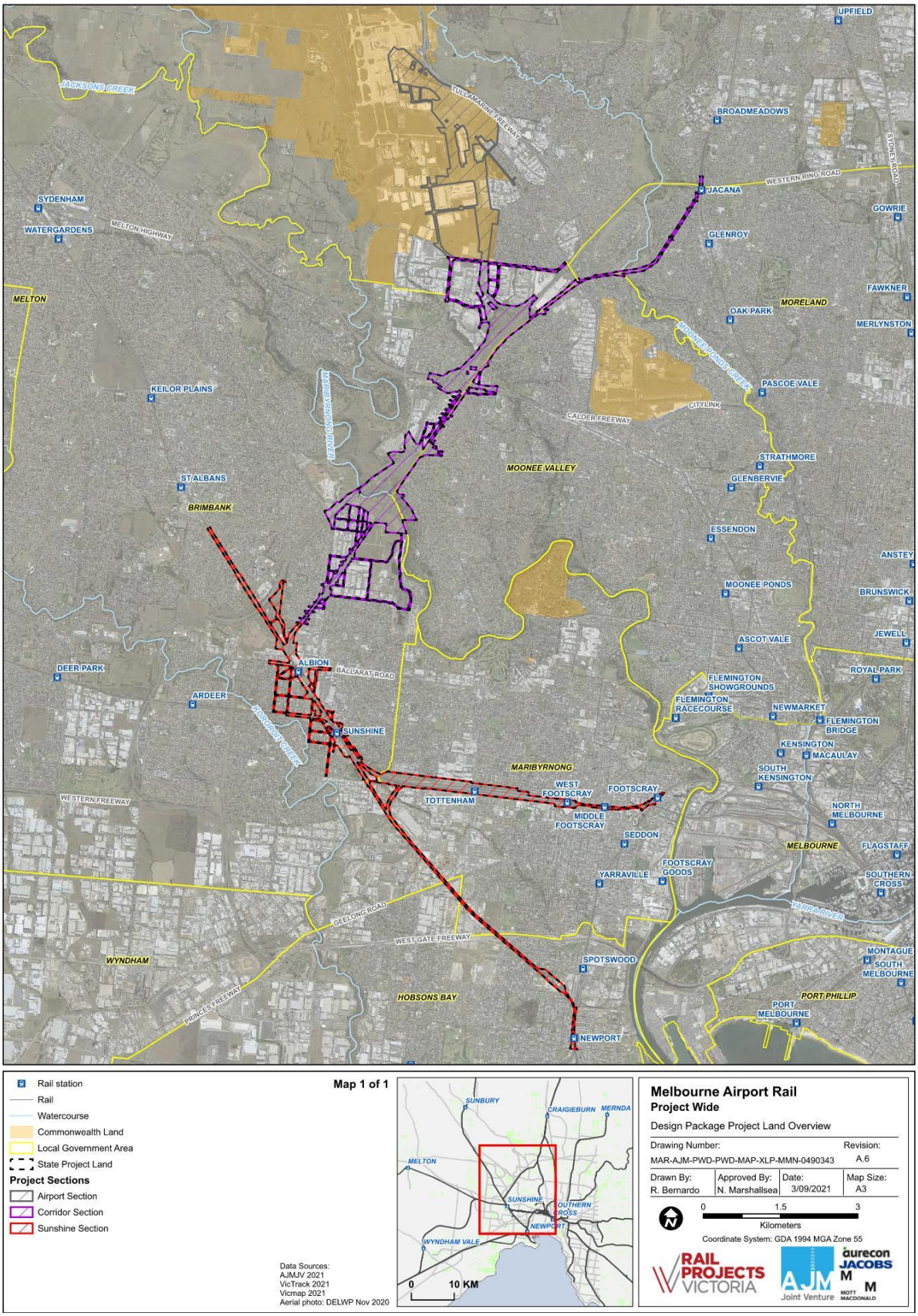

Figure 3-1 MAR State Project Land

3.3 Main Works Scope

3.3.1 Project Sections

The main works for the Project comprise of three geographically distinct sections. The sections are summarised in Table 3.1 and the location of the sections are shown in Figure 3-1.

Table 3.1 Summary of Project sections

Section	Summary
Airport section Not considered in State land approvals.	The Airport section generally includes all land relevant to the Project between Sharps Road, Tullamarine and Melbourne Airport and is located on Commonwealth owned land and is subject to a separate approvals process under the *Commonwealth Airports Act 1996*
Corridor section	The COR section generally includes the Albion-Jacana rail corridor between Jacana Station and south of Barwon Avenue, Sunshine North, as well as land between Sharps Road, Tullamarine and the Albion-Jacana rail corridor.
Sunshine section	The SUN section generally includes the existing rail corridor between Barwon Avenue, Sunshine North and Middle Footscray Station. The SUN Section also includes the Sunbury rail corridor to Ginifer Station and the Brooklyn freight corridor to Newport Station.

3.4 Corridor Section Summary

The COR section of the Project includes the following main works:

- Construction of the new MAR tracks, comprising an approximately 8 km dual track railway and associated overhead line equipment (OHLE), combined services route (CSR) and track drainage works, including:
  - A 2.3 km long elevated twin track viaduct structure between Sharps Road, Tullamarine and the Albion-Jacana rail corridor, crossing Steele Creek and the Western Ring Road including emergency and maintenance access points.
  - New at-grade MAR tracks within the existing Albion-Jacana rail corridor, located on the Western side of the existing Australian Rail Track Corporation (ARTC) tracks.
  - An elevated twin track viaduct structure across the Maribyrnong River valley, adjacent to the Western side of the existing state significant heritage bridge.
  - Slewing of ARTC tracks between Keilor Park Drive and the Calder Freeway.
- Signalling works along the Albion-Jacana rail corridor between Jacana Station and Barwon Avenue, Sunshine North and within the new MAR corridor North of the Western Ring Road.
- Construction of an intake supply substation at Terror Street or the Northeast area of Brimbank Park and two traction substations at Fullarton Road and within the McIntyre Sidings, Sunshine North.
- Construction of two new Digital Train Radio System (DTRS) facilities one North or South of Keilor Park Drive, Keilor East and a second at Airport Drive, Tullamarine.
- Diversion, relocation and replacement works associated with utilities and underground services, including the existing ARTC CSR, high voltage (HV) transmission lines and numerous miscellaneous assets
- Protection works associated with the Joint User Hydrant Installation (JUHI) jet fuel pipeline along the Albion-Jacana rail corridor.
- Modifications to existing structures, including structural modifications and strengthening works at Calder Freeway inbound and outbound bridges, Fullarton Road bridge, Western Ring Road on-ramp and off-ramp bridges, Keilor Park Drive and McIntyre Road bridges.

- Replacement of shared use path (SUP) connections at Calder Freeway / Fullarton Road, provision of a new SUP overpass at Cranbourne Avenue, and provision of a Strategic Cycling Corridor link between Western Ring Road and Airport Drive via Steele Creek.
- The provision of retention basins at several locations along the Albion-Jacana rail corridor
- Establishment of temporary construction laydown areas, site offices, worksites, storage, parking areas and access roads

3.5 Sunshine Section Summary

The SUN section of the Project includes the following main works:

- Construction of a new 1.8 km long MAR twin track viaduct structure, including associated OHLE and CSR between Sunshine Station and the Albion-Jacana corridor, crossing Anderson Road, Ballarat Road, the Sunbury rail corridor, St Albans Road and Stony Creek.
- Signalling works, including the installation of trackside equipment along the Sunbury line towards Ginifer Station, along the Brooklyn freight corridor towards Newport Station, and along the Western rail corridor to West Footscray Station.
- Modifications to the tracks, formation, drainage, CSR, OHLE and signalling equipment for the MAR, Sunbury and Bendigo tracks from Albion to the beginning of the Jacana freight corridor
- Modifications to the Western and Eastern Albion Station forecourts and car parks.
- Modifications to Sunshine Station, including modifications to platforms, the Sunshine Station western car park and the construction of a new concourse.
- Modifications to the existing Sunshine and Sunshine West substations
- Diversion, relocation and protection of existing utilities and underground services.
- Establishment of temporary construction laydown areas, site offices, worksites, storage, parking areas and access roads

4. Planning and Environment

4.1 Environment Effects Act 1978

The *Environment Effects Act 1978* (EE Act) provides for assessment of proposed projects (works) that could have a significant effect on the environment. Under section 8(4) of the EE Act, a referral is required to be submitted to the Minister for Planning to determine whether an EES is required. Referral criteria relevant to contaminated land are as follows:

> *Potential extensive or major effects on beneficial uses of waterbodies over the long term due to changes in water quality, stream flows or regional groundwater levels.*

> *Potential extensive or major effects on the health, safety or well-being of a human community, due to emissions to air or water or chemical hazards or displacement of residences*

4.2 Environment Protection Act 2017

The Environment Protection Amendment Act 2018 (Amendment Act 2018) is the principal environmental legislation in Victoria. The Project will be required to comply with *Environment Protection Act 2017 and Environmental Protection Regulations 2021*.

This includes the Environmental Reference Standard (ERS) which identifies water values and have indicators and objectives to assess if these values are being maintained. Under the State of Knowledge, the project will utilise requirements in the previously referenced State Environment Protection Policy (SEPP) (Waters). The SEPP (Waters) references the Best Practice Environmental Management Guidelines (1999) (BPEMG) which were developed to establish best practice performance objectives for urban stormwater (for urban development) which will be applicable to the Project.

Consultation with the Victorian EPA should be undertaken during the design phase to ensure further requirements can be incorporated into the project and design in a timely manner.

4.3 Planning and Environment Act 1987

The project is located within the municipalities of Hobsons Bay, Maribyrnong, Brimbank, Moonee Valley, Moreland and Hume and is subject to their local planning schemes. The respective planning schemes set out the relevant planning controls which determine whether planning approval is required for the use and/or development of land.

These controls include zones, overlays, and particular and general provisions. The *Planning and Environment Act 1987* is relevant to the project as land use planning studies have shown that a variety of approvals are triggered by the proposed works. There are a variety of pathways via which planning approval may be obtained for rail projects. The planning approval pathway for the project will be confirmed through further consultation with DELWP.

The Victoria Planning Provisions and planning schemes contain overlays that manage the presence and movement of surface water. Two of these overlays (Land Subject to Inundation Overlay and Special Building Overlay) exist within the proposed project boundary, meaning that planning approval may be required to commence and undertake works.

4.4 Water Act 1989

The *Water Act 1989* is the primary piece of legislation relating to resourcing and use of water in Victoria; it promulgates authority to the Catchment Management Authority (CMA) the responsibility to grant approvals and/ or permits to undertake works on or within a waterway and/ or flood plain overlay.

The *Water Act 1989* provides a well-established planning approvals process applied by the relevant statutory authorities which has been applied to a large number of similar infrastructure projects. This process will be implemented irrespective of the planning approvals pathway.

The MAR project must meet requirements set out by Melbourne Water, responsible for waterway, drainage and floodplain management functions in the Port Phillip and Westernport CMA region, for the Project to obtain a “A Works on Waterways Permit” to undertake any works within or in proximity of a designated waterway. Melbourne Water uses the one per cent AEP flood event as the reference event for delineating land potentially affected by flooding and setting requirements for developing this land.

5. Existing Conditions

Existing surface water conditions within the project boundary are described in general terms in this section. According to Melbourne Water's 2018 Healthy Waterways strategy, the Project is located in the Maribyrnong catchment. The strategy refers to the co-designed catchment program for a flexible framework for managing waterways in the Maribyrnong catchment whose ecological health has significantly improved since 2018 and is accessible, used and valued by the community. Its collaborative management reflects the contributions of Traditional Owners and the broader community.

The Maribyrnong catchment region covers an area of around 1408 square kilometres. About 10 per cent of the catchment retains its natural vegetation, 80 per cent is used for agriculture and 10 per cent is urban (confined to greater Melbourne and larger townships). People of the Woi wurrung language group were the original occupants of this land and their descendants place enormous cultural and spiritual significance on the region's land and waters. The catchment includes the 41-kilometre-long Maribyrnong River – the second major river in the Port Phillip and Westernport region – which begins on the southern slopes of the Great Dividing Range, in the Cobaw Ranges. Groundwater-fed wetlands in this catchment are predicted to be most likely impacted by climate change. Predicted sea level rise will impact the future condition of the region's estuaries and the values that they can support. Without planning for landward migration of estuarine vegetation, existing ecological values may be lost due to an increasingly saline environment.

5.1 Water Quality

The project will discharge into three key sub-catchments are Maribyrnong River, Stony Creek and Steele Creek; this section outlines the existing conditions for each.

Table 5-1: Key water interface between Project and waterways

Sub-catchment	Waterway Description (Existing conditions)
Maribyrnong River	The catchment includes the 160-kilometre Maribyrnong River (a tributary of the Yarra River) – the second major river in the Port Phillip and Westernport region. The Project is located in the Lower Maribyrnong sub-catchment system. Rivers and creeks in this catchment tend to be deeply incised and have highly variable flows, with long periods of low flows. They usually have poor water quality and have lost riverbank and aquatic habitat[3].
Steele Creek and Steele Creek North	Steele Creek and its main tributary, Steele Creek North, originate at the southern margin of Melbourne Airport and flow south through an airport industrial precinct and cleared land before meandering through urban residential areas to meet the Maribyrnong River at Avondale Heights. Both creeks are characterised by low flows and overall creek condition is poor with a degraded streamside zone. Steele Creek receives runoff from airport land and nearby roads. It features a number of constructed artificial bio-retention ponds along its alignment to treat stormwater runoff. These are located north of Annandale Road with a series of ponds located along Sharps Road that drain an unnamed tributary.
Stony Creek	Stony Creek is an urban waterway that runs through Melbourne's western suburbs. Stony Creek rises in the Sunshine area and enters the Yarra River at Yarraville, downstream of the confluence with the Maribyrnong River. The lower reaches of Stony Creek, through West Footscray and Yarraville, comprise constructed earthen and concrete-lined channels. The estuary is an earthen channel that runs alongside the West Gate Freeway. Stony Creek receives stormwater runoff via the local drainage system from where the Sunshine Albion Section will be located. Water quality in relation to environmental and recreational conditions are very low[4].

5.2 Flooding

The following section describes baseline flooding associated with the existing conditions.

[3] Melbourne Water (2021): https://www.melbournewater.com.au/water-data-and-education/water-facts-and-history/river-health-and-monitoring/maribyrnong-catchment
[4] Melbourne Water (2019) Stony Creek Rehabilitation Plan 2019-2029; https://www.melbournewater.com.au/media/14571/download

5.2.1 Methodology

Existing Flooding was assessed using hydrologic modelling using the RORB software and hydraulic modelling using the TUFLOW and HEC-RAS software. This modelling including assumptions and limitations is detailed in a number of reports as referenced in Appendix A. The hydrologic modelling followed Australian Rainfall and Runoff Guidelines 2019 (Ball et al, 2019) and Melbourne Water Flood Mapping Guidelines and Technical Specifications (2020) to provide appropriate inputs to the TUFLOW hydraulic and HEC-RAS models. Flood conditions for both the 1% AEP existing climate conditions and 1% AEP plus climate change (+18.4% increase in rainfall intensity) have been modelled.

The extent of the hydraulic models used to assess flooding is shown in Figure 5-1 below. The northern model (outlined blue) is known as the APAM model and includes Steele Creek. The southern model (outlined orange) is known as the Sunshine model and includes Stony Creek (Stony Creek Upper which is diverted to Kororoit Creek at Anderson Road and Stony Creek Lower which flows towards the Yarra River). Between these two areas is the Maribyrnong River which was modelled by adapting an existing HEC-RAS model (outlined red) provided by Melbourne Water.

It is noted that all base case hydrological and hydraulic flood models have been peer reviewed by Hydrology and Risk Consulting (HARC) on behalf of Melbourne Water throughout the reference design development. The majority of the comments raised have been closed with some items transferred through into delivery, due to timing or access to further information (survey etc).

The exception to this is the Keilor East model (outlined green) which covers a section of rail known as McIntyre Sidings which lies between the APAM hydraulic model to the north and the Maribyrnong River model to the south. This model was preliminary and was developed based upon limited information and has not been reviewed or verified. The preliminary model was used to estimate existing overland flow paths as there are a number of buildings which would obstruct flow from the adjacent catchment areas entering the rail corridor. On the basis of this preliminary modelling it was assumed that a detailed flood model was not required, and a drainage assessment was sufficient.

It is noted that works within the Airport Section (north of Sharps road) are on Commonwealth Land and subject to approvals under a Major Development Plan.

For ease of discussion the proposed route is split into several sub-sections along the project alignment. For each section a flood depth map is presented showing baseline flooding for the 1% AEP event.

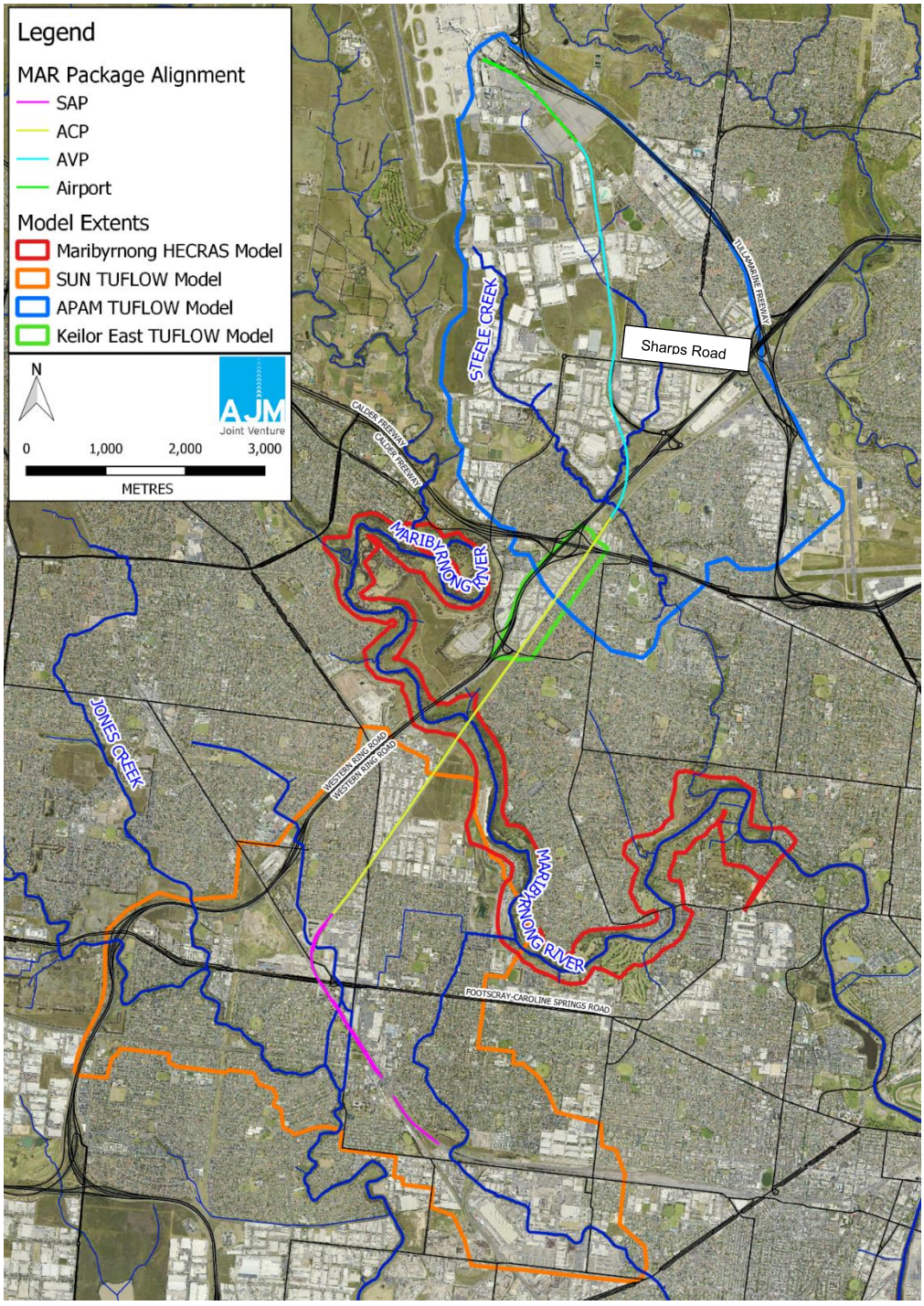

Figure 5-1: Hydraulic Model Boundaries

5.2.2 Stony Creek Lower to Sunshine Hub (MAR CH11+124 to 12+400)

Stony Creek is split into two; Stony Creek Upper is diverted via two large drains (shown on Figure 5-3) into Kororoit Creek. Stony Creek Lower (shown on Figure 5-2) starts to the east/south of Anderson Road and conveys flow through the urban area primarily via pipe before open channel at the southern rail crossing. Stony Creek Lower discharges to Yarra River many kilometres downstream.

This section starts at CH11+124 which is about one hundred metres north of the existing rail crossing of Stony Creek Lower.

In this area local drainage is generally directed by the pipe network from the north of the railway to south of the railway and into Kororoit Creek. The exception is the area north of the railway between Anderson Road and Sunshine station which is directed eastwards towards Stony Creek Lower.

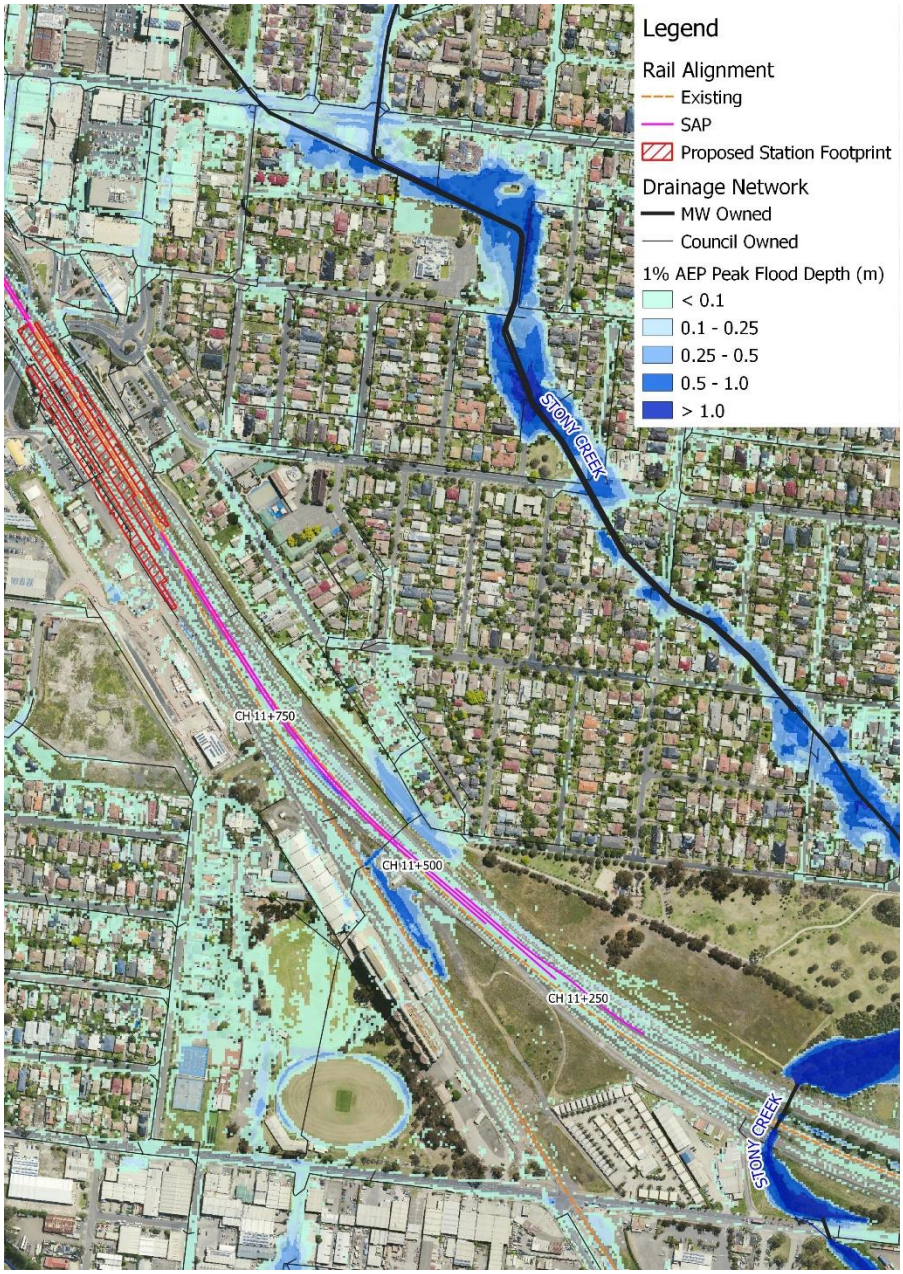

Figure 5-2: Stony Creek Lower to Sunshine Hub

5.2.3 Sunshine Hub to St Albans Road and Stony Creek (MAR CH12+400 to CH14+200)

In this location, the existing rail line is close to the catchment boundary between Stony Creek and Kororoit Creek. There are small catchments that drain towards the western side of the rail line near Albion Station, then alongside the rail line towards Sunshine Station. These flows are captured within the existing drainage network at Anderson Road as shown on Figure 5-3.

The rail line crosses Stony Creek to the east of St Albans Road. Stony Creek Upper is conveyed beneath Gilmour Road and the rail line via culverts. The original Stony Creek Upper rail bridge structure drains the small local catchment between the rail line and Gilmour Road.

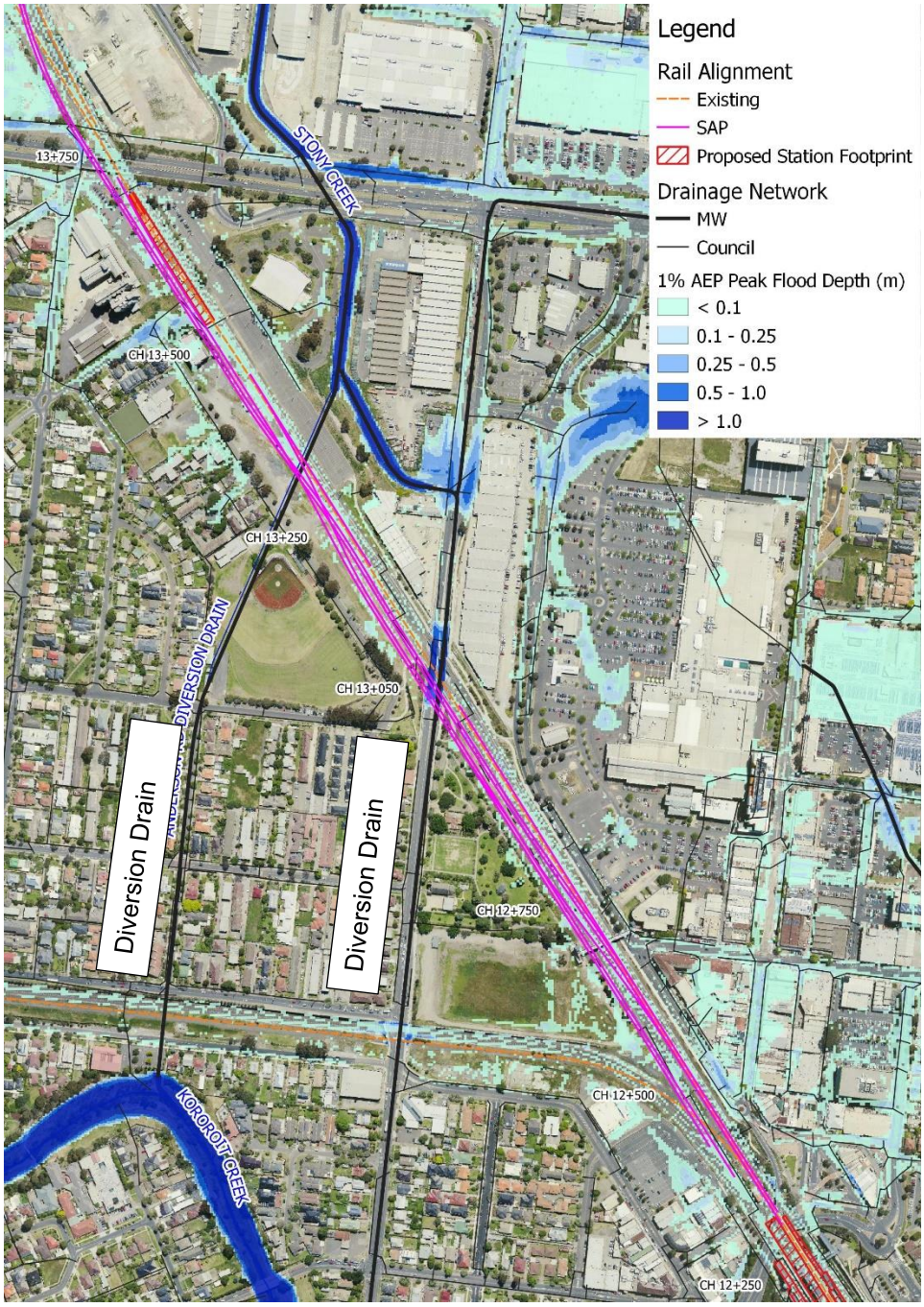

Figure 5-3: Sunshine Hub to St Albans Road and Stony Creek

5.2.4 Stony Creek to the Maribyrnong River (MAR CH14+200 to CH16+900)

In this section, overland flow north of the existing rail line generally travels in a south-west direction towards Stony Creek, however the north-south and east-west orientation of the road network means these flows travel in a stepped flow path through the streets (refer Figure 5-4). In the vicinity of the existing rail line, the north-south oriented streets direct overland flow towards the rail line. Runoff then flows south-west along the streets and rail line. This occurs at Auburn Avenue, Spalding Avenue, Imperial Avenue, Knight Avenue and Cromer Avenue, with the volume of water increasing at each respective street. In the 1% plus climate change event, the existing rail line is inundated near McIntyre Road.

West of McIntyre Road, overland flows continue to build in similar conditions to those described above and flow south-west along the rail line at Mansfield Avenue and Gilmour Road with increasing volume until they enter the Gilmour Road retarding basin near Stony Creek. Overtopping of the rail line occurs in the 1% AEP climate change event.

On the southern side of the existing rail line stormwater typically flows away from the rail line except for the three blocks south of Comley Street. In this location overland flows travel towards the rail line then along the rail line to enter Stony Creek Upper immediately downstream of the rail crossing.

Figure 5-4: Stony Creek to Maribyrnong River

5.2.5 Maribyrnong River (MAR CH17+400m to CH17+800)

The 1% AEP event flood levels are approximately 40m below the rail bridge soffit and contained within the channel (refer Figure 5-5). The existing rail bridge has six trestles within the 1% AEP flood extent.

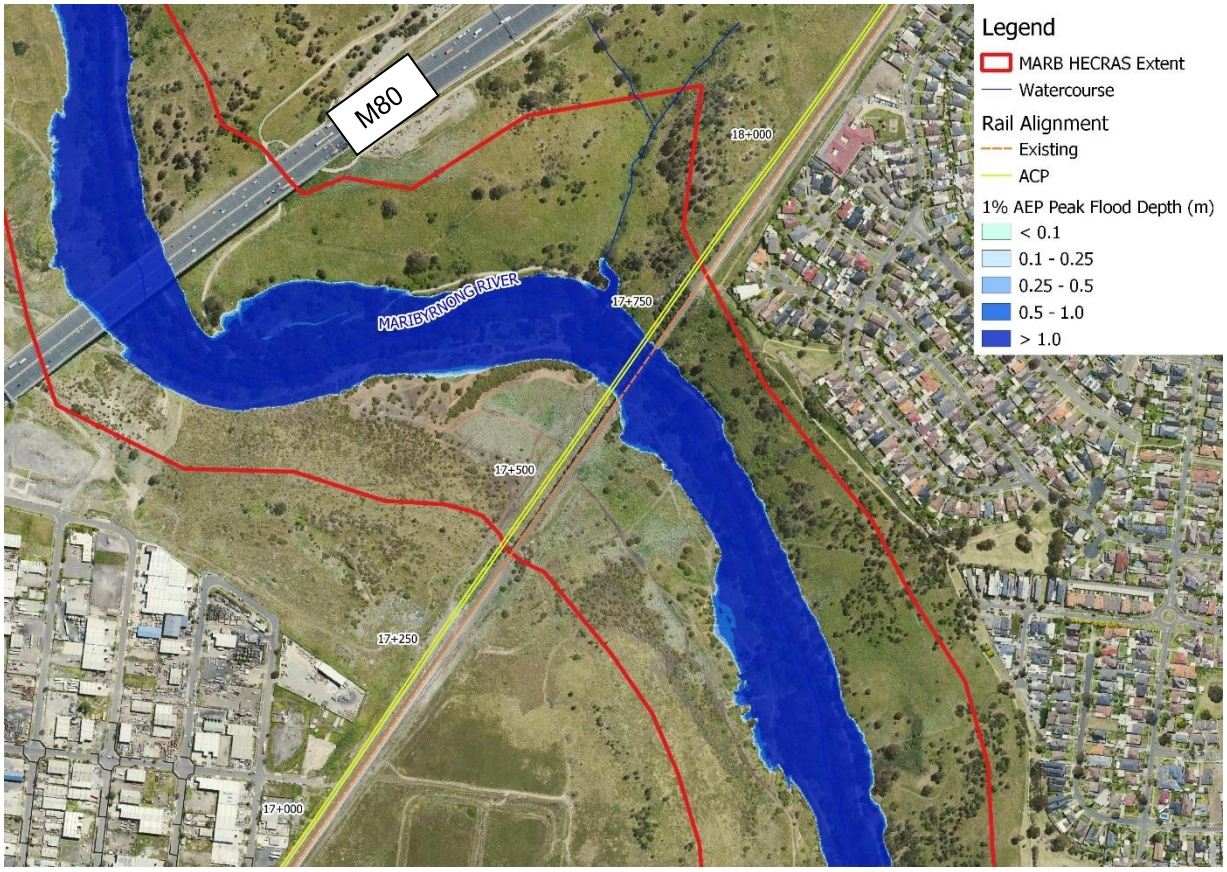

Figure 5-5: Maribyrnong River

5.2.6 McIntyre Sidings (MAR CH17+800 to CH19+500)

This section of rail is covered by the Keilor East (McIntyre Sidings) TUFLOW hydraulic model. This model is preliminary and was developed based upon limited information and has not been verified.

This preliminary modelling shown in Figure 5-6 identified that there is some potential for local runoff in the Keilor East Industrial Park to pond at a low point on Slater Parade in front of properties at 98, 100, and 102 Slater Parade to the west of the railway. However, there is limited space between the buildings so overland flow from this low point is unlikely to flow onto the rail corridor. No other overland flows across the railway were identified. On this basis it was assumed that a detailed flood model was not required, and a drainage assessment was sufficient.

Figure 5-6 McIntyre Sidings

5.2.7 Steele Creek to Airport Boundary (MAR CH19+500 to CH22+800)

South of Sharps Road flow is mainly conveyed via the drainage network to Steel Creek North to the east or Sharp Creek to the west. These two stream branches flow south towards the Western Ring Road and join immediately before passing under the Western Ring Road and then under the proposed railway at around CH20+950 (refer Figure 5-7).

There is also some shallow overland flow through the industrial are south of Tullamarine Park Road and in the reserve land adjacent to Steel Creek North and the Western Ring Road.

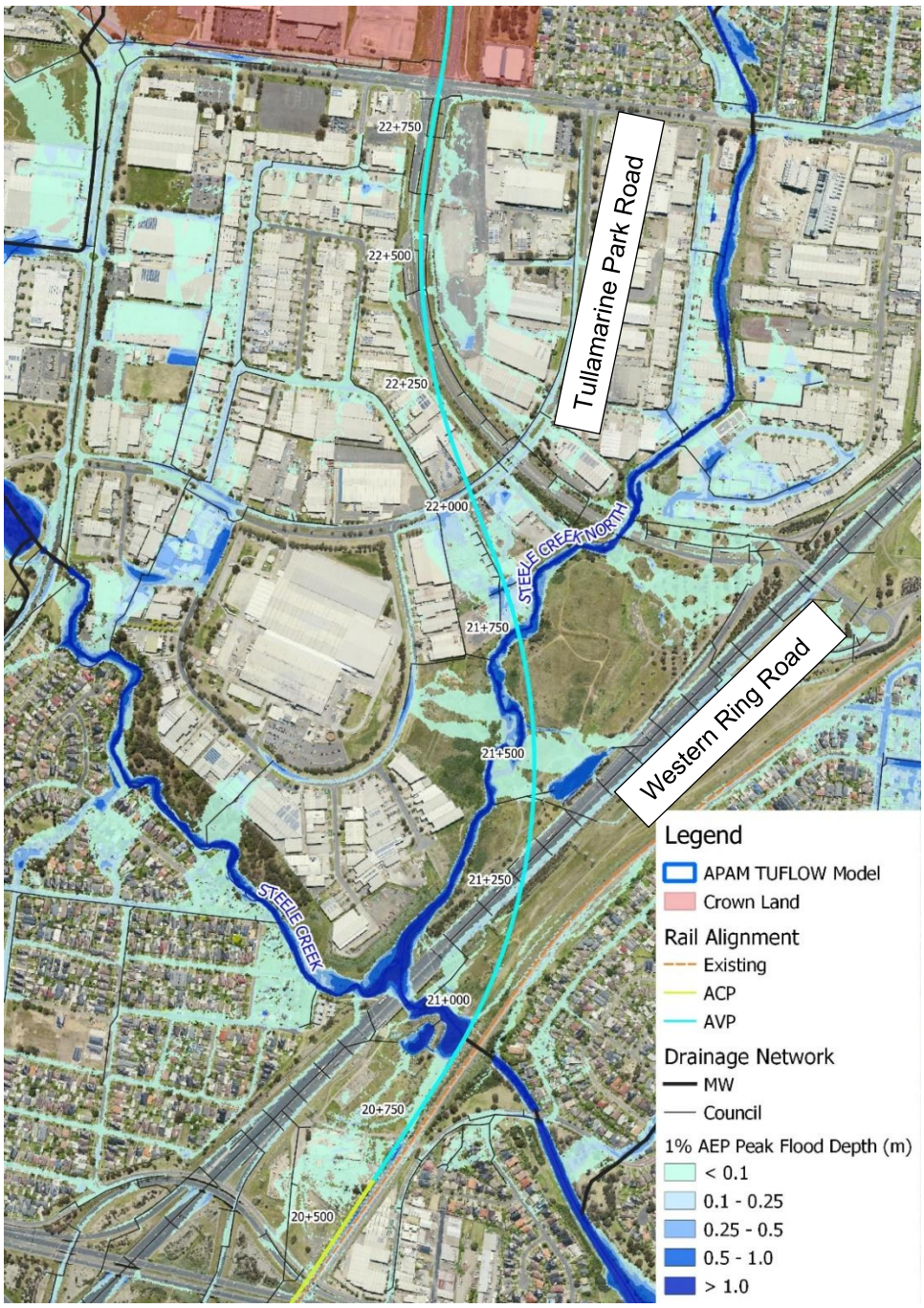

Figure 5-7: Steele Creek to Airport Boundary

6. Impact Assessment

The project will involve the replacement of existing water discharge points and the construction of viaducts over waterways. The associated disturbance could result in changes to the ecological or geomorphological nature of the waterway as well as floodplain characteristics. The key issues with surface water are associated with either impacts to river health, water quality, or hydraulic impacts to waterways and floodplains. AJM JV note that the aquatic ecology and geomorphology is covered by a separate impact assessment (Document reference MAR-AJM-PWD-PWD-REP-XEV-NAP-0001711).

The following section describes the potential impacts that may affect surface water during construction and operation, including:

- Obstruction of existing flow paths has the potential to cause changes to flooding conditions such as frequency and duration of flooding, increases in flood levels or flow velocities.
- Reduction of floodplain storage or other changes to flow regimes leading to increases in peak flows or floodwater volumes.
- Discharge of polluted water from construction activities or increased run-off from new assets that may impact on water quality and beneficial uses of surface water bodies.
- Interface of the Project with existing and future drainage assets.

Table 6-1: Key locations of impacts to surface water

Waterbody/ feature	Water Quality	Flood Impacts
Maribyrnong River	Construction of the Maribyrnong River Bridge, including ground level development of piers and associated piling works. Increased runoff during operation from the new bridge structure and proposed rail tracks.	The proposed rail will cross the Maribyrnong River on a viaduct some 40m above the river. As such any impacts will be limited to the construction of additional piers across the valley. Hydrologic and hydraulic modelling shows that one circular pier (pier 8) will be located within the 1% AEP flood extents. In addition, a safe working platform will be constructed around this pier to support Pier 8 substructure construction works, superstructure construction works and bridge maintenance requirements. Impacts from this pier and safe working platform are confined to the incised river channel and will not affect any previously unaffected properties or infrastructure. Minor impacts are contained within land designated as Public Park and Recreation Zone (PPRZ).
Steele Creek/ Steele Creek North	Construction of the elevated viaduct structure (south of Sharps Road), including ground level development of piers and associated piling works. Increased runoff during operation from the proposed rail tracks and the viaduct structure.	Both Steele Creek and Steele Creek North will be crossed by a viaduct stretching from the airport in the north over the Calder Freeway in the south and tying into the Jacana rail corridor. As such the proposed rail and viaduct will be elevated well above the 1% AEP peak water surface elevation across the inundated area. Flood modelling to date shows the piers will have minor localised impacts within the floodplain and this will be confirmed by modelling during detailed design.
Stony Creek	Construction activities within the Sunshine Albion Section. Diversion of local overland flows and increased runoff during operation from project area, new carparks and stations and proposed rail tracks and the viaduct structure.	In existing conditions, the 1% AEP flow from Stony Creek is attenuated in the recently constructed Gilmour Road Retarding Basin. Flow is then conveyed under both Gilmour Road and the existing rail via a continuous set of culverts. The flow from the local Gilmour Road catchment flows in a south-western direction towards Stony Creek along the rail corridor and Gilmour Road with a portion of the flow diverted to the Gilmour Road Retarding Basin and

Waterbody/ feature	Water Quality	Flood Impacts
		the remainder being conveyed through the existing shallow railway bridge. As Stony Creek flows are conveyed via the continuous culverts the historic railway bridge is oversized for the local catchment flows. The existing historic shallow rail bridge is in poor condition and may be replaced by culverts. The replacement culverts will be sized by modelling to ensure no impacts on adjacent property. The proposed rail will run parallel and between Gilmour Road and the existing rail. The proposed rail will be on a viaduct well above the inundated area across Stony Creek and then duplicating the existing ARTC track alignment and approximate level north of Stony Creek. Initial design mitigation measures have been developed for this section of the corridor, resulting in only minor localised impacts on flooding. Mitigation for Stony Creek consists of the following; • Large diameter carrier pipe for the COR track (included in COR section) • Smaller drainage network along Gilmour Road to offset impacts caused by SUN embankment (included in SUN section) No other mitigation are proposed for SUN other than 'normal' drainage'. No significant impacts are predicted by the flood model.
Stony Creek Lower Kororoit Creek	Construction activities within the Sunshine Albion Section. Diversion of overland flows and increased runoff during operation from project area, new carparks and stations and proposed rail tracks and the viaduct structure.	East of Anderson Road local drainage is generally directed by the pipe network from the north of the railway to south of the railway and into Kororoit Creek. The exception is the area north of the railway between Anderson Road and Sunshine Station which is directed eastwards towards Stony Creek Lower. Detailed drainage design will be undertaken to ensure cross drainage is maintained. The rail alignment is being retained within the current corridor and hence no significant impacts are expected. This section of the railway is along a broad ridge of land and so overland flow is generally directed away from the route and will not therefore be significantly impacted by the works. No works are being undertaken as part of this section at the existing rail crossing of Stony Creek lower.

6.1 Water Quality

6.1.1 Construction

The Project must protect waterways and waterway function and surface water in accordance with statutory objectives, to identify and prevent potential adverse environmental effects resulting from construction activities. This assessment has considered the impacts to surface water during the construction phase that may result in impacts to the beneficial uses of waterways and to aquatic ecology. Reductions in water quality caused by runoff to waterways (either directly or via stormwater drainage) via discharge of polluted water to surface water bodies can occur through the following:

- leaks, spills or discharges of hazardous substances during construction that impacts on surface water.
- erosion and sedimentation risks associated with ground disturbance works and spoil management.
- construction activities within flood prone areas that may be impacted during flood events that cause pollution events.

The impact assessment has identified that construction activities within the Maribyrnong River and Steele Creek valleys pose an impact to surface water quality based on proximity to the waterways, notably higher-risk works including works within the floodplains area or when working in the vicinity of waterways or other live drainage assets.

The Maribyrnong River is an actively eroding stream and whilst the riverbed appears stable, the river banks are showing signs of ongoing erosion. Works in the Maribyrnong River valley will include the construction of a rail bridge and further assessment will be required to understand the impacts of project works on the geomorphology of the Maribyrnong River and to be able to mitigate impacts. However, works in these locations are relatively limited (i.e. limited in-stream works) and works will be subject to Melbourne Water's requirements for working and or around waterways.

Furthermore, these risks will be further mitigated through controls outlined in Section 8.2; and if these proposed mitigation measures are implemented, would result in there being no significant residual surface water or water quality impacts associated with the construction

6.1.2 MUSIC Modelling

Using the Melbourne Water Rainfall distribution map (2010), the Project was found to be located within the Melbourne City weather station region. A Melbourne Water Model for Urban Stormwater Improvement Conceptualisation (MUSIC) meteorological template consisting of a ten-year record of rainfall and evaporation data was available for this station and was adopted with a 6 minute timestep for continuous simulation in MUSIC.

Default model parameters for source nodes were adopted, with the exception of pervious area soil storage capacity and field capacity which has been set to 120 mm and 50 mm respectively as per the 2018 Melbourne Water MUSIC Guidelines.

Model for Urban Stormwater Improvement Conceptualisation (MUSIC) modelling software can simulate the quantity and quality of runoff from catchments ranging in size and the effect of a wide range of treatment measures on the quantity and quality of runoff downstream. MUSIC modelling has been used to determine the stormwater pollutant source loads from the existing and new impervious areas within the road drainage outfall catchments.

Reference Design MUSIC modelling was then used to model at-source WSUD treatment elements and calculate if the required pollutant reduction targets are met for the new impervious surfaces. This includes a proposed raingarden/bio-retention system. This system was adequate to achieve the minimum retention required for suspended solids, phosphorus, nitrogen and gross pollutants.

Reference design modelling to-date has not been completed due to recent design changes and requirements, this outcome is no longer valid and further MUSIC modelling results are pending for design inputs and finalisation of discharge points.

However, it is anticipated there are no major constraints in terms of achieving water quality objectives during the detailed design phases, with a wide range of WSUD measures being available. The Project will be designed and constructed to comply with the requirements stipulated by the Catchment Management Authority (Melbourne Water) and Local Council requirements. Modelling based on the reference design shows compliance with the State Environment Protection Policy (Waters), that will protect beneficial uses of waterways and mitigate any significant impact to a human community from adverse water quality. The stormwater treatment system will be integrated into the design in accordance with the EPA Victoria Best Practice Environmental Management Guidelines for Urban Stormwater.

6.1.2.1 Design Criteria

Table 6-2 Design Criteria

<table>
<tr><th>Item Water Quality</th><th>Design Criteria</th><th>Description</th></tr>
<tr><td>Water Quality</td><td>Best Practice Environment Management Guidelines (BPEMG) Requirements.</td><td>Water Sensitive Urban Design (WSUD) measures are required to treat stormwater prior to discharge to downstream waterways for compliance with the water quality performance objectives as prescribed in Best Practice Environment Management Guidelines (BPEMG, CSIRO, 1999).
<table>
<tr><th>Current Best Practice Performance Objectives</th><th>Description / Values</th></tr>
<tr><td>Suspended Solids (SS)</td><td>80% retention of the typical urban annual load.</td></tr>
<tr><td>Total Phosphorus (TP)</td><td>45% retention of the typical urban annual load.</td></tr>
<tr><td>Total Nitrogen (TN)</td><td>45% retention of the typical urban annual load.</td></tr>
<tr><td>Litter</td><td>70% reduction of the typical urban annual load.</td></tr>
<tr><td>Flows</td><td>Maintain discharges for the 1.5-year ARI at pre-development flows.</td></tr>
<tr><td>Current Best Practice Performance Objectives</td><td>Description / Values</td></tr>
<tr><td>Suspended Solids (SS)</td><td>80% retention of the typical urban annual load</td></tr>
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<tr><td>Litter</td><td>70% reduction of the typical urban annual load.</td></tr>
<tr><td>Flows</td><td>Maintain discharges for the 1.5 year ARI at per-development flows</td></tr>
</table></td></tr>
<tr><td></td><td>Offsets</td><td>Melbourne Water has provided advise that they will not accept offset payment in lieu of water quality treatment.
It is currently assumed Brimbank City Council (BCC) will accept offsets for part or full treatment of water quality.
The BCC will determine if stormwater compliance can be achieved through the Stormwater Quality (SWQ) Offsets program. Urban Stormwater Improvement Conceptualisation (MUSIC) is used to determine the percentage of SWQ Offset payable given the treatment proposed on site.
The rate is measured based on the cost of future stormwater treatment works is calculated per kilogram of the annual total nitrogen load.</td></tr>
</table>

6.2 Flooding

The flood impact assessment covers potential surface water impacts during both construction and operation phases, including:

- Changes to flooding conditions such as frequency and duration of flooding, increases in flood levels, flows or velocities
- Potential for the construction activities to change surface water flows or increase flood risk due to the temporary placement of construction and maintenance structures or materials within the floodplain, including pier construction in Maribyrnong River valley and Steele Creek/ Steele Creek North
- Potential during operation to increase flood levels, affecting private property and infrastructure
- Flooding of the railway corridor and/ or stations during construction or operation, compromising the safety of construction workers, rail staff or commuters, and disrupting rail services. This could occur from riverine flooding or overland flows greater than of the capacity of the stormwater drainage system
- Temporary or permanent structures obstructing riverine flood or overland drainage flows or resulting in a loss of flood storage. This could potentially increase flood levels or velocities, resulting in an increased flood risk to infrastructure and property
- Reduction of floodplain storage or other changes to flow regimes leading to increases in peak levels, flows or floodwater volumes
- Interface of the Project on existing and future drainage assets.

6.2.1 Methodology

Hydrologic and hydraulic models were used to establish existing drainage conditions (i.e. peak flood levels and flows). These base models are described in Section 5.2.1 and shown on Figure 5-1. It is noted that all base case hydrological and hydraulic flood models have been peer reviewed by Hydrology and Risk Consulting (HARC) on behalf of Melbourne Water.

The reference design, was included in the hydraulic models to assess impacts on flood levels, flows and flood extents. Where impacts were observed, mitigation measures were tested to achieve no significant adverse effects for consultation with relevant statutory authorities.

6.2.2 Potential Flood Impacts from Construction Activities

Potential exists for the construction activities to change surface water flows or increase flood risk due to the temporary placement of construction structures or materials within the floodplain.

Risk associated with impacts to surface waters during construction can be managed through standard mitigation measures implemented via the Construction Environment Management Plan (CEMP), and the preparation and implementation of a Surface Water Management Plan (SWMP) specifying the required mitigation measures or performance criteria. Some specific construction activities with potential to create flood impacts are discussed below.

Maribyrnong River

The likely construction method involves establishment of a working platform around Pier 8, which is located within the 1% AEP inundation extent. In the hydraulic model a pier and levee was added to represent the position and dimensions proposed as the construction method. The estimated duration of the construction for Pier 8 and works proposed is approximately 18 months, but the safe working platform around pier 8 will be retained permanently to support future bridge maintenance work

Modelling shows that the impacts from the construction phase of the bridge are confined to the incised river channel and will not significantly affect any previously unaffected properties or infrastructure. There is no significant change in flow velocity under the proposed design at the existing trestles compared to existing conditions.

During construction of the proposed bridge, particularly the piers closest to the channel invert, the contractor must develop a staging plan to avoid or minimise, to the satisfaction of Melbourne Water, the amount of equipment and works within the channel up to the 1% AEP flood level to mitigate any safety risks.

Steele Creek

The new rail will cross both Steele Creek and Steele Creek North on a viaduct supported by piers. The piers take up only a minor part of the 1% AEP floodplain. Modelling indicates that impacts are generally very localised.

Stony Creek Upper

Stony Creek currently passes under both Gilmour Road and the existing rail via a continuous set of culverts. In existing conditions, the 1% AEP the flow passes through the culverts with only a small amount of overland flow from the small local catchment between the rail line and Gilmour Road passing under the existing railway bridge. The proposed rail will run parallel and between Gilmour Road and the existing rail. At Stony Creek Upper the proposed rail will be on a viaduct well above the inundated area. As such construction of the piers for the viaduct will not disturb the Stony Creek channel and any flood impacts will be minor and localised.

As Stony Creek conveys flows via the continuous culverts beneath Gilmour Road the existing historic shallow railway bridge is oversized for the local catchment. Structural assessment of the existing rail bridge indicates that the bridge is in poor condition and may therefore be replaced by culverts. The replacement culverts will be sized by modelling to ensure no impacts on adjacent property and infrastructure. Construction works for the replacement of the shallow railway bridge will not impact Stony Creek. Works will be organised so that the existing local catchment overland flow path is maintained during construction.

Stony Creek Lower

No works are being undertaken as part of this section at the existing rail crossing of Stony Creek Lower.

Other Potential Issues:

Due to the disconnect between the Sunshine/Albion Section (SAP) and Corridor Section (ACP) construction programs, there will be a time gap before the ultimate flood mitigation infrastructure developed for the ACP will be implemented. This has the potential to cause flood impacts at the interface of the two sections.

In the ultimate design the existing flow paths between Gilmour Road and the existing rail will be filled in by the track duplication and replaced by a 900mm to 1800mm pipe. However, there is potential for there to be a 3-year period where the overland flow path is obstructed prior to the mitigating pipeline being installed.

Modelling of this interim scenario has been undertaken and it has shown increases in flood levels in the Gilmour Street area of around 50mm in the 1% AEP flood event. It is noted that adjacent properties still have around 200mm of freeboard. Interim mitigation measures are currently being tested which include installation of a culvert under the length of the abutment structure with a small temporary retention basin at the northern end of this culvert to buffer flows into the culvert.

6.2.3 Potential Flood Impacts from Final Design and Operation

Figures showing the modelled impacts after mitigation measures have been put in place are included in Appendix B.

6.2.3.1 Stony Creek Lower to Sunshine Hub (MAR CH11+124 to CH12+400)

This section starts around a hundred metres north of the existing rail crossing of Stony Creek Lower. In this area local drainage is generally directed by the pipe network from the north of the railway to south of the railway and into Kororoit Creek. The rail alignment is being kept within the current corridor. Modelling has shown only minor impacts all of which are contained within the rail corridor (Refer Figure B.1. These minor impacts will be mitigated by more detailed cross-drainage design.

No works are being undertaken as part of this section at the existing rail crossing of Stony Creek Lower.

6.2.3.2 Sunshine Hub to St Albans Road and Stony Creek (MAR CH12+400 to CH14+200)

Initial modelling of the design showed minor impacts at Ferguson/Talmage Street and King Edward Avenue. The proposed drainage design resolves adverse impacts on Talmage Street and King Edward Avenue by capturing and conveying local stormwater to an existing Legal Point of Discharge (LPD) and preventing excess flow reaching Talmage Street. Adverse impacts on Ferguson Street are not fully resolved yet but modelling of further drainage improvement is currently being undertaken. It is noted no properties are affected at this location (Refer Figure B.2 and Figure B.3).

6.2.3.3 Stony Creek Upper to the Maribyrnong River (MAR CH14+200 to CH16+900)

Stony Creek currently passes under both Gilmour Road and the existing rail via a continuous set of culverts. In existing conditions, the 1% AEP the flow passes through the culverts with only a small amount of overland flow from the small local catchment between the existing rail line and Gilmour Road passing under the existing railway bridge. The proposed rail will run parallel and between Gilmour Road and the existing rail. At Stony Creek the proposed rail will be on a viaduct well above the inundated area. As such the new rail crossing of Stony Creek will have only very minor localised impacts on flooding.

As Stony Creek now flows under the continuous culverts the existing railway bridge is oversized for just the local catchment. The existing rail bridge is in poor condition and may be replaced by culverts. The replacement culverts will be sized by modelling to ensure no impacts.

Immediately north of Stony Creek the proposed new rail duplication descends from the viaduct to ground level and the embankment works will occupy the existing cess drain along the north western side of the rail line. If unmitigated, this will reduce the conveyance capacity of this flowpath and cause increased flooding to properties west of Gilmour Road. Different designs have been tested in the hydraulic model. The preferred solution comprises a 900mm stormwater pipe transitioning into a 1500mm pipe and then 1800mm pipe before discharging to Stony Creek downstream of the Gilmour Road culverts.

An impact of piping this flow is that flow at the outfall (southern) end of the existing cess drain will no longer overflow Gilmour Road into the retarding basin west of Gilmour Road between Stony Creek and Gilmour Road. Instead flows will be directed downstream of Gilmour Road. This will mean less flow is attenuated through the existing retarding basin and potentially higher flows downstream. This impact is to be mitigated by excavating an additional 3,000m3 basin to the south of Stony Creek immediately downstream of the existing continuous culverts. Modelling of this design shows impacts in the Gilmour Road area are fully mitigated.

Currently alternate mitigation strategies are also being assessed to determine the best solution in terms of minimising flood impacts, cost and providing ease of construction and maintenance. (refer Figure B.4, Figure 3-1 Figure B.5 and Figure B.6)

6.2.3.4 Maribyrnong River (MAR CH+17400 to CH17+800)

The proposed rail will cross the Maribyrnong River on a viaduct some 40m above the river. As such any impacts will limited to the construction of additional piers across the river valley. Hydraulic modelling shows that only one circular pier (pier 8) will be within the 1% AEP flood extents. In addition, a permanent safe working structure will be constructed around this pier to support, pier 8 substructure construction works, superstructure construction works and future bridge maintenance requirements. Impacts from the pier and a safe working platform are confined to the incised river channel and will not affect any previously unaffected properties or infrastructure (refer Figure B.8).

6.2.3.5 McIntyre Sidings (MAR CH17+800 to CH19+500)

It was identified that there is some potential for local runoff in Keilor East Industrial Park to pond at a low point on Slater Parade in front of properties at 98, 100, and 102 Slater Parade. However, there is limited space between the buildings so overland flow toward the rail corridor is unlikely. No other overland flows across the railway were identified. Hence the proposed rail will have no significant impacts in this section. A drainage assessment and design will be used to mitigate any minor impacts.

6.2.3.6 Steele Creek to Airport Boundary (MAR CH19+500 to CH22+800)

The proposed ACP alignment, between CH19+500 and 20+700, is at-grade and results in track widening or duplication on the northern side of the formation. From modelling design flood impacts appear localised within the rail corridor. To provide track immunity upgraded drainage is required. Mitigation measures being considered include a small detention basin at Gungarlan Drive/Moyangul Drive at CH19+580 and an upgraded stormwater pipe (600mm diameter through the Calder freeway overpass).

Where the alignment moves from at-grade to viaduct at CH20+700 a 65m long abutment structure will be constructed. The proposed abutment location is located within an area of shallow surface flow which should be relatively straightforward to divert around the structure. Options for mitigating the modelled localised impacts of this abutment are currently being considered.

North of the abutment the rail will be on a viaduct to the airport. Both Steele Creek and Steele Creek North will be crossed by the viaduct. Modelling has shown the piers from the viaduct have only small localised impacts.

The current design shows the piers located in the central swale located between the north and southbound road carriageways of Airport Drive. These piers could cause adverse impacts on flooding by both taking up volume in the swale and obstructing flow along the swale. This is to be mitigated by relocating the swale slightly to the east away from the pier locations.

For impact maps (refer Figure B.7, Figure B.9 and Figure B.10)

7. Environmental Risk Mitigation

Where appropriate recommendations have been made to minimise the impact on waterway values through mitigation and management measures. These measures will be formalised through an Environmental Management Framework (EMF), prepared and approved in accordance with the relevant planning approval. The EMF will provide a transparent and integrated governance framework to manage the environmental aspects of the Project and will detail Environmental Management Requirements (EMRs) that must be implemented by the delivery partner.

7.1 Design

During the detailed design phase, the key objective is to protect environmental values of the receiving waters downstream during operational phase. It is recommended that the risk mitigation measures outlined below be undertaken in planning and design phases to minimise potential impacts.

7.1.1 Water Quality

The following mitigation measures are recommended to be implemented to mitigate any impacts to surface water quality:

- Water Sensitive Urban Design (WSUD) Melbourne Water requirements will be applied to the drainage design. The Melbourne Water Stormwater Quality Performance Criteria for the Project provides a hierarchy of stormwater treatment measures to be implemented by the project; in order or preference, these are:
  - > treat at source
  - > treat close-by
  - > treat in the wider catchment
  - > treat in a separate catchment
  - > a combination of the above
  - > offset contributions.
- All discharges and runoff from the project to meet/ maintain objectives outlined Environmental Reference Standard (ERS)
- Comply with CSIRO (1999) Best Practice Environmental Management Guidelines for Urban Stormwater
- Retaining or replacing existing water quality treatment assets to maintain or exceed their current performance. Including minimising wastewater and incorporating new water treatment features into the project design to minimise the potential for pollutants to end up in waterways
- The proposed track surface drainage (impervious area) will be collected via adjacent cess channels and undertrack drainage which will drain to downstream receptors.
- Maintaining existing surface water drainage patterns where practical to do so.
- Managing water from different resources separately:
- Undisturbed runoff to be diverted around disturbed areas where practical
- Construction of bed control and or bank protection to protect waterways from bed degradation and aggradation.

7.1.2 Flooding

The following mitigation measures are recommended to be implemented to mitigate any flooding impacts:

- A key Melbourne Water requirement is that there shall be no adverse flood impacts because of the Project for a range of events up to and including the ‘1% Annual Exceedance Probability (AEP) event. Flood risk will be assessed by modelling of the design of works and structures to demonstrate that the project meets flood level, flow and velocity requirements. Structures will not increase overall flood risk or modify the flow regime of waterways without the consent of Melbourne Water or any other relevant statutory authority. Climate change is also considered as per RPV Sustainability Policy.
- The Melbourne Water Standards for Infrastructure Projects in Flood-Prone Areas (2018) require flow attenuation structures, such as retarding basins, or similar mitigation works to be undertaken where catchment imperviousness is to be increased. If filling of the floodplain is to occur, at minimum an equal offset is required to maintain pre-development floodplain storage.
- As much of the proposed new rail is on a viaduct filling of the floodplain is minimised requiring less mitigation. Elsewhere the track is duplicating existing rails at the same level as existing meaning the potential to dam flows upstream is minimised.
- While piers in the Maribyrnong River may have some limited impacts (up to 130 mm at the bridge site itself but with decreasing impacts upstream) these impacts are contained within the channel. No previously unaffected properties have been identified as being impacted. Given that the rail and adjacent freeway both have over 40m of freeboard, mitigation of 130mm of impact does not appear necessary.
- Piers in Steele Creek and Steele Creek North catchment have been modelled to have only limited and localised impacts. The main mitigation will be to provide scour protection around the piers.
- At Stony Creek the new rail crossing is on piers. The piers will be placed on ground above existing culverts and therefore do not impact on the Stony Creek channel.

However, there are some specific locations where there is the potential for flood impacts and the following mitigation has been proposed:

- On Airport Drive the piers for the viaduct will be located in the current median swale. To mitigate potential impacts of the piers within this swale it is proposed to offset the swale to the east slightly.
- Adjacent to Gilmour Road the new rail will occupy an existing cess drain blocking flows. This is to be mitigated by a new pipe (transitioning from 900mm at the upstream end to 1800mm at the downstream end.
- Additional storage is also to be provided in this area. Currently it is proposed to provide 3,000 cubic metres of additional storage area for floodwaters on a parcel of land at the southern extents of the assessment boundary, east of the existing rail line and on the southern side of Stony Creek. However, it is noted that this requires valuable land and hence other mitigation schemes are therefore also being investigated and modelled to determine the best solution in terms of minimising flood impacts, cost and providing ease of construction and maintenance.
- Works in the Sunshine Section include filling in of a swale on the southern side of the existing tracks. Enlarged stations/platforms will also increase the impervious footprint in this area. Minor impacts at Ferguson/Talmage Street have been resolved by drainage design capturing and conveying local stormwater to an existing Legal Point of Discharge (LPD) and preventing excess flow reaching Talmage Street Adverse impacts on Ferguson Street are not fully resolved yet but modelling of further drainage improvement is currently being undertaken. It is noted no properties are affected at this location.

7.2 Delivery

It is recommended that the following risk mitigation measure be undertaken in the pre-construction/ construction phases to minimise potential impacts:

- Implementing a Surface Water Management Plan that mandates best practice sediment and erosion control and monitoring in accordance with EPA Victoria guidelines. The Management Plan shall include:
  - > Monitoring water quality prior to construction.

    - > Monitoring water quality during construction, at both upstream and downstream locations
- Meet Melbourne Water waterway and floodplain management requirements to submit documentation for Melbourne Water's review and comment prior to construction. The submission to Melbourne Water should include:
    - > Asset protection plan
    - > Quality management plan
    - > Safety and environmental management plan
    - > Design plans and modelling to demonstrate minimum flood impacts as a result of temporary works
    - > Waterways or floodways are to be reinstated after construction

7.2.1 Melbourne Water Requirements

7.2.1.1 Design

7.2.1.2 Construction

Where construction activities are undertaken in, near or over waters, Construction Environmental Management Plan(s) would be prepared by the Contractor. A key Melbourne Water waterway and floodplain management requirement for construction phase is to submit documentation for Melbourne Water's review and comment prior to construction. The submission to Melbourne Water should include:

- Asset protection plan
- Quality management plan
- Safety and environmental management plan
- Design plans and modelling to demonstrate minimum flood impacts as a result of temporary works
- Waterways or flood ways are to be reinstated after construction.

7.2.2 Council Requirements

No council engagement has been undertaken prior to this report. Our current assumptions are based on industry best practices and guidelines provided by the councils.

Key requirements of these guidelines include:

- Minor systems consisting of pipe networks are typically designed to convey the 10% AEP (1 in 10 year average recurrence interval (ARI)).
- Major systems consisting of overland routes are typically designed to convey the 1% AEP (1 in 100 year ARI).
- Adopt *Urban Stormwater – Best Practice Environmental Management Guidelines* (BPEMG) for stormwater runoff from urban areas.
- Councils have a requirement for detention for all commercial and industrial areas designed for the 10 year ARI (10% AEP). Ensure overflows do not comprise the Council 10% AEP network design capacity. This requirement allows for an increased volume and duration of runoff from redeveloped areas and the possibility of this delayed flow coinciding with peak flow from larger catchments.

7.2.3 Delivery Partner Requirements

The delivery partner will be required to comply with Environmental management requirements (EMRs). EMRs will be developed as part of the EMF to manage and mitigate any changes to surface water/ flooding (e.g. management measures during construction to manage discharges, requirement for design to meet flood standards).

Prior to the commencement of works (other than Preparatory Works), the Delivery Contractor must develop, implement, and maintain a CEMP and other plans (or procedures) as required by the EMRs as relevant to any stage of the works. The plans required by these EMRs may be included as part of the CEMP or standalone management plans. The CEMP must be developed in accordance with EPA Publication 1834: Civil construction, building and demolition guide. The CEMP is to outline how these assets will be protected and managed so as not to cause negative water quality impacts on the receiving environment.

The following measures are to be considered when preparing for CEMP:

- Clearly identifying and delineating areas (through use of flagging, fencing or bunds) required to be disturbed and limiting disturbance to those areas;
- Minimisation of all disturbed areas;
- Stabilisation by progressive rehabilitation as soon as practicable;
- Construction of diversion drains/bunds/coffer dams upslope of areas to be disturbed to direct clean runoff away from disturbed areas;
- Construction of catch drains and sediment dams to capture runoff from disturbed areas as required;
- Construction of other erosion and sediment controls works such as silt fences prior to construction works commencing within the catchment area;
- Construction of drainage controls such as table drains at tracksides and hardstand areas as required;
- Use of scour protection in temporary diversion drains;
- Construction of all temporary drains as earthen drains at typical grades no steeper than 5% (giving maximum peak velocities in the order of 1.5m/s) to minimise scouring, otherwise providing adequate scour protection;
- Use of stabilising vegetation, geotextile liners, rock check dams etc. (as appropriate) in drains as required to reduce water velocities and prevent scouring;
- Construction of graded banks over the majority of the reshaped overburden areas to minimise erosion and re-direct runoff to catch drains and water disposal areas;
- Locate stockpiled material away from concentrated water flows;
- Seeding of topsoil stockpiles if stored for longer than six months;
- Regular inspection and maintenance of erosion and sediment controls.

8. Conclusion

8.1 Impact Assessment Summary

Base case hydrological and hydraulic flood models have been peer reviewed by Hydrology and Risk Consulting (HARC) on behalf of Melbourne Water and these verified models have been used to assess impacts of the project.

8.1.1 Construction

This report has investigated the potential for construction activities to increase flood risk due to the temporary placement of construction structures or materials within the floodplain, particularly during ground level pier and piling works for the Maribyrnong and Viaduct sections. Construction activities in the floodplain could have the potential to increase the flood frequency and levels at properties within or adjacent to the existing floodplain. Flooding of construction work areas/ laydown areas/ haul roads and other exposed sites located within floodplains will also likely generate polluted water that may impact on the beneficial uses of waterways.

It is anticipated that environmental risk management measures (outlined in Section 7) will be implemented during the construction process so that risks are minimised to the greatest extent practicable. The Delivery Contractor will be required to develop and implement CEMP, including a Surface Water Management Plan specifying the required mitigation measures, as well as drainage asset condition assessments before and after construction works would avoid or minimise adverse effects for works within the flood plain and on waterways.

All works on the waterways would be undertaken to minimise the potential for erosion and to the requirements of Melbourne Water in consultation with relevant local councils. The measures would be informed by the modelling of temporary work stages to demonstrate that the project meets Melbourne Water's flood level, flow and velocity requirements.

8.1.2 Operation

The project will marginally increase the amount of paved surface area through the creation of many new impervious surfaces, such as car parks. Connectivity of stormwater runoff from roads to the drains and waterways would be increased, as well as the risk of increasing peak inflows to drains and receiving waterways.

To minimise the potential for pollutants to end up in receiving waterways, the stormwater treatment system would be integrated into the design in accordance with the EPA Victoria Best Practice Environmental Management Guidelines for Urban Stormwater. Modelling has shown that pollutant reductions in accordance with best practice can be achieved using a subset of the potentially available sites. The Reference Design is compliant with the flow and water quality objective of local councils and Melbourne Water for the retardation of increased flows. Further discussions with stakeholders, refinement of the design and modelling assessment of the design's performance is expected to demonstrate that application of the controls would result in a project with acceptable surface water construction risks and long-term outcomes during operation. Permanent works must not have any adverse impacts on flow velocities, and any change to the flow regime must satisfy Melbourne Water and adhere to its requirements.

The Reference Design has been modelled to assess flood and water quality impacts. Flood modelling assessed the potential for flood impacts on surrounding public safety, property and assets indicates that with some further refinement, sufficient storage and flow control would be provided to offset the loss of floodplain storage, and no downstream impacts are anticipated to occur. It is anticipated that environmental risk management measures will be implemented in the detailed design phase to demonstrate through modelling that the design of permanent infrastructure, which may vary from the reference project assessed, meets the flood level, flow and velocity requirements and there are no outstanding risks.

8.2 EE Act Referral Trigger Assessment

The *Environment Effects Act 1978* (EE Act) provides for assessment of proposed projects (works) that may have a significant effect on the environment. Under section 8(4) of the EE Act, a referral is required to be submitted to the Minister for Planning to determine whether an EES is required.

Increases to impervious areas, due to rail related works, will increase the stormwater pollutant loads. However, the Project will be designed and constructed to comply with the requirements stipulated by the Catchment Management Authority (Melbourne Water) and Local Council requirements. Modelling based on the reference design shows compliance with BPEMG Requirements, that will maintain environmental values outlined in the ERS, and mitigate any significant impact to a human community from adverse water quality.

All works on the waterways would be undertaken to minimise the potential for erosion and to meet the requirements of Melbourne Water in consultation with relevant local councils. Preparation and implementation of a Surface Water Management Plan specifying the required mitigation measures, as well as drainage asset condition assessments before and after construction works would avoid or minimise adverse effects on bank stability. Risk associated with impacts to surface waters during construction can be managed through standard mitigation measures implemented via the Construction Environment Management Plan (CEMP), or management sub-pans.

Flood risk has been assessed by modelling of the design of works (reference design) and structures to demonstrate that the project meets flood level, flow and velocity requirements. Flood modelling assessed the potential for flood impacts on surrounding public safety, property and assets and indicates that with some further refinement, sufficient storage and flow control would be provided to offset any effects of the project. Minimal, if any, upstream and downstream impacts are therefore anticipated to occur. It is anticipated that environmental risk management measures will be implemented in the detailed design phase to demonstrate through modelling that the design of permanent infrastructure, which may vary from the reference project assessed, meets the flood level, flow and velocity requirements and there are no outstanding risks. All works on the waterways will be undertaken to the requirements of Melbourne Water in consultation with relevant local councils.

Based on environmental assessment undertaken to date and the current scope of the project, it is considered unlikely that the project will trigger either of the relevant referral criteria below to warrant referral to the Minister for Planning for the following criteria:

- *Potential extensive or major effects on beneficial uses of waterbodies over the long term due to changes in water quality, stream flows or regional groundwater levels.*
- *Potential extensive or major effects on the health, safety or well-being of a human community, due to emissions to air or water or chemical hazards or displacement of residences*

APPENDIX A
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APPENDIX B
IMPACT MAPS (1%AEP)

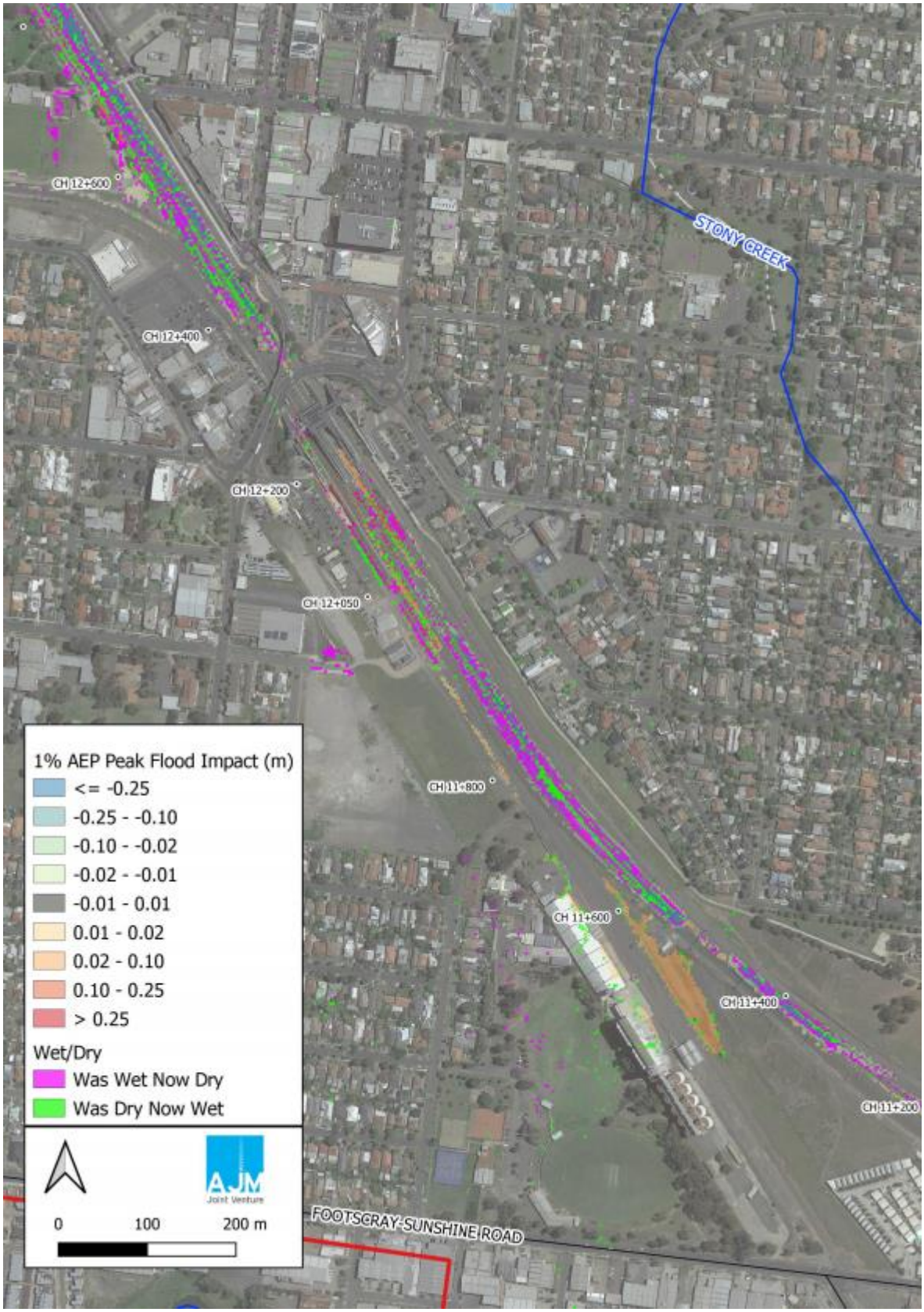

Figure B.1 SAP Mitigation Impacts (CH11+400 to CH12+400)

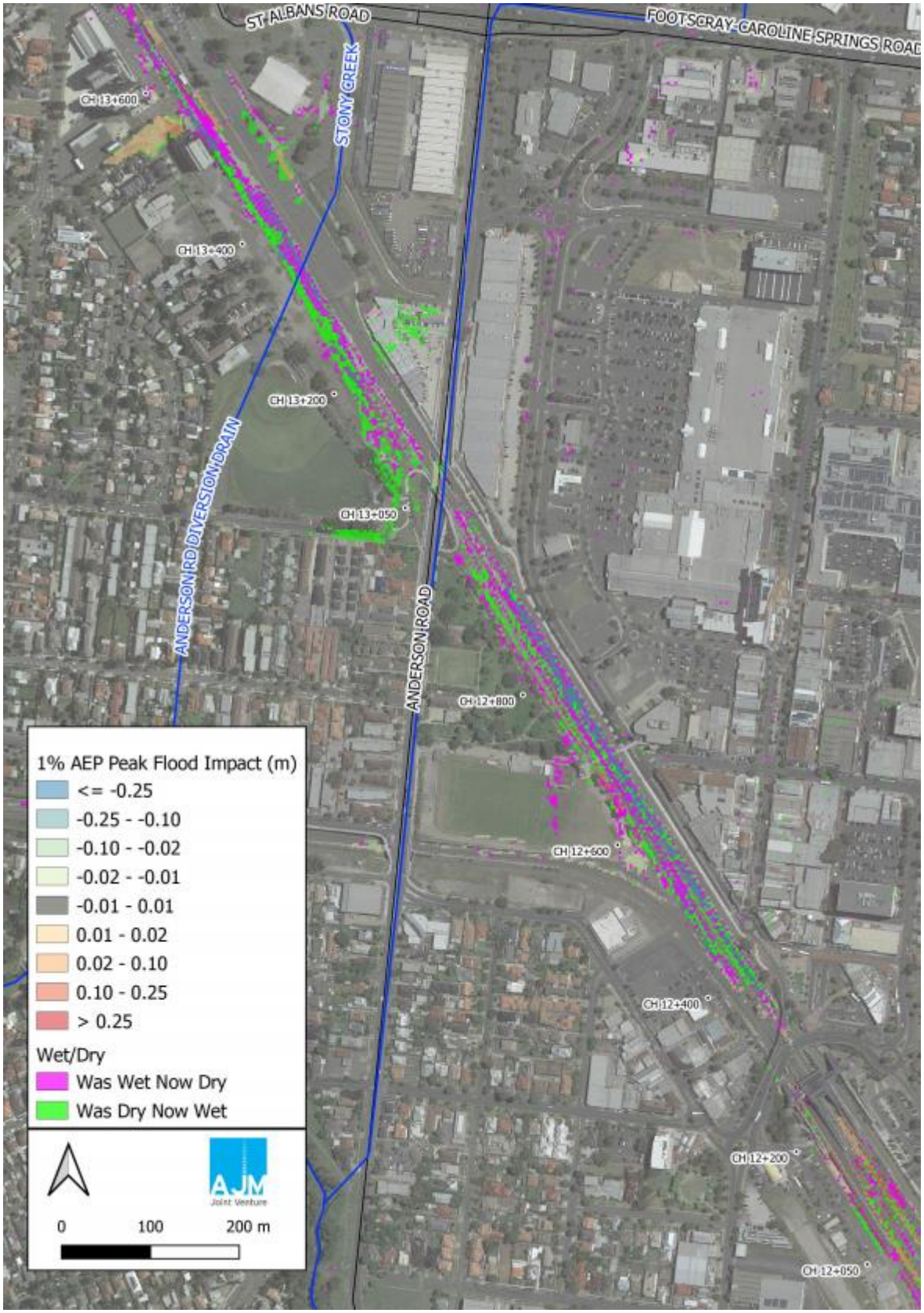

Figure B.2 SAP Mitigation Impacts (CH12+400 to CH13+400)

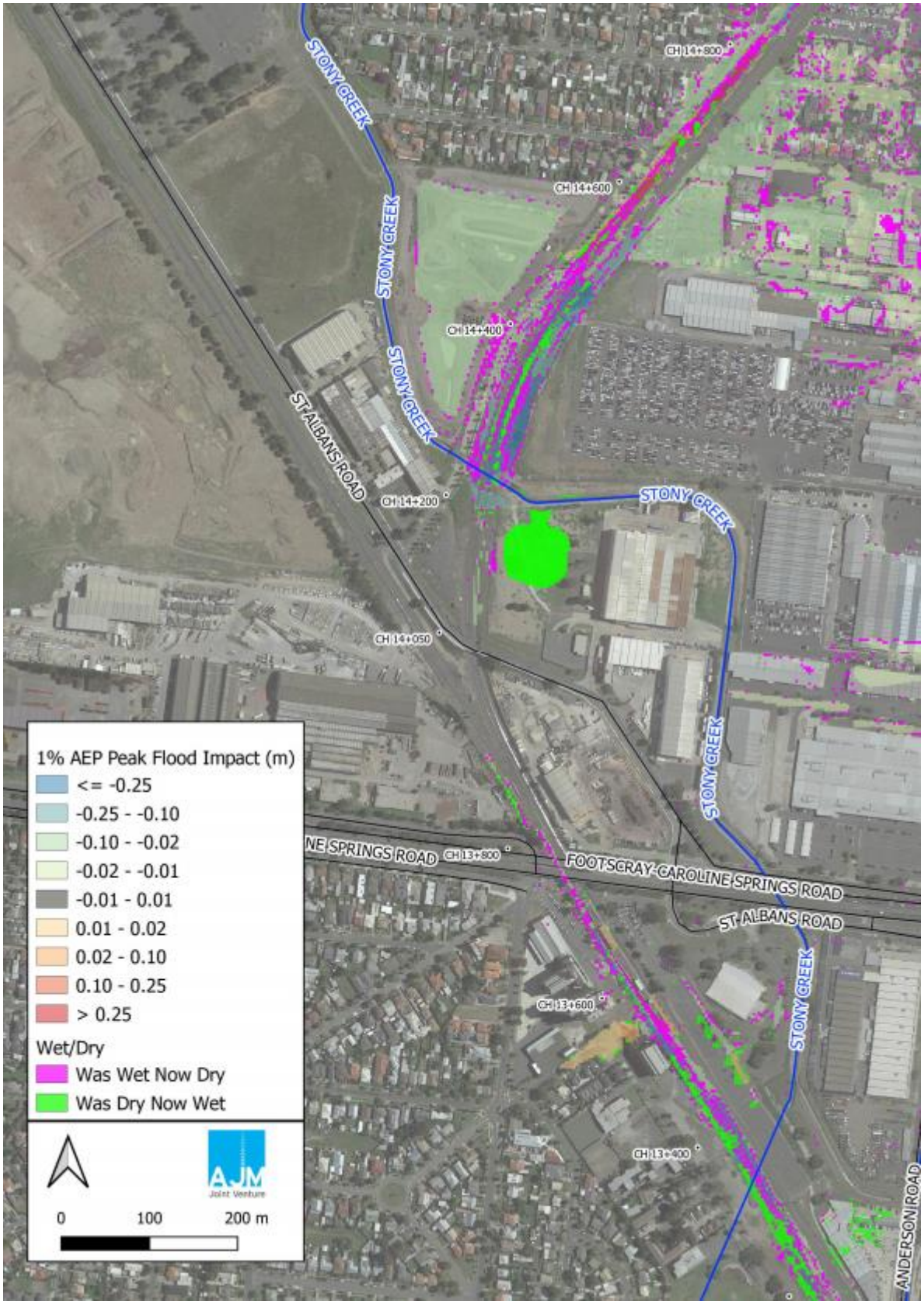

Figure B.3 SAP Mitigation Impacts (CH13+400 to CH14+800)

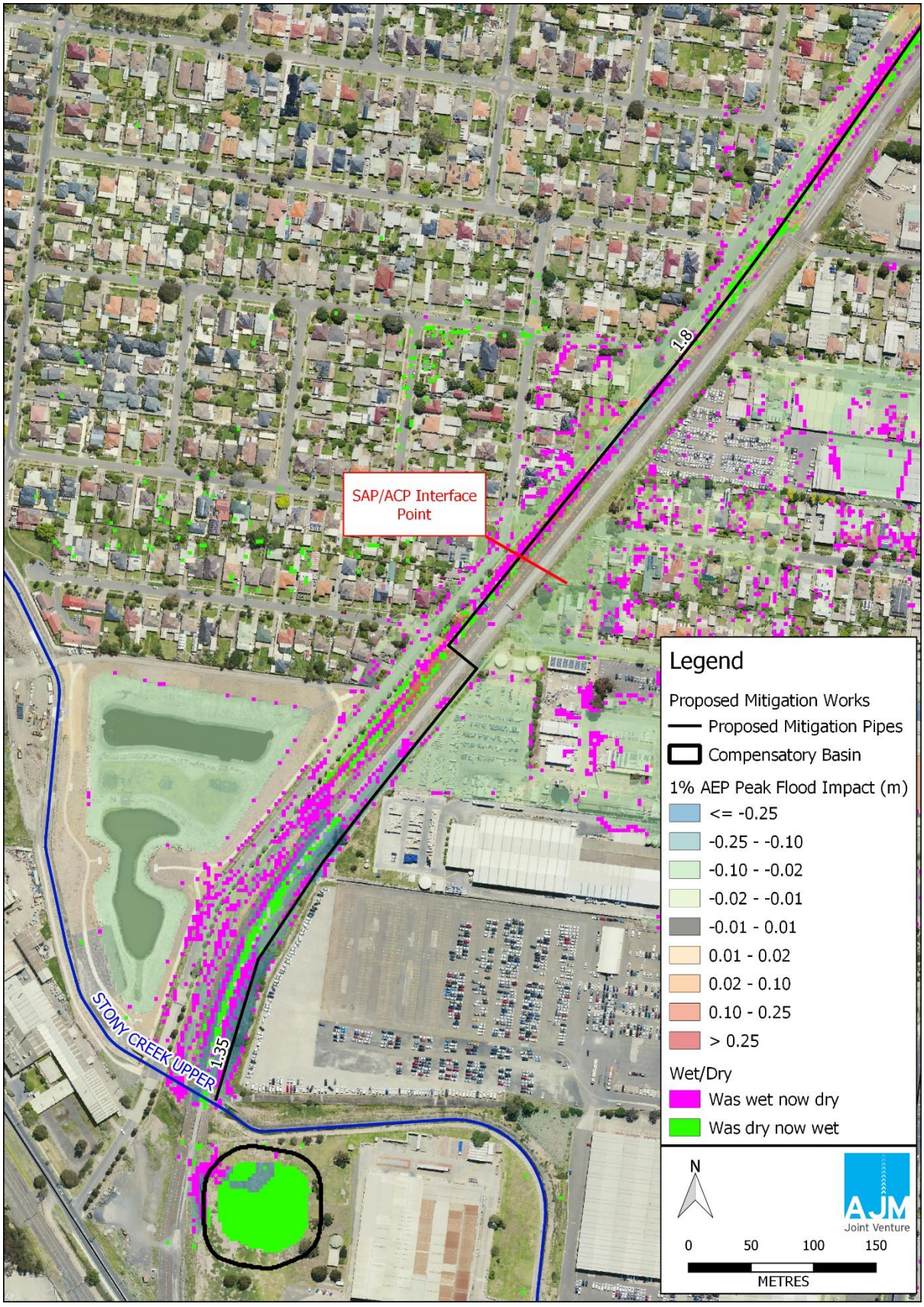

Figure B.4 ACP Mitigation Impacts (CH14+250 to CH15+250)

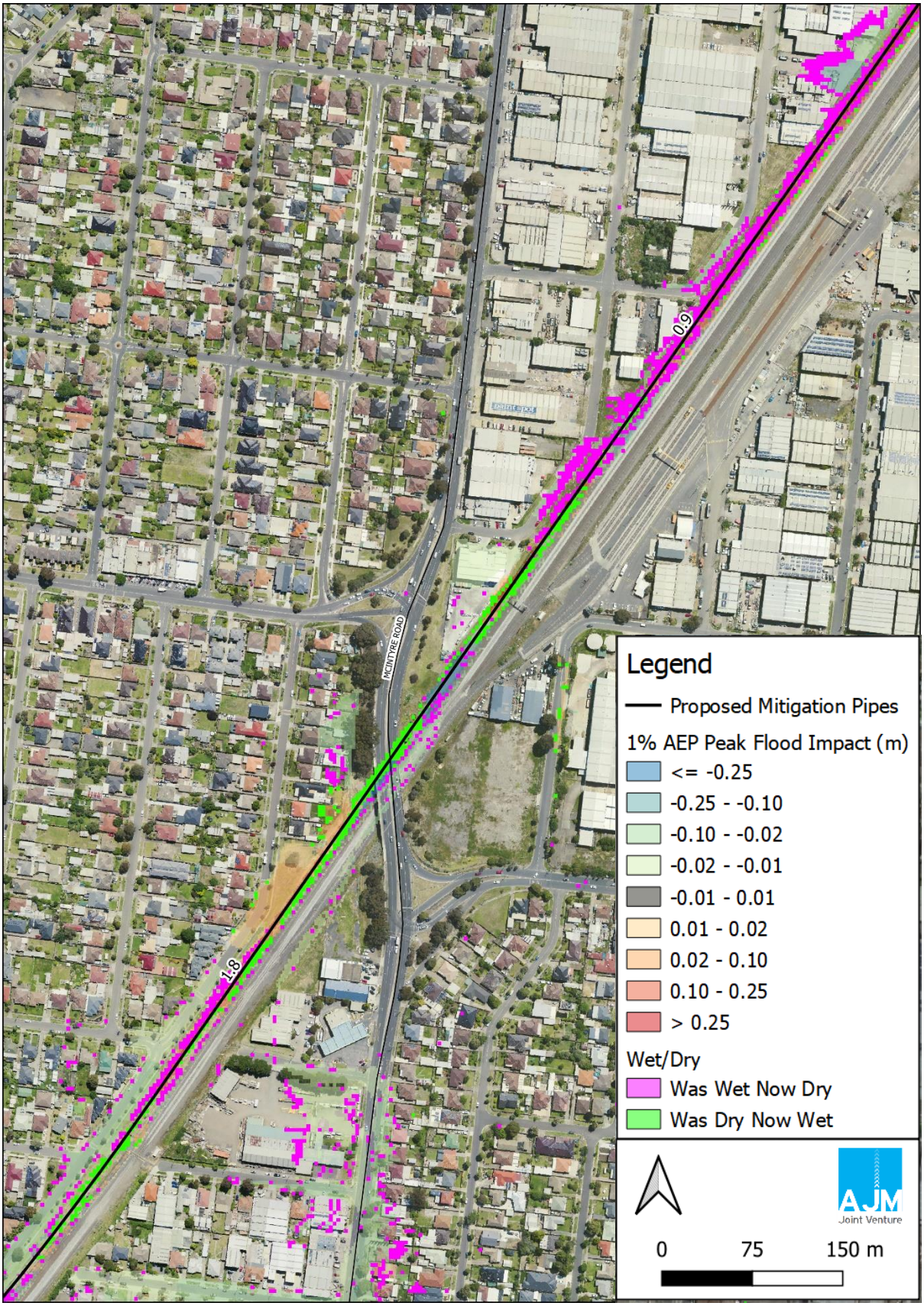

Figure B.5 ACP Mitigation Impacts (CH15+000 to CH16+150)

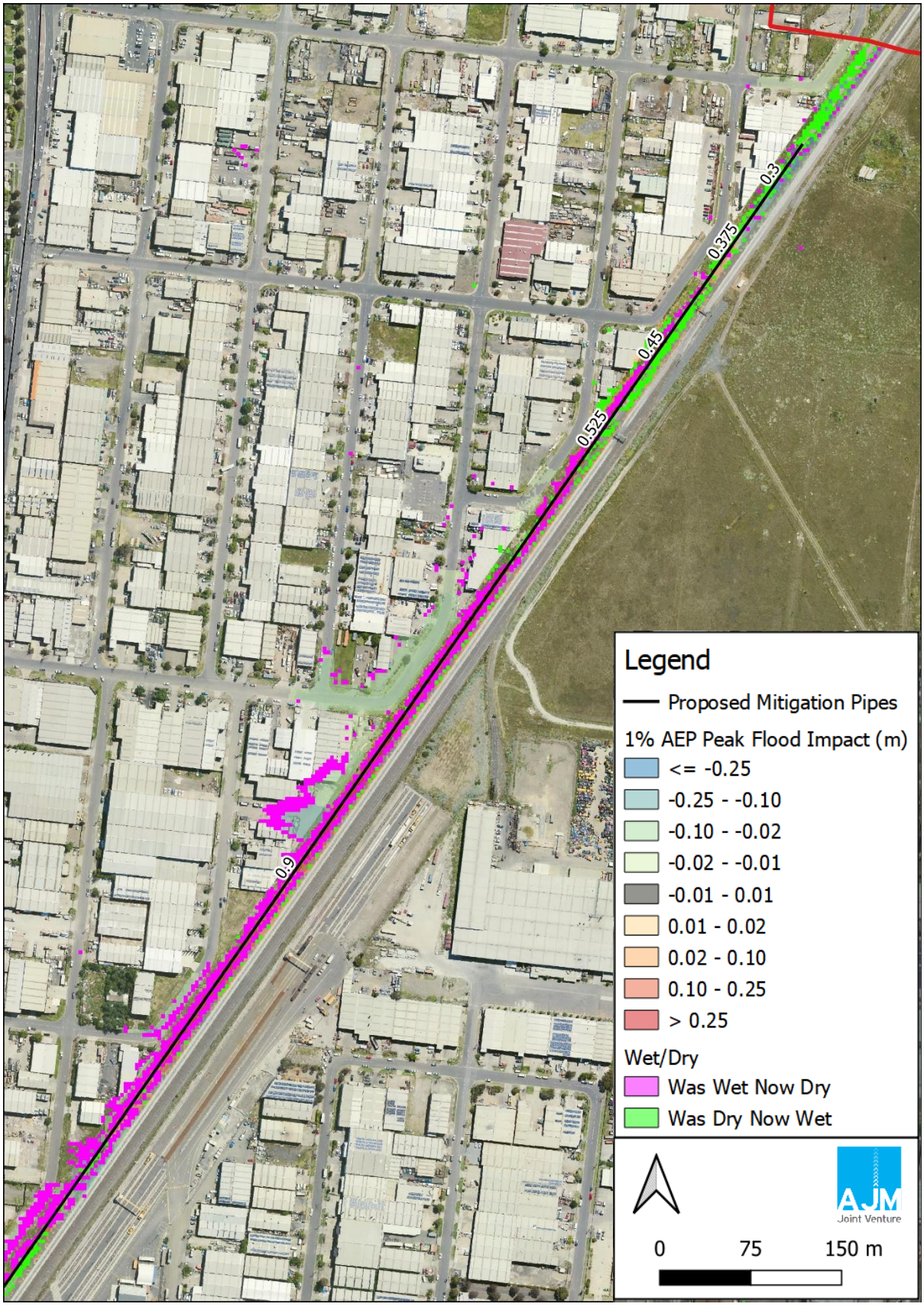

Figure B.6 ACP Mitigation Impacts (CH15+750 to CH16+850)

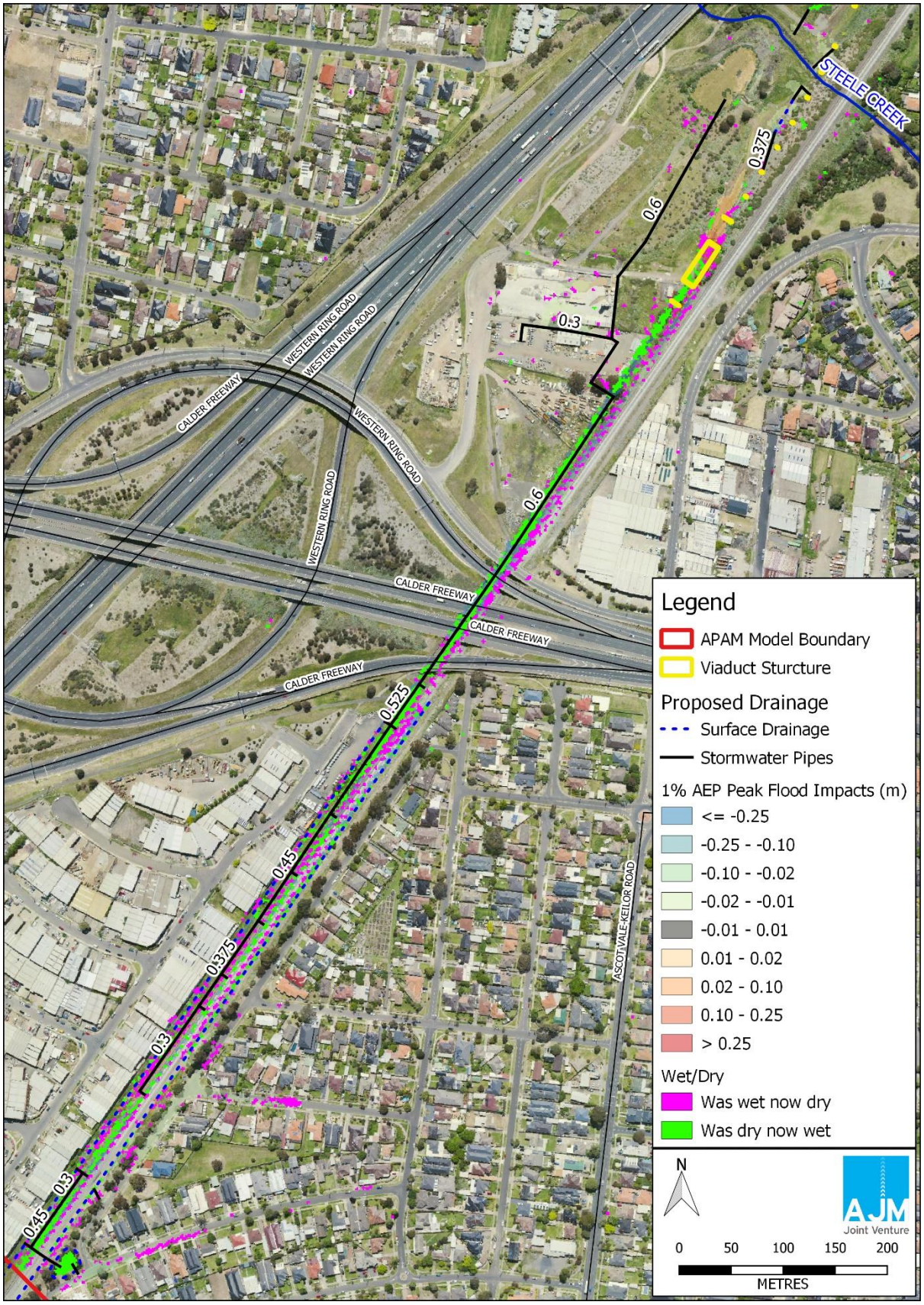

Figure B.7 ACP Mitigation Impacts(CH19+500 to CH20+620)

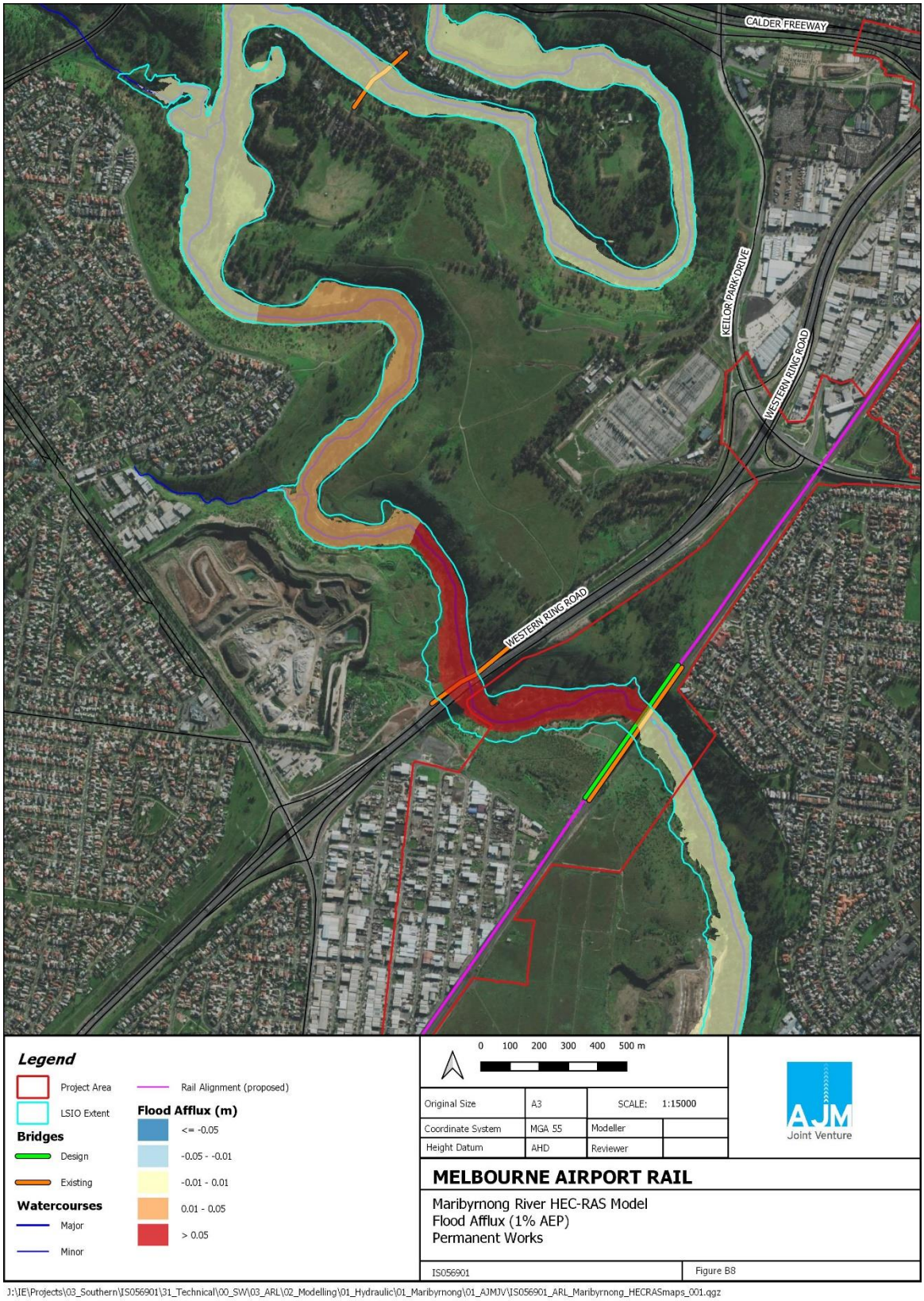

Figure B.8 Maribyrnong River Flood Afflux (proposed permanent works)

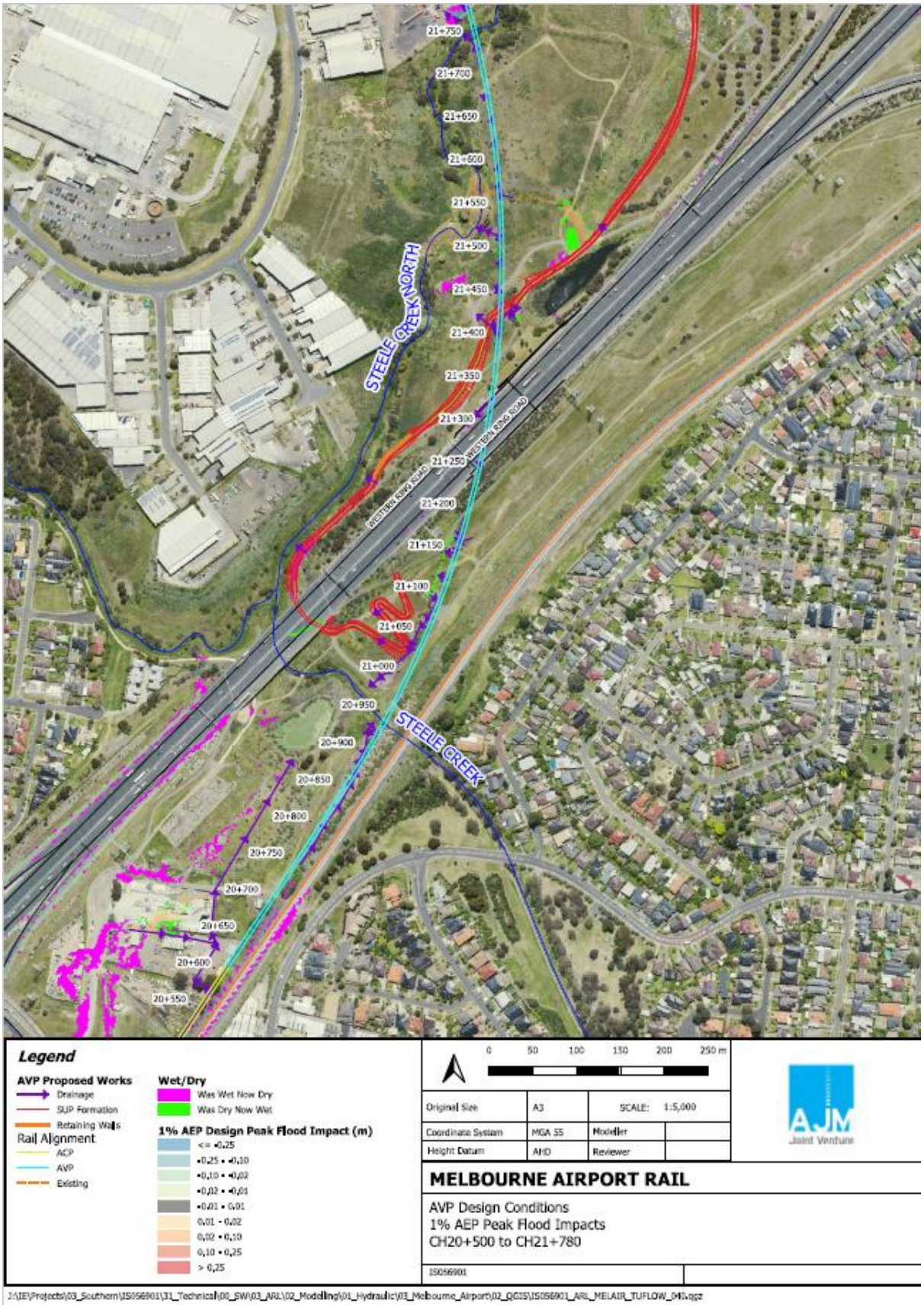

Figure B.9 AVP Mitigation Impacts (CH20+500 to CH21+780)

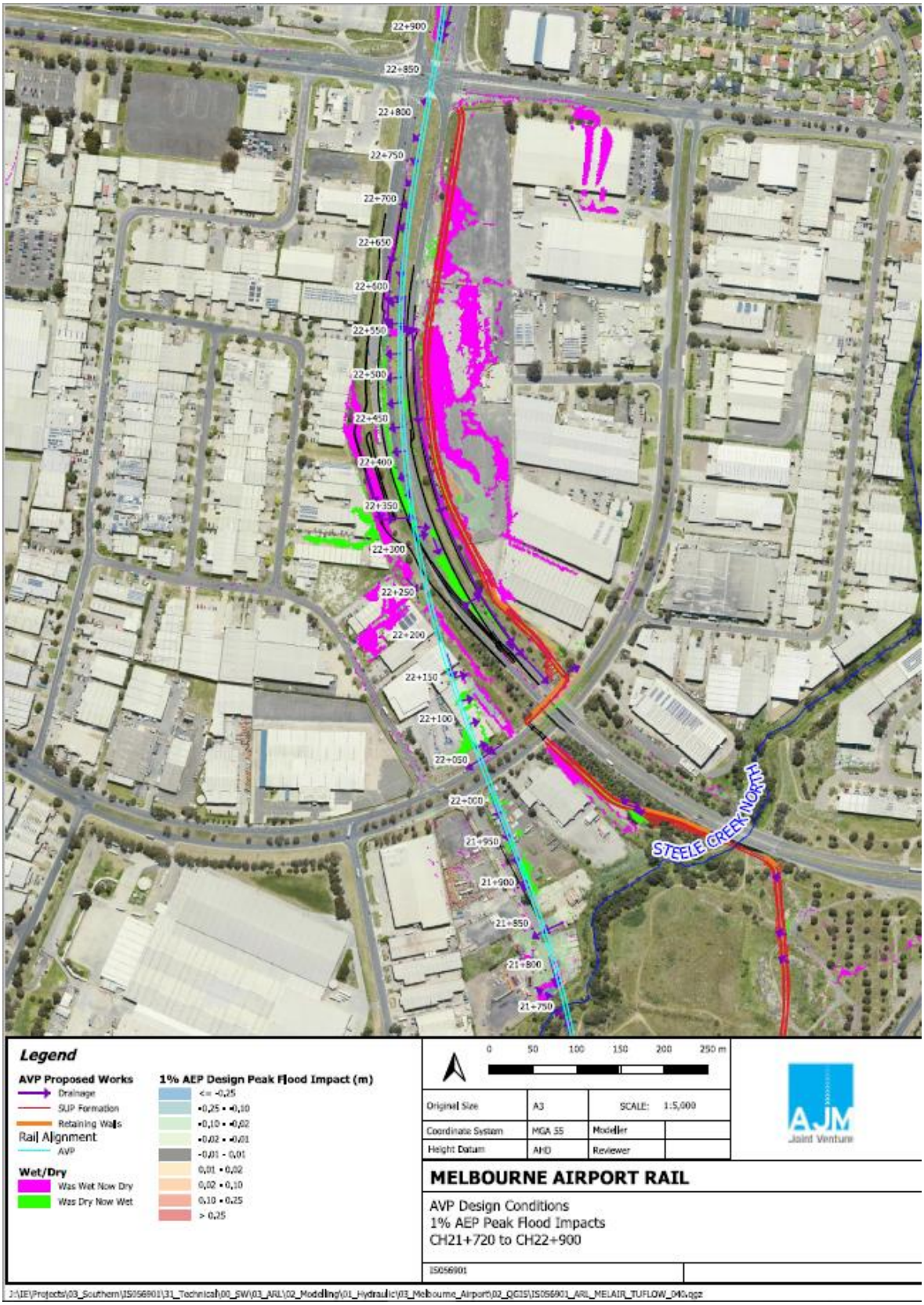

Figure B.10 AVP Mitigation Impacts (CH21+720 to CH22+900)

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