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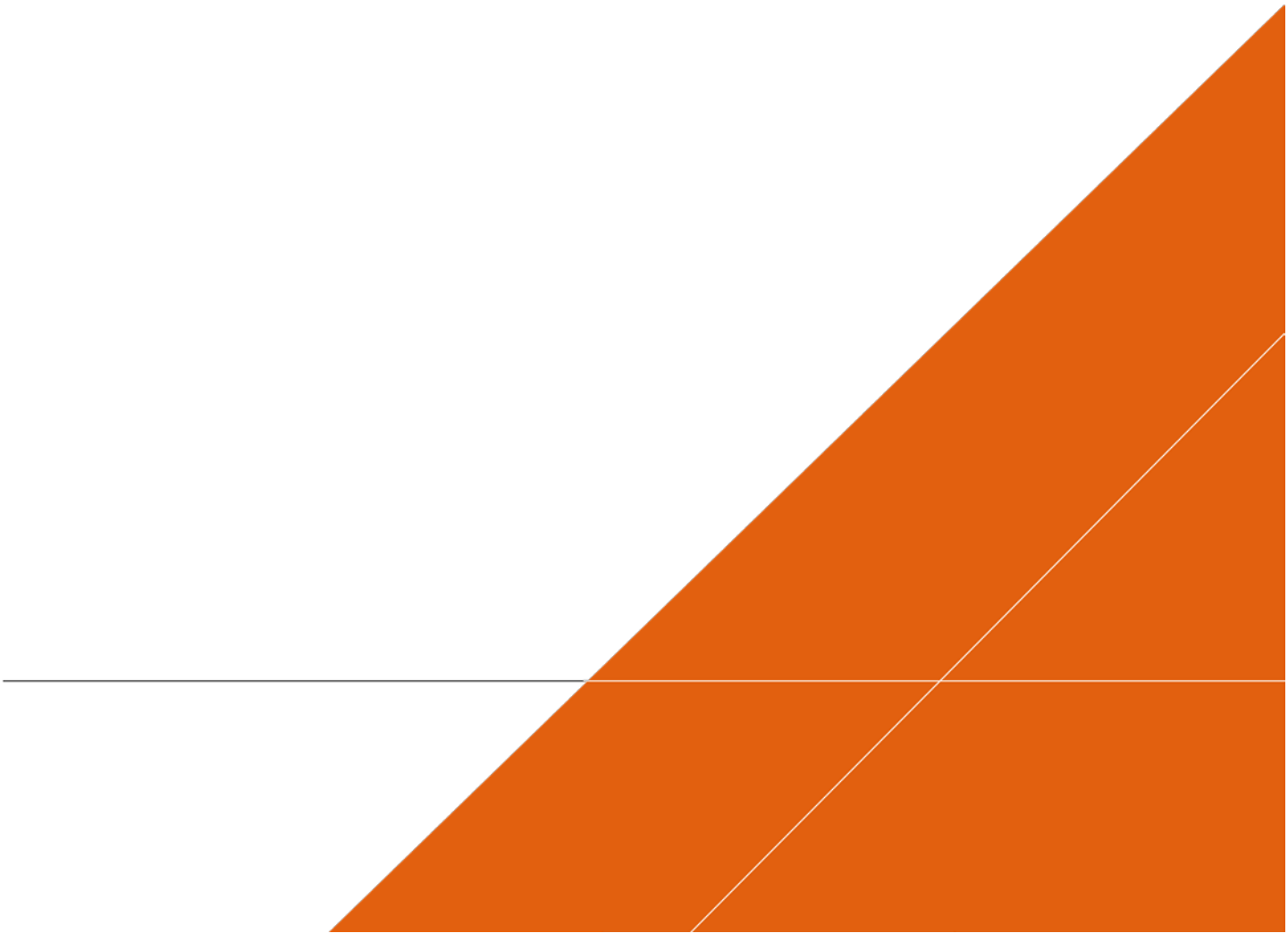
MRPV

CRAIGIEBURN ROAD WEST UPGRADE

Mickleham Road to Hume Highway

Phase 1 - Preliminary Surface Water Assessment

14 JUNE 2019



CONTACT

SELINA MOK

Arcadis Northern Package Environment Lead

T 03 8623 4000
M 0400 516 351
E selina.mok@arcadis.com

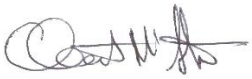
Arcadis
Level 32/140 William Street
Melbourne VIC 3000

MRPV
PHASE 1 - PRELIMINARY SURFACE WATER ASSESSMENT

Craigieburn Road West Upgrade

Mickleham Road to Hume Highway

FINAL

Author	Clement McAteer	
Checker	Peter Rand; Karen Kataguiri	
Approver	Selina Mok	

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REVISIONS

Revision	Date	Description	Prepared by	Approved by
01	19/11/18	Draft MRPV submission	CMA	SM
02	21/11/18	WSP comments	CMA	SM
03	14/12/18 19/12/18	MRPV comments Final for WSP review	CMA	AS
04	06/02/19	Final – revised project area	CMA	SM
05	14/06/19	Final – revised project length	KK	SM
06	14/06/19	Final – revised project description	KK	SM

CONTENTS

ABBREVIATIONS

Acronym	Meaning
ARI	Average Recurrence Interval
ARR	Australian Rainfall and Runoff
ASI	Area of Strategic Importance
BCA	Biodiversity Conservation Areas
BPEMG	Best Practice Environmental Management Guidelines
CEMP	Construction Environmental Management Plan
CMA	Catchment Management Authorities
DCI	Directly Connected Imperviousness
DS	Drainage Scheme
DSS	Development Services Scheme
FO	Flood Overlay
LSIO	Land Subject to Inundation Overlays
mAHD	metres Australian Height Datum
MWC	Melbourne Water Corporation
MRPA	Major Road Projects Authority
MRPV	Major Road Projects Victoria
MSA	Melbourne Strategic Assessment
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
RFI	Request for Information
RFO	Rural Flood Overlay
SBO	Special Building Overlays
SCO	Specific Controls Overlay
SEPP	State Environment Protection Policy
SRU	Suburban Roads Upgrade
WRSD	Water Sensitive Road Design

EXECUTIVE SUMMARY

The proponent for the Craigieburn Road West Upgrade is Major Road Projects Victoria (MRPV), a dedicated government body responsible for planning and delivering major road projects in Victoria. MRPV was established on 1 January 2019 and is part of the Major Transport Infrastructure Authority. Prior to 1 January 2019, MRPV was the Major Roads Project Authority (MRPA), which began its operation on 1 July 2018 as an Administrative Office under the Office of the Coordinator General. Prior to 1 July 2018, MRPV was the Major Projects division of VicRoads. Once the Upgrade is completed, the operation and maintenance responsibilities will be handed over to VicRoads and/or the relevant local government authority. While the Upgrade is being delivered by MRPV, both MRPV and VicRoads are referred to throughout this document as the Upgrade was previously managed by Major Projects division of VicRoads and various reference documents and tools were published or provided by VicRoads. MRPV will adopt existing VicRoads guidelines, plans and tools until such time as MRPV develop its own.

Arcadis Australia Pacific Pty Ltd (Arcadis), as a sub-consultant to WSP Australia Pty Limited (WSP), was commissioned by MRPV to undertake Preliminary Surface Water Assessment at Craigieburn Road West, Mickleham Road to Hume Highway (referred to as Craigieburn Road Upgrade Project). The Craigieburn Road Upgrade Project is one of the projects which comprises the Suburban Roads Upgrade (SRU) Program.

This report outlines the findings of a Phase 1 – Preliminary Surface Water Assessment to identify potential impacts on surface water and provides recommendations for any subsequent Phase 2 – Detailed Surface Water Assessment.

Purpose

The purpose of this Phase 1 – Preliminary Surface Water Assessment is to determine potential impacts on surface water within the Craigieburn Road Upgrade Project Area during construction and under typical operational conditions. The Phase 1 assessment comprised a desktop investigation and assessment of potential impacts on surface water intersecting and in close proximity to the Craigieburn Road Upgrade Project. This assessment is based on the reference design and project area as at December 2018. Melbourne Water Corporation (MWC) was consulted, and information provided by the statutory authority was considered during the Phase 1 assessment. MWC provided the following information:

- Existing flood models;
- As-built drawings of surface water assets, where available; and
- Environmental studies, generally related to ecological values associated with the relevant surface water bodies.

The key environment and planning legislation that guides the surface water management requirements for the Craigieburn Road Upgrade Project is listed below:

- *Environment Protection Act, 1970;*
- State Environment Protection Policy (Waters), 2018;
- *Water Act, 1989;*
- *Catchment and Land Protection Act, 1994 (Port Phillip and Westernport Catchment Management Authority); and*
- *Planning and Environment Act, 1987.*

Key Findings and Recommendations

The key outcomes following the Phase 1 - Preliminary Surface Water Assessment are:

- The Craigieburn Road Upgrade Project is located in the Merri Creek Upper sub-catchment, within the wider Yarra Catchment;
- The Craigieburn Road Upgrade Project intersects with one named waterway, Aitken Creek, at Aitken Boulevard and Craigieburn Road and is close proximity to the several other waterbodies;

- No primary industry 'Take and Use' licences have been identified for waterways intersecting the Craigieburn Road Upgrade Project;
- No industrial 'Take and Use' licences have been identified for waterways intersecting the Craigieburn Road Upgrade Project;
- The study area is not within a Water Supply Protection Area;
- During construction, water quality may be impacted through increased pollutant loads discharging into waterways and waterbodies directly from construction sites;
- Vegetation clearing has the potential to alter localised overland flow and increase sediment laden run-off into Aitken Creek and associated wetlands / settlement pond;
- There is a Biodiversity Conservation Area associated with Merri Creek Reach 1 and Craigieburn which relates to Growling Grass Frog Corridor. There is also a terrestrial habitat buffer to Area of Strategic Importance at Craigieburn Road East (Hume Highway to Hume Freeway). These habitat areas and Merri Creek do not intersect the Craigieburn Road Upgrade Project. However, there is the potential for run-off during construction (and the operational phase) that could flow into these habitat areas and Merri Creek via associated drainage lines;
- The most significant risks to surface water values occur during construction when activities with the greatest impact (i.e. clearing and earthworks) occur. Mitigation measures for the construction phase will be required to be set out in the Construction Environmental Management Plan (CEMP), which will be developed and implemented in accordance with construction best practice adhering to VicRoads procedures and guidelines. The placement of temporary works, stockpiles, equipment and plant can result in a reduction in flood conveyance or floodplain storage, potentially leading to increases to flood levels, flow velocities and flood frequency; and
- During operation, there may be an increased pollutant load entering waterways and waterbodies and an increased risk of localised flooding due to a larger impervious area and subsequent run-off associated with the Craigieburn Road Upgrade Project. Operational mitigation measures will be required to be developed alongside the Phase 2 - Detailed Surface Water Assessment, which will include hydrologic and hydraulic modelling of the Aitken Creek. Measures will include the introduction of effective water sensitive road design (WRSD) measures and all key stakeholders (i.e. MWC, Hume City Council) will be required to be consulted and engaged following the selection of a final design solution to determine if there are any other works planned which could also impact surface water in the vicinity of the Craigieburn Road Upgrade Project. Increased run-off volumes / rates may impact Aitken Creek and other nearby waterbodies and identified sensitive receptors (i.e. Merri Creek and Growling Grass Frog habitat areas). There is an additional potential impact on one of the 20-year strategic priorities outlined in the Healthy Waterways Strategy (Lower Yarra System – Merri Creek sub-catchments) due to run-off from the site, specifically the goal to maintain species richness and improve overall abundance and distribution of expected species of frog populations.

It is recommended that comprehensive assessment of the significance of impacts long-term (i.e. during operation) is undertaken during detailed design. The Phase 2 – Detailed Surface Water Assessment will include:

- Collation of water quality data to confirm whether existing waterway quality is within State Environment Protection Policy (Waters), 2018 objectives;
- Detailed hydrologic and hydraulic modelling of waterway crossings for existing and proposed conditions;
- Water sensitive road design utilising MUSIC (or another suitable methodology) taking into account MWC prescribed conditions and VicRoads standards; and
- Assessment of spill management and containment controls (e.g. spill basins) to manage fuel or chemical spills as a result of road traffic incidents involving bulk transport vehicles.

A CEMP will be required to be developed and implemented to manage and control construction activities to minimise water quality impacts as far as is reasonable practicable.

Ongoing consultation with MWC and Hume City Council will be required to confirm any additional environmental assessments required in the Aitken Creek and Merri Creek area to assess impacts associated with the Craigieburn Road Upgrade Project, e.g. ecological risk assessment, targeted ecological surveys.

1 INTRODUCTION

Arcadis Australia Pacific Pty Ltd (Arcadis), as a sub-consultant to WSP Australia Pty Limited (WSP), has been engaged by Major Road Projects Victoria (MRPV) as the Technical Advisor (TA) for the Suburban Roads Upgrade (SRU) Program.

The proponent for the Craigieburn Road West Upgrade is MRPV, a dedicated government body responsible for planning and delivering major road projects in Victoria. MRPV was established on 1 January 2019 and is part of the Major Transport Infrastructure Authority. Prior to 1 January 2019, MRPV was the Major Roads Project Authority (MRPA), which began its operation on 1 July 2018 as an Administrative Office under the Office of the Coordinator General. Prior to 1 July 2018, MRPV was the Major Projects division of VicRoads. Once the Upgrade is completed, the operation and maintenance responsibilities will be handed over to VicRoads and/or the relevant local government authority. While the Upgrade is being delivered by MRPV, both MRPV and VicRoads are referred to throughout this document as the Upgrade was previously managed by Major Projects division of VicRoads and various reference documents and tools were published or provided by VicRoads. MRPV will adopt existing VicRoads guidelines, plans and tools until such time as MRPV develop its own.

The Northern Package of the SRU Program consists of seven projects, located in the outer Northern suburbs of Melbourne, within the Local Government Areas (LGA) of Hume City, Whittlesea City, Nillumbik Shire Councils and Manningham City Shire Councils. This report relates to the desktop surface water assessments undertaken to assess the potential impacts and identify mitigation measures that will be used to inform the reference design for the Craigieburn Road Upgrade Project, which is within the jurisdiction of Hume City Council LGA.

1.1 Project Background

Craigieburn Road is a primary east-west arterial road located in Melbourne's Northern Growth Corridor, approximately 25 kilometres north of the Melbourne Central Business District (CBD). Craigieburn Road is key strategic link that facilitates access to employment and services around Craigieburn Town Centre and Craigieburn Plaza. Additionally, it provides connections to Craigieburn train station and the Hume Freeway, allowing high capacity access to Melbourne's CBD, the wider metropolitan area, as well as regional Victoria and interstate. Connections from Craigieburn Road to key north south arterials, such as Mickleham Road, Aitken Boulevard and Sydney Road provide access to other existing key activity centres such as Broadmeadows and Melbourne Airport.

The current design solution is to duplicate approximately 5.5 km of Craigieburn Road between Mickleham Road and Hume Highway, i.e. from two to four lanes between Vantage Boulevard to Mickleham Road (with provision in the cross section to cater for six lanes in the ultimate arrangement), from four to six lanes between Hume Highway and Hanson Road, and from two to six lanes between Hanson Road and Vantage Boulevard. The duplication also includes upgrades of approximately 1 km section of Mickleham Road and Aitken Boulevard, north and south of Craigieburn Road, from two to four lanes. The proposed Upgrade includes:

- Provision of shared use path and continuous safety barrier along the project length;
- Upgrades to six existing signalised intersections;
- Construction of six new signalised intersections including conversion of three existing roundabouts;
- Provision of bus priority at most intersections;
- Provision of new street lighting, road signage and landscaping along the project length; and
- Provision of new drainage and utility service upgrades/relocations.

The proposed Upgrade aims to:

- Improve traffic flow and travel times;
- Provide better access to the Hume Highway and northern activity centres;

- Improve bus service reliability along Craigieburn Road;
- Support better connection for the community and businesses in Wollert and Craigieburn;
- Improve access to Craigieburn train station, providing better local and city connections;
- Make it easier and safer for you to walk or cycle around your local area; and
- Lower the risk and severity of crashes with safety barriers.

1.2 Scope of Works

The Phase 1 – Preliminary Surface Water Assessment includes a desktop assessment of potential impacts on surface water, surface flow regimes and beneficial uses of the environment. This assessment is based on the reference design and project area as at December 2018.

The objective of this Phase 1 assessment is to determine potentially significant impacts on surface water during construction and operational phases of the Craigieburn Road Upgrade Project to inform the next phase of the design. This report provides recommendations that will be considered and addressed during detailed design and the Phase 2 - Detailed Surface Water Assessment. The Phase 2 assessment will be undertaken by the Contractor.

This Phase 1 assessment considers the following surface water values:

- Water quality and flooding;
- Primary industries (irrigation and general water uses, stock drinking water, aquaculture and human consumption of aquatic foods);
- Recreation and aesthetics;
- Drinking water; and
- Industrial water.

The Phase 1 – Preliminary Surface Water Assessment addresses both construction and operational phases of the Craigieburn Road Upgrade Project and highlights potential impacts on surface water values in downstream receiving waters.

1.3 Methodology

Preparation of the Phase 1 – Preliminary Surface Water Assessment for the Craigieburn Road Upgrade Project comprised the following key tasks:

- Collation of available infrastructure data (both existing and proposed), topography data, waterway corridors and extents of significant water bodies (ponds, reservoirs, etc.);
- Overlaying of flood level data from previous flood studies, Land Subject to Inundation Overlays (LSIO) and Special Building Overlays (SBO);
- Delineation of approximate project footprint and overlay proposed design layout;
- Identification of whether the Craigieburn Road Upgrade Project footprint overlaps existing surface waterways and undertaking of a high-level assessment of potential impacts on surface water values identified in Section 1.2;
- Review of environmental reports provided by Melbourne Water Corporation (MWC); and
- Provision of recommendations to support the Phase 2 - Detailed Surface Water Assessment.

As part of this Phase 1 - Preliminary Surface Water Assessment, the following sources of information were reviewed:

- SRU Sitemap – online GIS Database (WSP, 2018);
- Public available aerial imagery;
- Healthy Waterways Strategy (Melbourne Water, 2018);
- Growling Grass Frog Masterplan (DELWP, 2017);
- Growling Grass Frog Area of Strategic Importance GIS (DELWP, 2017);
- Victorian Water Register (DELWP, 2018);
- Waterwatch Victoria;
- Victorian Resources Online;
- Moonee Ponds Creek Strategic Plan Summary Report – Final 300311, (Land Design Partnership Urban Enterprise Golder Associates, 2011)
- Possible ecological futures for Merri and Darebin Creeks (Melbourne Watery Research Partnership, 2013);
- Greenvale Reservoir Catchment: Drinking Water Quality Risk Management Plan (Melbourne Water, 2008);
- Merri Creek Report (Melbourne Water Corporation, 2002); and
- A survey of the fish fauna in the Moonee Ponds Creek catchment (Melbourne Water, 2005).

2 RELEVANT GUIDELINES AND LEGISLATIVE REQUIREMENTS

The following sections provide an overview of relevant legislative requirements, as well as guidance documents and planning schemes, relevant to the Craigieburn Road Upgrade Project.

2.1 Legislation

2.1.1 Environment Protection Act 1970

The *Environment Protection Act 1970* (EP Act) regulates and controls actions relating to the protection of Victoria's environment. The EP Act was created to prevent environmental damage from air, land, noise, water and waste pollution and does this by establishing a framework for environmental quality objectives and programs to meet them. This Act also provides for the establishment and operation of the Victorian Environment Protection Authority (EPA) who regulate emissions. The EPA regulate discharges to surface water and may take legal action in the event of pollution to surface water caused by construction or operation of a road. The EP Act also facilitates implementation of State Environment Protection Policies (SEPP) for air, land, noise, waste and water.

2.1.2 Planning and Environment Act 1987

The *Planning and Environment Act 1987* (PE Act) establishes a framework for planning the use, development and protection of land in Victoria in the present and long-term interest of all Victorians. Victorian Planning Provisions (VPP) are set out in the PE Act to assist in providing a consistent and coordinated framework for planning schemes. The PE Act contains details of land use constraints including designated flooding zones which may occur within the Craigieburn Road Upgrade Project.

2.1.3 Catchment and Land Protection Act 1994

The intent of the *Catchment and Land Protection Act 1994* (CLP Act) includes:

- To establish a framework for the integrated management and protection of (land) catchments; and
- To encourage community participation in the management of land and water resources.

The CLP Act provides for the establishment of Catchment Management Authorities (CMA) for each catchment and land protection region. The Craigieburn Road Upgrade Project is located within the Port Phillip and Westernport CMA area. The CMA is responsible for developing and overseeing the implementation of the Port Phillip and Westernport Regional Catchment Strategy.

2.1.4 Water Act 1989

The intent of the *Water Act 1989* (Water Act) is to:

- Promote the orderly, equitable and efficient use of water resources; and
- Make sure water resources are conserved and properly managed for sustainable use for the benefit of present and future Victorians. The document provides formal means for the protection and enhancement of environmental qualities of waterways and their instream users.

Under the Water Act, MWC has the power to make by-laws of which By-law No. 2: Waterways, Land and Works Protection and Management is relevant to this assessment.

The objectives of By-law No.2 are:

- Preventing or minimising interference with the flow of water;
- Preventing or minimising pollution of our waterways;

- Prohibiting or regulating the removal of materials from our waterways; and
- Regulating certain activities.

2.1.5 State Environment Protection Policy (Waters) 2018

The Victorian Government has reviewed the State Environment Protection Policy (Waters of Victoria) 1988 and State Environment Protection Policy (Groundwaters of Victoria) to ensure Victoria has clear and relevant water quality standards and obligations to protect and improve the health of Victoria's water environments.

As part of the review the Victorian Government developed the State Environment Protection Policy (Waters) 2018, (SEPP (Waters) 2018), which came into effect 19 October 2018. SEPP (Waters) 2018 is a streamlined policy that merges the previous water and groundwater SEPP's. SEPP (Waters) 2018 aim is to provide a more streamlined policy that reflects community values, applies updated science, better clarifies industry obligations and provides for greater accountability.

SEPP (Waters) 2018 outline beneficial uses of water. The beneficial uses relevant to surface water include:

- Water dependent ecosystems and species;
- Human consumption after appropriate treatment;
- Potable water supply;
- Potable mineral water supply;
- Agriculture and irrigation;
- Human consumption of aquatic foods;
- Aquaculture;
- Industrial and commercial use;
- Water based recreation (primary contact, secondary contact and aesthetic enjoyment);
- Traditional Owners' and Aboriginal Victorians' cultural values;
- Cultural and spiritual values;
- Navigation and shipping;
- Buildings and structures; and
- Geothermal properties.

Schedule 3 of SEPP (Waters) 2018 prescribes the environmental quality indicators and objectives required to protect the beneficial uses of surface water. Schedule 1, Clause 3(d), identifies the geographic areas (segments) to which the water quality objectives relate.

The Craigieburn Road Upgrade Project is located in the river and stream reaches in the Urban Segment which are excluded from the Central Foothills and Coastal Plains segment. Water quality objectives for the Urban segment are outlined in Table 2-1. The Urban segment has been included so that environmental quality objectives that are more reflective of highly modified environments can be applied. The inclusion of the Urban segment is intended to drive urban stormwater management plans and waterway strategies to improve water quality.

Acknowledging that the Craigieburn Road Upgrade Project is located in the Urban segment the following protected beneficial uses are not relevant:

- Human consumption after appropriate treatment;
- Potable water supply;
- Potable mineral water supply;

- Aquaculture;
- Navigation and shipping;
- Buildings and structures; and
- Geothermal properties.

Clause 17 Subclause 3 of the SEPP (Waters) 2018 states that the environmental quality and objectives specified in the Policy will apply unless the background level of the waters are better than the environmental quality objectives or the environmental quality objectives are not able to be obtained due to natural levels in environmental quality indicators. In essence if suitable background water quality data is available this would become the objective for the purposes of SEPP (Waters) 2018.

Clause 34 of the SEPP (Waters) 2018 provides guidance on the management of urban stormwater and refers to the Urban Stormwater Best Practice Environmental Management Guidelines, 1999.

Clause 42 of the SEPP (Waters) 2018 provide guidance on minimising impacts on surface waters for those undertaking construction activities, and Clause 47 provides guidance on management of roads.

These Clauses are prevalent to the Craigieburn Road Upgrade Project.

Table 2-1 Environmental quality objectives for rivers and streams in the Urban segment

Segment	Total phosphorus (µg/L)	Total nitrogen (µg/L)	Dissolved oxygen (percent saturation)	Turbidity (NTU)		Electrical conductivity (µS/cm@ 25°C)	pH		Toxicants Water[1]	Toxicants Sediment [2]
	75th percentile	75th percentile	25th percentile	Maximum	75th percentile	75th percentile	25th percentile	75th percentile	% protection	
Urban (*Highly modified*)[3] Lowlands of Dandenong Creek, Mornington Peninsula, Western Port catchment and tributaries of the Yarra River	≤110	≤1,300	≥70	130	≤35	≤500	≥6.4	≤7.9	90	Low

[1] For toxicants water, '% Protection' refers to the '% Ecosystem Protection' values in the ANZECC Guidelines.
[2] For toxicants sediments, 'low' and 'high' refer to the sediment values in the ANZECC Guidelines.
[3] Urban segment consists of the areas within the urban growth boundary for Metropolitan Melbourne (as shown on the metropolitan fringe planning schemes set out in section 46AA of the Planning and Environment Act 1987), including Dandenong Creek, the tributaries of the Yarra, Maribyrnong and Werribee Rivers, and the current developed areas in the Mornington Peninsula and Western Port catchments, but not including –

- the Yarra, Maribyrnong and Werribee Rivers which are included in the Central Foothills and Coastal Plains segment; or
- the undeveloped urban land in the Urban Growth Zones and Low Density Urban Residential Zone in the metropolitan fringe planning schemes, as set out in the Victoria Planning Provisions which are included in the Central Foothills and Coastal Plains segment.

2.2 Guidelines

2.2.1 Guidelines for Development in Flood-prone Areas (Melbourne Water, 2008)

One of the purposes of MWC's Guidelines for Development in Flood-prone Areas, version 1 (Melbourne Water, 2008) is to assist property owners, developers, designers and builders plan and develop properties, buildings and structures so that they are safe from flooding from the outset without compromising the safety of other properties. The guiding principles of the document are to minimise risk to people and property; identify and prevent adverse impacts on adjacent, upstream or downstream areas and reduce reliance on emergency service personnel at the time of flooding.

2.2.2 Integrated Water Management Guidelines (VicRoads, 2013)

VicRoads has developed the Integrated Water Management Guidelines (VicRoads, 2013) to set the direction for the management of water resources during road construction, operation and maintenance activities. The guidelines provide information on regulatory information, water sensitive road design, water reuse, surface water quality management, groundwater quality management and identifying relevant stakeholders.

2.2.3 Australian Rainfall and Runoff

Australian Rainfall and Runoff (ARR) is a national guideline document, published by Engineers Australia (1987, 2016), for the estimation of design flood characteristics in Australia.

2.2.4 Urban Stormwater Best Practice Environmental Management Guidelines, 1999

The Urban Stormwater Best Practice Environmental Management Guidelines (BPEMG) (CSIRO, 1999) establishes stormwater quality objectives to help determine the level of stormwater management necessary to meet SEPP (Waters) 2018 objectives. The objectives for environmental management of stormwater are:

- 80% retention of the typical urban load of suspended solids;
- 45% retention of the typical urban load of total phosphorus;
- 45% retention of the typical urban load of total nitrogen;
- 70% retention of the typical urban load of litter; and
- Maintain discharges for the 1.5 year Annual Recurrence Interval (ARI) at pre-development levels.

BPEMG also helps to improve the quality of urban stormwater entering receiving waters by providing guidance in ten key areas:

- Environmental performance objectives and principles;
- Stormwater management planning;
- Land-use planning;
- Water sensitive urban design;
- Construction site management;
- Business surveys;
- Education and awareness;

- Municipal operations and enforcement;
- Structural treatment measures; and
- Flow management.

2.2.5 Healthy Waterways Strategy, 2018

MWC is responsible for ensuring waterways in the Port Phillip and Westernport region are protected and improved on behalf of the community. The Healthy Waterways Strategy outlines the role MWC plays, in partnership with the community, their customers and stakeholders, in managing waterways to ensure their value to the community is protected and improved.

The Healthy Waterways Strategy is a driven single regional 50-year vision, which was adopted from the previous Healthy Waterways Strategy (Melbourne Water, 2013). Over the previous five years, the Healthy Waterways Strategy has guided significant investment in the catchment, with over 300 kilometres of new vegetation established, over 4,000 km of vegetation managed, and 71 kilometres of stock-exclusion fencing. The Healthy Waterways Strategy has a 'whole of catchment' view of waterways (including wetlands, estuaries, rivers and creeks).

The Port Phillip and Westernport region comprises 5 major catchments; the Craigieburn Road Upgrade Project is in the Yarra Catchment. The Healthy Waterways Strategy provides detailed, catchment-specific visions, goals, long-term targets (10-50 years), and 10-year performance objectives for the 25 sub-catchments, 20 representative wetlands and 1 estuary that comprise the Yarra Catchment. Effort and investment at catchment and sub-catchment levels are prioritised and aligned to ensure they contribute to broader, regional goals and outcomes.

2.2.6 Integrated Water Management Framework for Victoria, 2017

The Integrated Water Management Framework for Victoria aims to help government, the water sector and the community work together to better plan, manage and deliver water in Victoria's towns and cities. The Framework outlines how greater community value can be delivered by consistent and strategic collaboration within the water sector – including water corporations, local governments and catchment management authorities – and through their links with organisations involved in land use planning.

2.3 Planning Schemes

The Specific Controls Overlay (SCO) is the functional planning overlay that is required to be implemented under the *Planning and Environment Act 1987* to enable a planning scheme amendment for the Craigieburn Road Upgrade Project. For all intents and purposes, reference to the Project Area throughout this report is an actual reference to the SCO. The Project Area is the extent of the road corridor (and adjacent private land, where applicable) nominated by MRPV as available for the construction of the Craigieburn Road Upgrade Project. The Project Area is sufficient for road duplication, modification and construction of intersections, shared user paths, footpaths, drainage and service relocations and street lighting and road signage required for the Craigieburn Road Upgrade Project.

The key purpose of an overlay map in a council planning scheme is to show the location and extent of special features, i.e. where land may be subject to flooding, to minimise the effects of overland flows and flooding on new buildings and ensure new developments do not adversely affect existing properties. The Craigieburn Road Upgrade Project is located within the Hume Planning Scheme.

The types of overlays relevant to this surface water assessment are:

- Land Subject to Inundation Overlay (LSIO);
- Floodway Overlay or Rural Floodway Overlay (FO/RFO); and
- Special Building Overlay (SBO).

The LSIO identifies land in a flood storage or flood fringe area affected by the 1 in 100-year flood or any other area determined by the floodplain management authority that is susceptible to flooding by waterways and open drainage systems. A permit is typically required for planning and building works in a LSIO.

The FO/RFO identifies waterways, major floodpaths, drainage depressions and high hazard areas which have the greatest risk and frequency of being affected by flooding.

SBO identifies land prone to overland flooding. The overlay sets appropriate conditions and building floor levels to address the flood risk.

A permit is required to construct or carry out works in the flood overlays listed previously. An application must be referred to the relevant floodplain management authority (MWC).

A LSIO intersects with the Craigieburn Road Upgrade Project. Figure 5-1 illustrates how the LSIO interacts with the Project Area.

The permitting requirements for undertaking road works within these overlays are discussed in the North preliminary planning assessment report and have been considered in the north planning approval pathways document.

3 REGIONAL CONTEXT

3.1 Yara Catchment

The Yarra catchment covers an area of 4,046 km^2. The Yarra River, which is the largest river in the Port Phillip and Westernport region, rises in the Great Dividing Range to the east of Warburton and flows 245 km until entering Port Phillip at Newport. The Lerderderg River and Yarra River, between Warburton and Warrandyte, have been identified as a Victorian Heritage River, meaning that it has significant recreation, nature conservation, scenic and cultural heritage attributes.

Approximately 55% of the Yarra catchment retains its natural vegetation, 30% is used for agriculture and 15% is urban. There are over 21,000 wetlands in the Yarra catchment, including approximately 16,000 constructed wetlands and nearly 5,100 natural wetlands that support significant environmental and social values. More than one third of Victoria's native plant and animal species can be found in the Yarra catchment. Poor quality stormwater inputs, drainage and clearing of vegetation have already impacted many wetlands of the Yarra catchment.

Over the previous five years, the Healthy Waterways Strategy has guided significant investment in the catchment, with over 300 km of new vegetation established, over 4,000 km of vegetation managed, and 71 km of stock-exclusion fencing. The majority of waterways in the Lower Yarra catchment area have been modified from their original morphology by way of straightening, channelling and concrete lining, and water quality is often impacted by large volumes of stormwater inflows from surrounding land uses.

The Craigieburn Road Upgrade Project is located in the Merri Creek Upper sub-catchment, one of the 25 sub-catchments that make up the Yarra catchment. The Healthy Waterways Strategy includes a co-designed catchment program developed specifically for the Yarra catchment to holistically manage waterways for environmental, social, cultural and economic values. Over the 10-year implementation period of the Strategy, the shorter-term outcomes (10-year performance objectives) collectively contribute to either maintaining or improving the waterway conditions, in turn maintaining or improving the status of the key waterway values, and ultimately contributing to the regional and catchment visions and goals for waterways.

The Craigieburn Road Upgrade Project intersects one waterway, Aitken Creek.

3.1.1 Merri Creek Upper Sub-catchment

Merri Creek Upper sub-catchment includes the catchment upstream of Craigieburn Road. Merri Creek flows from the foothills of the Great Dividing Range near Wallan, through basalt plains north of Melbourne and joins the Yarra River at Fairfield. Major tributaries of Merri Creek in this section are Kalkallo, Malcolm and Aitken creeks.

The Healthy Waterways Strategy provides targets for each sub-catchment under:

- **Performance Objectives** (1-10 years) – to guide activities and indicate progress towards improving the waterway conditions;
- **Waterway Conditions Targets** (10+ years) – waterway management focuses on ensuring waterway conditions are appropriate to improve waterway values; and
- **Waterway Values Targets** (10-50 years) – established to ensure goals are on track.

Surface water quality objectives / targets listed under each of the headings include:

- **Performance Objectives**
  - To prevent decline in stormwater condition, treat urban development so directly connected imperviousness (DCI) remains below 2% on the Merri Creek at Summerhill Road (Wollert). For every hectare of new impervious area, this requires harvesting around 4.5 ML/y and infiltrating 1.1 ML/y, which is about 21.4 GL/y and 5.2 GL/y for full development to the urban growth boundary.

- **Waterway Conditions Targets**
  - Stormwater Condition is measured by DCI, which is the proportion of the impervious surface in the catchment that is directly connected to a stream through a conventional drainage connection. The current state is moderate and the target is moderate;
  - Water Quality (Environmental) indicates compliance with the State Environment Protection Policy Waters of Victoria environmental water quality objectives (EPA Water Quality Index) using the Yarra and Bay Report Card Scoring Method. The current state is moderate and the target is moderate;
  - Litter absence is a strong indicator of stream health – clean waterways are healthy waterways and aesthetically pleasing. Litter detracts from the sense of naturalness and creates a perception that a place is uncared for. It also detracts from the enjoyment of active and passive recreation. The current state is high and the target is very high; and
  - Water Quality (Recreational) is critical to minimise human health risks. Exposure to pathogens (disease causing microorganisms) via primary (e.g. swimming) and/or secondary (e.g. boating) can lead to illness. Water quality guidelines set water standards for primary and secondary contact. The current state is high and the target is high.
- **Waterway Values Targets**
  - Fish are currently rated as very low due to a lack of suitable habitat (instream and riparian), barriers to migration, and the impact of urban and rural land use on water quality and flows. The increased current trajectory score is due to climate change increasing habitat suitability for common and widespread species. Significant improvements to riparian vegetation, stormwater management, and fish passage, is predicted to increase the score to high in the long term and support a wider range of species;
  - Macroinvertebrates score is low due to poor riparian and instream habitat, and flows. Improvements to vegetation and protection of flows and water quality through stormwater management is predicted to increase score to moderate in long term; and
  - Fish are currently rated as very low due to a lack of suitable habitat (instream and riparian). This is largely a result of extensive urbanisation, stormwater, channel modifications and barriers to fish movement. The increased current trajectory score is due to climate change increasing habitat suitability for common and widespread species. Improvements to riparian vegetation, stormwater and fish passage will provide suitable habitat for a wider range of species and contribute to a moderate rating in the long term. Threatened dwarf galaxias are known to occur in this sub-catchment.

4 CONSULTATION WITH MELBOURNE WATER CORPORATION

MWC is a key stakeholder for this Phase 1 - Preliminary Surface Water Assessment. The Project Area is within the Port Philip and Westernport Catchment Management Authority (CMA) region. Under the Water Act, the designated waterways, regional drainage and floodplain management authority for the Port Philip and Westernport CMA region is MWC. Liaison and communication with MWC was undertaken to confirm existing and available information relevant to the Craigieburn Road Upgrade Project.

Drainage Schemes (DS) or Development Services Schemes (DSS) are master plans for drainage in specific catchments and are developed and managed by MWC. DS areas are provided on the MWC website. They guide the standards for flood protection, water quality and waterway health. DS determine the financial contributions developers need to make to MWC to fund required drainage and stormwater quality treatment works.

The Craigieburn Road Upgrade Project intersects two MWC Drainage Schemes:

- Aitken Creek, (DS No. 4480); and
- Craigieburn East Strategy, (DS No. 4492).

Over half the of the Craigieburn Road Upgrade Project lies within the Aitken Creek DS area. A small section of the Project Area, closest to the Hume Highway, lies within the Craigieburn East Strategy DS.

MWC provided information relating to riparian vegetation, aquatic / semi aquatic fauna in the local area which was reviewed as part of this Phase 1 assessment. The information provided included:

- Growling Grass Frog Area of Strategic Importance GIS (DELWP, 2017);
- Growling Grass Frog Masterplan for Melbourne's Growth Corridors (DELWP, 2017);
- Biodiversity Conservation Areas (BCA) and Melbourne Strategic Assessment (MSA) timestamped native vegetation;
  - There is a BCA associated with Merri Creek Reach 1 at Craigieburn which relates to a Growling Grass Frog Corridor. The objective of the BCA is to maintain connectivity between separate populations of Growling Grass Frog in the northern growth corridor. The Growling Grass Frog Masterplan identifies this area as a terrestrial habitat buffer to Area of Strategic Importance (ASI) and Merri Creek. The purpose of the ASI is to protect potential breeding habitat of Growling Grass Frogs while terrestrial habitat buffers are designed to ensure sufficient terrestrial habitat remains in the vicinity of the ASI and instream waterbodies; and
  - The MSA indicates that native vegetation is associated with the waterways in the study area.

The extent of the implications of the BCA and MSA will be discussed in detail in the Ecology Report prepared for the Craigieburn Road Upgrade Project. Impacts on flora and fauna under the jurisdiction of these policies will trigger financial penalties.

MWC has specified performance criteria and surface water design requirements which will be required to be satisfactorily addressed. These include:

- Performance Criteria for Waterways and Drainage Schemes – SRU North and South East (October 2018);
- MWC standards for infrastructure projects in flood-prone areas; and
- Performance Criteria for Stormwater Quality and Management.

5 PRELIMINARY SURFACE WATER ASSESSMENT

Potential impacts on surface water due to the Craigieburn Road Upgrade Project will be addressed in two phases, as described below:

- Phase 1 - Preliminary Surface Water Assessment (this report): comprised a desktop assessment and review of available information, to identify areas where surface flow regimes may potentially be impacted. The Phase 1 assessment did not include modelling; and
- Phase 2 - Detailed Assessment (future design reports): will comprise a detailed assessment, including hydrologic and hydraulic modelling and water quality modelling to define existing conditions and quantify the magnitude of impacts on surface water, particularly in relation to drainage, associated with the proposed Craigieburn Road Upgrade Project.

5.1 Environmental Setting

Understanding the environmental setting of the Craigieburn Road Upgrade Project is important when determining potential impacts.

The Craigieburn Road Upgrade Project is in the Merri Creek Upper sub-catchment that forms part of the larger Yarra Catchment, which ultimately comprises part of the Port Philip and Westernport region catchment. The Project Area is located to the north of Greenvale Reservoir within the Hume Local Government Area (LGA) approximately 25 km north of Melbourne. The section of Craigieburn Road between Mickleham Road and the Hume Highway is part of the Aitken Creek catchment and the existing land generally falls to the south and east.

The local catchment area is mainly urbanised covering approximately 2.4 km^2. It drains from north-west to south-east direction. There is a mix of rural, residential and commercial land use adjacent to the Craigieburn Road. The catchment is split by Craigieburn Road that runs in an East West direction. Flow in this catchment will drain to Aitken Creek either by underground drainage pipes or as overland flowpaths.

The Craigieburn Road Upgrade Project intersects Aitken Creek, at Aitken Boulevard and Craigieburn Road. Aitken Creek discharges into Merri Creek east of the Hume Highway. Merri Creek is the main waterway associated with the Merri Creek Upper sub-catchment and the Project Area, with all other waterways and drainage lines in the surrounding area flowing into Merri Creek at some point, before its confluence with the Yarra River at Abbotsford. The Craigieburn Road is also close to several waterbodies. Key local water features include:

- Aitken Creek Wetland - located approximately 100 m to the south of the Craigieburn Road (at the closest point);
- Aitken Creek Wetland and Sediment Pond - approximately 25 m to the west of Aitken Boulevard (at the closest point);
- Highlands Lake Sediment Pond / Highlands Lake Wetland - approximately 320 m to the north of Craigieburn Road;
- Flax Lily Creek Wetland - approximately 280 m to the south of Craigieburn Road;
- An unnamed man-made water body - approximately 20 m to the north of Craigieburn Road;
- Aitken Creek Wetland and Sediment Pond and Flax Lily Creek Wetland to the south; and
- Highland Lake Sediment Pond and Wetland to the north.

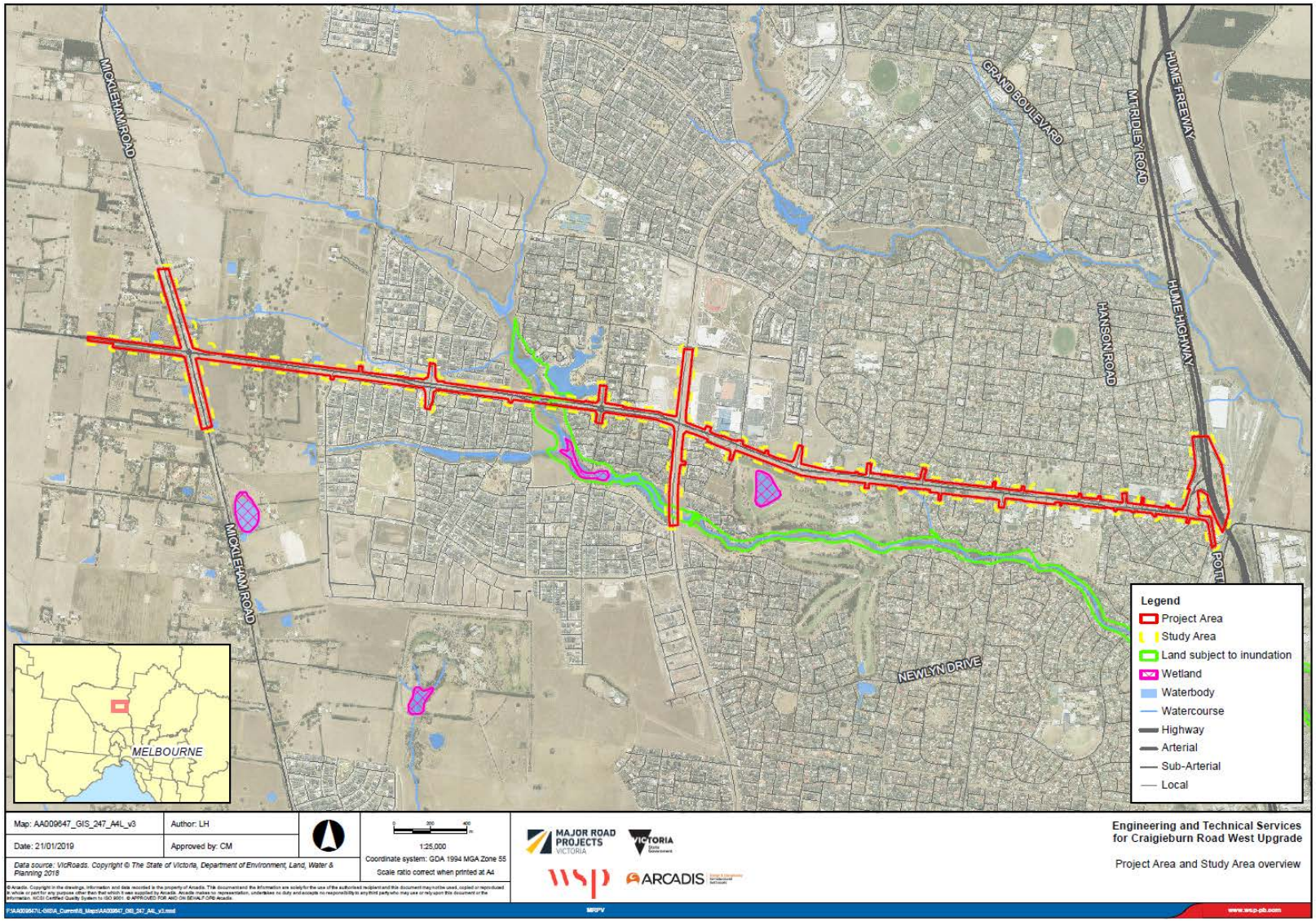
Table 5-1 provides a high-level overview of the environmental setting for surface water for the Craigieburn Road Upgrade Project.

Figure 5-1 provides an overview of the Craigieburn Road Upgrade Project area and nearby surface water features.

Table 5-1 Environmental setting

Project	Environmental setting
Craigieburn Road Upgrade Project	The local topography at Craigieburn Road ranges from approximately 191 meters Australian Height Datum (mAHD), at Oaklands Road to 273 mAHD the intersection of Oaklands Junction and Craigieburn Road. The Project Area intersects Aitken Creek. Aitken Creek rises to the north of Craigieburn Road and discharges into Merri Creek to the east of the Hume Highway. Malcom Creek, (350 m north east to the Project, at the closest point), also discharges into Merri Creek. There are several wetlands and unnamed waterbodies in close proximity and either side of the Craigieburn Road. The Healthy Waterway Strategy lists waterway objectives, and current, 10+ years and 10-50 year targets for waterway values and waterway conditions, for each sub-catchment within the Yarra Catchment. The values are ranked Very Low to Very High. The current status for key waterway values and conditions associated with Merri Creek Upper sub-catchment are listed below. • Water Quality (Environmental) – Moderate • Water Quality (Recreational) – High • Stormwater Condition – Moderate • Litter (absence) – High • Fish score – Very low • Frogs score – Moderate • Macroinvertebrates score – Low • Vegetation score – Low • Social values such as amenity, community connection and recreation have all high current scores There is a BCA associated with Merri Creek Reach 1 at Craigieburn (approximately 650 m east of the Project) which relates to a Growling Grass Frog Corridor. The Growling Grass Frog Masterplan identifies this area as a terrestrial habitat buffer to ASI and Merri Creek.

Figure 5-1 Craigieburn Road Upgrade Project area and surface water features



5.2 Potential Construction Impacts

The following sub-sections provide an overview of the potential environmental impacts on surface waters associated with construction activities for the Craigieburn Road Upgrade Project.

5.2.1 Water Quality

Water quality could potentially be impacted through increased pollutant loads discharging into waterways and drains directly from construction sites. This includes de-watering from sediment basins or uncontrolled run-off from the work areas. Increased sediment loads are predicted to be a key impact during construction due to the likely removal of existing vegetation and ground cover to facilitate construction and the design. During construction, there is the potential to reduce water quality and associated aquatic values in Aitken Creek and its sub-catchment from runoff of dirty or sediment laden water (e.g. progressive clearing and site rehabilitation and use of sediment controls such as silt fencing, coir logs, sand bags).

Leaks and / or spills associated with construction plant, equipment and on-site bulk storage of fuels and chemicals will be required to be managed by the construction contractor.

5.2.2 Flooding

As previously stated in Section 2.3 and illustrated in Figure 5-1 the Craigieburn Road Upgrade Project intersects an LSIO.

A hydrologic and hydraulic assessment has been undertaken, focusing on flood behaviour around Craigieburn Road between Aitken Boulevard and Cimberwood Drive. The flood behaviour around the Craigieburn Road Upgrade Project is complicated due to natural topography, several distinct overland flow paths, various hydraulic features (large pipes / culverts and open drains) and numerous local and arterial roads. There are several major drainage lines crossing or parallel with Craigieburn Road between Aitken Boulevard and Cimberwood Drive.

The local catchment is mainly urbanised covering approximately 2.4 km^2. It drains from north-west to south-east direction. The catchment is split by Craigieburn Road that runs in an East West direction. Flow in this catchment will drain to Aitken Creek either by underground drainage pipes or as overland flowpaths.

Construction activities (e.g. temporary works, vegetation clearing, laydown areas) have the potential to increase local flooding by altering inundation levels, flow velocities, duration of flooding and inundation of areas that currently do not experience flooding. Waterway function and capacity may be impacted where the natural watercourse or its characteristics, such as flow, are altered.

5.2.3 Primary Industries

Primary industries are industries that are involved with turning natural resources into products and include activities such as mining, agriculture and forestry. The extraction of water from waterways within the Yarra Catchment to support these activities is licenced by MWC.

The Craigieburn Road Upgrade Project intersects one waterway, Aitken Creek, which does not have a have primary industry ‘Take and Use’ licences associated with it. Merri Creek does have a number of ‘Take and Use’ licences associated it.

Table 5-2 shows the ‘Take and Use’ licences, registration licences and associated volumes in relation to Merri Creek recorded on the Victorian Water Register (DELWP, 2018).

Table 5-2 Primary industry 'Take and Use' licences

Licence #	Delivery System	Use	Method of taking	Annual Volume (ML)
TAKE AND USE LICENCE				
BEE019567	Merri Creek (Upper)	Domestic and stock	Direct extraction from surface water	2
BEE019558	Merri Creek (Middle)	Irrigation	Direct extraction from surface water	44
BEE019569	Merri Creek (Upper)	Irrigation	Extraction from a waterway to fill an off-waterway dam	6
BEE073521	Merri Creek (Upper)	Irrigation	Direct extraction from surface water	16

The precise location for each of the 'Take and Use' licences and registration licences, proximity to the Project Area was not determined during the Phase 1 assessment. There are several 'Take and Use' licences associated with nearby Merri Creek, risks and impacts on the quality of surface water in the area will be determined during detailed design so that appropriate mitigation measures are adopted.

5.2.4 Recreation, Aesthetics and Environmental Values

MWC provide amenity rankings in the Healthy Waterways Strategy for each of the systems within the Yarra River Catchment. Amenity includes access to recreation facilities and aesthetic values.

- Amenity is scored on the level of satisfaction and is currently ranked as high; but likely to decline in long-term if environmental values decline; the target is to improve to very high;
- Community connection is based on the level of satisfaction and is currently ranked as high but likely to decline in long-term if opportunities don't keep up with population growth; the target is to maintain as high;
- Recreation, which is based on the level of satisfaction and is currently ranked as high but likely to decline in long-term if supply doesn't keep up with population growth; the target is improve to very high;
- Aesthetics (Litter) is a strong indicator of stream health – clean waterways are healthy waterways and aesthetically pleasing and don't detract from the enjoyment of active and passive recreation. The current state is high and the target is very high;
- Water Quality (Recreational) is critical to minimise human health risks. Exposure to pathogens (disease causing microorganisms) via primary (e.g. swimming) and/or secondary (e.g. boating) can lead to illness. Water quality guidelines set water standards for primary and secondary contact. The current state is high and the target is high;
- Fish score is very low due to lack of suitable instream and riparian habitat, flows and barriers to migration. Current trajectory is driven by common and widespread species that appear to respond favourably to predicted climate change conditions. Significant improvements to riparian vegetation, stormwater and fish passage are predicted to increase score to high in long term and support wider range of species;
- Frogs score is moderate since not as many species of frog were recorded. With appropriate management score can be maintained as moderate. Significant species include Growling Grass Frog and Brown (Bibron's) Toadlet;

- Macroinvertebrates score is low due to poor riparian and instream habitat, and flows. Improvements to vegetation and protection of flows and water quality through stormwater management is predicted to increase score to moderate in long term; and
- Vegetation score is low. Land use impacts have highly modified and fragmented the vegetation. Score will decline to very low due to persistent and emerging threats such as stormwater, pest plant and animals and climate change. There are 27 known listed water dependent species. Improving the quality and extent of vegetation and managing key threats will increase score to moderate in long term.

There is a BCA associated with Merri Creek Reach 1 at Craigieburn (approximately 650 m east of the Project) which relates to a Growling Grass Frog Corridor. The Growling Grass Frog Masterplan identifies this area as a terrestrial habitat buffer to ASI and Merri Creek.

Table 5-1 includes additional information regarding the environmental setting for the Craigieburn Road Upgrade Project.

There is a risk that construction activities associated with the Craigieburn Road Upgrade Project have the potential to impact recreational, aesthetic and environmental values, however, it is anticipated impacts will be the result of land clearance, accidental leaks or spills of chemicals or fuels or through run-off of dirty or sediment laden water from the site.

Provided the construction activities are undertaken in accordance with the mitigation measures outlined in Section 5.3 and Section 5.5, and appropriate urban design principles are employed, impacts on recreation and aesthetic values should be able to be appropriately managed.

5.2.5 Drinking Water

Drinking Water in Hume City Council LGA is provided by Yarra Valley Water as the retail water authority that services most of the northern and eastern suburbs of Melbourne. The Craigieburn Road Upgrade Project is not in a Water Supply Protection Area and it is considered unlikely that drinking water will be sourced directly from any of the surface water bodies referenced in this report. Yarra Valley Water has not advised of any capital works in the Project Area at the time or preparing this report.

The Aitken Creek DS (Scheme No. 4480) shows a planned pipeline crossing Mickleham Road and running along the north side of Craigieburn Road. MWC has advised the pipeline under Mickleham Rd should be constructed as part of the road project.

5.2.6 Industrial Water

Surface water may be used in industrial and commercial operations including manufacturing, washing and cooling and will require a ‘Take and Use’ licence to be obtained from MWC if sourced from surface water bodies within the Yarra Catchment.

There are no industrial ‘Take and Use’ licences for Aitken Creek. Merri Creek is the closest water source which has ‘Take and Use’ licences associated with it.

Potential impacts on surface water users are considered low taking into consideration the proposed extent of works and impacts will be appropriately managed in accordance with Section 5.3 and Section 5.5.

5.3 Construction Mitigation Measures

Clause 42 of SEPP (Waters) 2018 requires construction works be managed appropriately to minimise:

- Land disturbance;
- Soil erosion; and
- Discharge of sediment and other pollutants to surface waters.

To achieve this, construction works will be consistent with the following EPA Publications:

- Construction Techniques for Sediment Pollution Control (1991); and
- Environmental Guidelines for Major Construction Sites (1996).

Mitigation of adverse impacts during the construction phase should ultimately be addressed though a Construction Environmental Management Plan (CEMP) which will be developed and implemented in accordance with construction best practice adhering to VicRoads procedures and guidelines. The CEMP will be project specific and include subplans specifically developed to manage impacts to water quality, for example, control measures could include water quality monitoring upstream and downstream form the Project Area or when dewatering ponded water to receiving waters, inspection of erosion and sediment controls, siting stockpiles at appropriate locations and at a sufficient distance from nearby waterways and drainage lines, development of emergency response and spill clean-up procures, incident reporting procedures, etc. The minimum requirements for surface water management (including specifications) are presented in the Outline Scope and Requirements document.

The Craigieburn Road Upgrade Project will have a requirement for the development and implementation of an erosion and sediment control plan that is consistent with the above guideline document.

5.4 Potential Operational Impacts

The following sub-sections provide an overview of the potential environmental impacts to surface water associated with the operational phase of the Craigieburn Road Upgrade Project.

5.4.1 Water Quality

Alterations to the characteristics of the catchment, for example, increasing the impervious area associated with the planned Craigieburn Road Upgrade Project will potentially contribute to increased pollutant loads entering local waterways, adversely impacting existing surface water quality. Potential pollutants may include sediment, nutrients and hydrocarbons.

With higher traffic numbers, there may also be increased potential for a contaminant spill to occur as a result of a crash. However, this could potentially be offset by improved road safety outcomes as a result of the upgrades.

5.4.2 Flooding

The Craigieburn Road Upgrade Project has the potential to impact existing flood behaviour in two ways:

1. Increasing the impervious area as part of the Craigieburn Road Upgrade Project runoff volumes, potentially resulting in higher flood levels and velocities.
2. Reducing the current floodplain area has the potential to reduce local flood water storage capacities altering flow regimes and increasing peak flows and / or floodwater volumes.

MWC Standards require infrastructure projects in flood prone areas to consider the effects of climate change, specifically sea level rise of 0.8 m by 2100 and an increase in rainfall intensity (derived from either ARR 2016 book or ARR Data Hub).

Figure 5-1 illustrates where the Craigieburn Road Upgrade Project intersects an LSIO.

5.4.3 Recreation, Aesthetics and Environmental Values

Upon completion of construction activities, the potential impacts on recreation, aesthetics and environmental values reduces due to the cessation of high impact activities and provision of landscaping and urban design that is designed to improve visual amenity and aesthetic values.

Potential impacts on environmental values including frog populations (identified in Section 5.2.4) is still present because of the potential for increased day to day pollutant loads and for spills to be discharged into receiving waters, however, incorporation of effective stormwater treatments that are compatible with the design will assist to minimise potential impacts.

5.4.4 Drinking Water

Drinking Water in Hume City Council LGA is provided by Yarra Valley Water as the retail water authority that services most of the northern and eastern suburbs of Melbourne. Surface water direct from the numerous local drains and downstream receiving waters are unlikely to be used for drinking water purposes. The Craigieburn Road Upgrade Project is not located within a Water Supply Protection Area (surface water).

5.4.5 Industrial Water

There is are no industrial and commercial 'Take and Use' licences associated with Aitken Creek. Merri Creek is the closest water source which has several 'Take and Use' licences associated with it. It is important that any construction and operational activities consider downstream water users including those related to primary and industries or commercial water users. Table 5-2 lists the potential number of stakeholders in relation to primary and industrial water use.

Potential impacts on surface water users are considered low taking into consideration the proposed extent of works and impacts will be appropriately managed in accordance with Section 5.3 and Section 5.3.

5.5 Operational Mitigation Measures

Impacts to local flooding and water quality can potentially occur during the operation, through activities that alter the land use and characteristics of a catchment. Typical consequences as a result of road upgrades that will potentially impact a catchment is an increase in impervious surface or constrictions to existing flow paths. These can result in changed flood levels, velocities, extents and routes, and cause flooding where there is currently none.

Adverse impacts during the operational phase (those identified in Sections 5.4) will be assessed and mitigated during design development. Assessment of flood levels and flow characteristics at the waterway crossing for existing and operational conditions will be undertaken through hydrologic and hydraulic modelling of the crossing. Comparison of modelled results will assist in:

- Identifying changes to the flow regime and potential impacts on neighbouring properties following completion of the works; and
- Developing engineering solutions to minimise the departures from existing flow conditions.

The potential pollutant impact from road surface run-off entering the waterways will be assessed further during detailed design and mitigated through introducing effective water sensitive road design measures. Water sensitive road design will utilise Model for Urban Stormwater Improvement Conceptualisation (MUSIC) or another suitable methodology and take into account MWC's prescribed conditions and VicRoads standards.

The requirement for spill management and containment controls (e.g. spill basins) will be required to be assessed and determined during detailed design so that fuel or chemical spills as a result of road traffic incidents involving bulk transport vehicles will be suitably managed.

MWC and Hume City Council will be required to be consulted following selection of the final design solution to determine whether there are any future works planned in the vicinity of the Craigieburn Road Upgrade Project that may potentially impact surface waters. Future works often take the form of Drainage Schemes (also known as Development Services Schemes) which are master plans for drainage in specific catchments and are developed and managed by MWC.

The organisation responsible for maintenance of the Craigieburn Road will be required to implement procedures to manage the process for responding to vehicle incidents in an appropriate and effective manner to minimise impacts from potential leaks and spills from vehicles and / or vehicle loads.

6 CONCLUSION

Based on the proposed extent of works and information provided during for the Phase 1 – Preliminary Surface water Assessment, the general impacts posed to surface water users and environmental values is considered to be low.

During construction, water quality may be impacted through increased pollutant loads discharging into waterways and waterbodies directly from construction sites.

Vegetation clearing has the potential to alter localised overland flow and increase sediment laden run-off into Aitken Creek and associated wetlands / settlement pond.

There is a BCA associated with Merri Creek Reach 1 and Craigieburn which relates to Growling Grass Frog Corridor. There is also a terrestrial habitat buffer to Area of Strategic Importance at Craigieburn Road East (Hume Highway to Hume Freeway). These habitat areas and Merri Creek do not intersect the Craigieburn Road Upgrade Project. However, there is the potential for run-off during construction (and the operational phase) that could flow into these habitat areas and Merri Creek via associated drainage lines.

The most significant impacts on surface water values occur during construction when activities with the greatest impact (i.e. clearing and earthworks) occur. Mitigation measures for the construction phase will be required to be set out in the CEMP, which will be developed and implemented in accordance with construction best practice adhering to VicRoads procedures and guidelines. The placement of temporary works, stockpiles, equipment and plant can result in a reduction in flood conveyance or floodplain storage, potentially leading to increases to flood levels, flow velocities and flood frequency.

During operation, there may be an increased pollutant load entering waterways and waterbodies and an increased localised flooding due to a larger impervious area and subsequent run-off associated with the Craigieburn Road Upgrade Project. Increased run-off volumes / rates may impact Aitken Creek and other nearby waterbodies and identified sensitive receptors (i.e. Merri Creek and Growling Grass Frog habitat areas). There is an additional potential impact on one of the 20-year strategic priorities outlined in the Healthy Waterways Strategy (Lower Yarra System – Merri Creek sub-catchments) due to run-off from the site, specifically the goal to maintain species richness and improve overall abundance and distribution of expected species of frog populations. Operational mitigation measures will be required to be developed alongside the Phase 2 – Detailed Surface Water Assessment, which will include hydrologic and hydraulic modelling of the Aitken Creek. Measures will include the introduction of effective water sensitive road design (WRSD) measures and all key stakeholders (i.e. MWC, Hume City Council) will be required to be consulted and engaged following the selection of a final design solution to determine if there are any other works planned which could also impact surface water in the vicinity of the Craigieburn Road Upgrade Project.

It is recommended that the extents and magnitude of potential surface water impacts are further investigated through detailed hydrologic, hydraulic and water quality modelling so that effective mitigation measures can be incorporated as part of the design where required. WSRD measures, based on MWC advice, should be introduced at detailed design stage to ensure that the SEPP (Waters) 2018 are met.

Comprehensive assessment of the significance of long term impacts (i.e. during operation) will be required to be undertaken during detailed design. The Phase 2 – Detailed Surface Water Assessment will include:

- Collation of water quality data to confirm whether existing waterway quality is within SEPP (Waters) 2018 objectives;
- Detailed hydrologic and hydraulic modelling of waterway crossings for existing and proposed conditions;
- Water sensitive road design utilising MUSIC or another suitable methodology taking into account MWC prescribed conditions and VicRoads standards; and

- Assessment of spill management and containment controls (e.g. spill basins) to manage fuel or chemical spills as a result of road traffic incidents involving bulk transport vehicles.

A CEMP will be required to be developed and implemented to manage and control construction activities to minimise water quality impacts as far as is reasonable practicable.

Ongoing consultation with MWC and Hume City Council will be required to confirm any additional environmental assessments required in the Aitken Creek and Merri Creek area to assess impacts associated with the Craigieburn Road Upgrade Project, e.g. ecological risk assessment, targeted ecological surveys.

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