7.0 Environmental assessment

7.5 Surface water and groundwater

The section provides an assessment of potential surface water and groundwater impacts that could be generated during construction and operation of by the proposed modification. Where potential impacts are identified appropriate mitigation measures to avoid and minimise these impacts have been recommended.

7.5.1 Introduction

Table 7-40 sets out the SEARs relevant to surface water and groundwater and identifies where the requirements have been addressed in this section.

Table 7-40 SEARs – Surface water and groundwater

Desired Performance Outcome	SEAR	Where addressed within the Modification Report
7. Water – Quality and Hydrology The project is designed, constructed and operated to protect the NSW Water Quality Objectives over time where they are currently being achieved, including downstream of the project to the extent of the project impact including estuarine and marine waters (if applicable). Assess the impacts of the development on hydrology and waterway health and develop measures to avoid and mitigate these impacts.	1. The Proponent must assess water quality impacts, including:	
	a. stating the ambient NSW Water Quality Objectives (NSW WQO) and environmental values for the receiving waters relevant to the project, including the indicators and associated trigger values or criteria for the identified environmental values in accordance with the Australian & New Zealand Guidelines for Fresh & Marine Water Quality and or local objectives, criteria or targets endorsed by the NSW government;	Refer to **Section 7.5.2** for details regarding the NSW WQOs
	b. identifying and estimating the quality and quantity of pollutants that may be introduced into the water cycle by source and discharge point and describe the nature and degree of impact that any discharge(s) may have on the receiving environment, including consideration of all pollutants that pose a risk of non-trivial harm to human health and the environment;	Pollutants that may be introduced are identified and discussed in **Section 7.5.5**

Desired Performance Outcome	SEAR	Where addressed within the Modification Report
	c. identifying the rainfall event that the water quality protection measures will be designed to cope with;	Identifying and estimating the quality and quantity of pollutants that may be introduced is detailed in **Section 7.5.5** and guidelines for acceptable levels for the environment are detailed in **Section 7.5.2**. Potential risks to human health and the environment are summarised in **Section 7.5.5**
	d. the significance of any identified impacts including consideration of the relevant ambient water quality outcomes;	**Section 7.5.5**
	e. demonstrating how construction and operation of the project will, to the extent that the project can influence, ensure that: - where the NSW WQOs for receiving waters are currently being met, they will continue to be protected; and - where the NSW WQOs are not currently being met, activities will work toward their achievement over time;	**Section 7.5.5** provides the assessment of impacts during construction and operation against the NSW WQOs. Further measures to meet or improve the NSW WQOs are incorporated into detailed design, as per **Section 7.5.6**
	f. justifying, if required, why the WQOs cannot be maintained or achieved over time;	**Section 7.5.4** discusses the existing water quality, which does not currently meet the NSW WQOs based on the ANZG 2018 and ANZECC 2000 guidelines. **Section 7.5.6** addresses how the WQOs would be improved over time.
	g. demonstrating that all practical measures to avoid or minimise water pollution and protect human health and the environment from harm are investigated and implemented;	**Section 7.5.4** discusses the capacity of the existing stormwater quality controls to minimise water pollution and protect human health and the environment. Further mitigation measures are proposed in **Section 7.5.6** to further minimise identified impacts.

Desired Performance Outcome	SEAR	Where addressed within the Modification Report
	h. identifying sensitive receiving environments (which may include estuarine and marine waters downstream) and develop a strategy to avoid or minimise impacts on these environments; and	**Section 7.5.4** identifies sensitive receiving environments, while **Section 7.5.6** details measures to avoid impacts to them. Further details are found in Section 5.3 of **Appendix G** (Surface water and flooding assessment).
	i. identifying proposed monitoring locations, monitoring frequency and indicators of surface and groundwater quality.	**Section 7.5.6** details a monitoring plan to be implemented.
	2. An assessment of the impact of the development on hydrology, including:	
	a. detailed and consolidated site water balance, including quantity, quality and source;	Section 4.1.6 and Section 6.1.5 of **Appendix G** (Surface water and flooding assessment) describe the methodology to assess the impact of the proposed modification on the quantity and quality of surface water runoff and the water demand and likely sources during the construction of the proposed modification.
	b. effects to downstream rivers, wetlands, estuaries, marine waters and floodplain areas;	**Section 7.5.5** contains a discussion of the potential effects to surface water quantity and geomorphology including the effects to downstream receiving waterways. **Appendix H** (Biodiversity Development Assessment Report) contains an assessment of the impact of the proposed modification to downstream rivers, wetlands, estuaries, marine waters and floodplain areas.
	c. effects to downstream water-dependent fauna and flora including groundwater dependent ecosystems;	**Appendix H** (Biodiversity Development Assessment Report) contains an assessment of the impact of the proposed modification to aquatic ecosystems, including groundwater dependent ecosystems

Desired Performance Outcome	SEAR	Where addressed within the Modification Report
	d. impacts to natural process and functions within rivers, wetlands, estuaries and floodplains that affect river system and landscape health such as nutrient flow, aquatic connectivity and access to habitat for spawning and refuge (e.g. river benches);	**Section 7.5.5** presents the findings of the impact assessment from the proposed modification on the natural process and functions within receiving waterways downstream of the Westlink M7 corridor. **Appendix H** (Biodiversity Development Assessment Report) contains an assessment of impact to natural processes and functions within downstream rivers, wetlands, estuaries, marine waters and floodplain areas in terms of nutrient flow, aquatic connectivity and access to habitat for spawning and refuge.
	e. changes to environmental water availability;	**Section 6.1.4** and **Section 7.1.4** of **Appendix G** (Surface water and flooding assessment) includes an assessment of the proposed modification on environmental water availability.
	f. mitigation measures for the management of stormwater and wastewater during both construction and operation (including volumes, flow rates, management methods and re-use options); and	**Section 7.5.6** details the construction and operational related impacts of the proposed modification on stormwater runoff. Management of wastewater is dealt with **Section 7.16** (Waste).
	g. proposed surface and groundwater monitoring activities and methodologies.	**Section 7.5.2** describes the surface water monitoring that has been undertaken to support the surface water assessment. **Section 9** of **Appendix G** (Surface water and flooding assessment) outlines the proposed monitoring of surface water quality that would be undertaken prior to, throughout and following the construction of the proposed modification.

7.5.2 Assessment methodology

Legislation and policy context - Surface water

The surface water assessment methodology was prepared in accordance with the following legislation, regulations and policies, where relevant:

- *Water Management Act 2000* (NSW) (WM Act)
- *Fisheries Management Act 1994* (NSW) (FM Act)
- *Protection of the Environment Operations Act 1997* (NSW) (POEO Act)
- *Protection of the Environment Operations (Waste) Regulation 2014* (NSW)
- *State Environmental Planning Policy (Biodiversity and conservation) 2021* (NSW)
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC Water Quality Guidelines) (Australian and New Zealand and Conservation Council, 2000)
- NSW Water Quality Objectives (NSW WQOs) (DECCW, 2006) and the *Healthy Rivers Commission Inquir*y (NSW Government 1995) (HRC WQOs)
- *Managing Urban Stormwater: Soils and Construction Volume 1* (DPIE, 2004) and *Volume 2* (A. Installation of Services; B. Waste Landfills; C. Unsealed Roads; D. Main Roads; E. Mines and Quarries) (DECC, 2008a) (the 'Blue Book')
- Liverpool City, Fairfield City and Blacktown City Council guidelines and policies including *Managing Urban Stormwater – Council Handbook* (Environmental Protection Authority (EPA), 1997) and *Georges River Estuary Coastal Zone Management Plan* (Georges River Combined Councils Committee (GRCCC), 2013)
- *NSW Sustainable Design Guidelines Version 4.0* (Transport for NSW, 2017)
- *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW* (DECC, 2008b).

Legislation and policy context - Groundwater

The groundwater assessment methodology was prepared in accordance with the following legislation, regulations, and policies, where relevant:

- *Water Management Act 2000* (NSW) (WM Act) and the *Water Management (General) Regulation 2011*
- *NSW Aquifer Interference Policy* (Department of Primary Industries (DPI), 2012)
- *NSW Groundwater Dependent Ecosystems Policy* (Department of Land and Water Conservation, 2002a).

Input from **Appendix H** (Biodiversity development assessment report) was also used in regard to assessment of groundwater dependent ecosystems (GDEs).

Method of Assessment

The surface water and groundwater assessments involved a review of the design and scope of the proposed modification to identify the likely surface water and groundwater impacts that would arise from construction and operation.

Surface water

The scope of the surface water assessment has included the following:

1. A desktop review and analysis of existing surface water information including catchment studies and plans of management, water quality data, as well as catchment and land use history
2. Definition of a surface water assessment study area, shown in Figure 7-35
3. Completion of 10 months and ongoing field survey and water quality monitoring to supplement the available sampling data and provide a general understanding of the drainage-related features along the Westlink M7 within the construction footprint

4. Identification of sensitive receiving environments and environmental values that are relevant to the surface water assessment
5. Establishment of Water Quality Objectives (WQOs) and criteria relevant to the receiving waters
6. Assessment of the potential impacts to surface water values during construction and operation of the proposed modification with reference to the relevant Water Quality Objectives. This assessment has included the use of Model for Urban Stormwater Improvement Conceptualisation (MUSIC) software to assess operational impacts
7. Identification of appropriate measures to avoid, minimise and mitigate the potential impacts of the proposed modification on surface water conditions during its construction and operation.

NSW Water Quality Objectives

WQOs and criteria were based on the NSW WQOs and the Healthy Rivers Commission (HRC) WQOs which classify the study area as "predominantly urban" or "affected by urban development". Based on this classification and the environmental values applicable to the study area, the water quality objectives relevant to the proposed modification are presented in Table 7-41. Further details on other water quality objectives including visual amenity and contact recreation are included in **Appendix G** (Surface water and flooding assessment).

Table 7-41 Select water quality objectives relevant to the proposed modification

Environmental value	Indicator	Guideline value
Aquatic ecosystems(1) Maintaining or improving the ecological condition of waterbodies and their riparian zones over the long term	Total phosphorus (TP)	0.025 mg/L
	Total nitrogen (TN)	0.350 mg/L
	Turbidity(5)	6-50 Nephelometric Turbidity Unit (NTU)(2)
	Total suspended solids (TSS)(3)	< 50 mg/L
	Salinity (electrical conductivity)	200-300 µS/cm
	Dissolved oxygen	85-110 per cent saturation
	pH(5)	6.5-8.5
	Chemical contaminants or toxicants that include(4): • Copper • Nickel • Lead • Zinc	Based on Table 3.4.1 of the ANZECC Water Quality Guidelines: • 0.0014 mg/L • 0.011 mg/L • 0.0034 mg/L • 0.008 mg/L

[1]Based on default guideline values for lowland rivers and protection of aquatic ecosystems for slightly to moderately disturbed ecosystems as set out in the ANZG and ANZECC Water Quality Guidelines

[2]In accordance with Table 3.3.3 of the ANZECC Water Quality Guidelines, a value at the low end of the range would apply to waterways flowing through well vegetated catchments at during low flows while a values at the high end of the range would apply to waterways draining slightly disturbed catchments and other waterways at high flows. The values at the high end are considered to be applicable to the proposed modification given the disturbed nature of the catchments within which it is located.1

[3]Table 3.3.3. of the ANZECC Water Quality Guidelines advises that the trigger levels for TSS would be similar to those reported for turbidity. By limiting TSS to less than 50 milligrams per litre the project would generally meet the recommended trigger value for protection of aquatic ecosystems.

[4] Default guideline values for slightly to moderately disturbed ecosystems and 95% level of species protection have been adopted except for cases where there is potential bioaccumulation (such as mercury) in which the 99% level of species protection has been applied.

[5] Turbidity and pH in ambient waters are likely to vary outside the criteria above. Treatment at the point of use is likely to be necessary to achieve criteria above. It is advisable to maintain pH within this range to protect plumbing and fittings from corrosion and scale.

Surface water quality monitoring

Monthly surface water quality monitoring was conducted during the site visits from September 2021 to June 2022, and is ongoing. Ten locations within the study area were sampled over 10 months to assess the existing water quality in the watercourses that would receive runoff from the proposed modification (refer to Figure 7-35). Of these 10, four were located in the Cabramatta Creek catchment, one in the Ropes Creek catchment, and five in the Eastern Creek catchment.

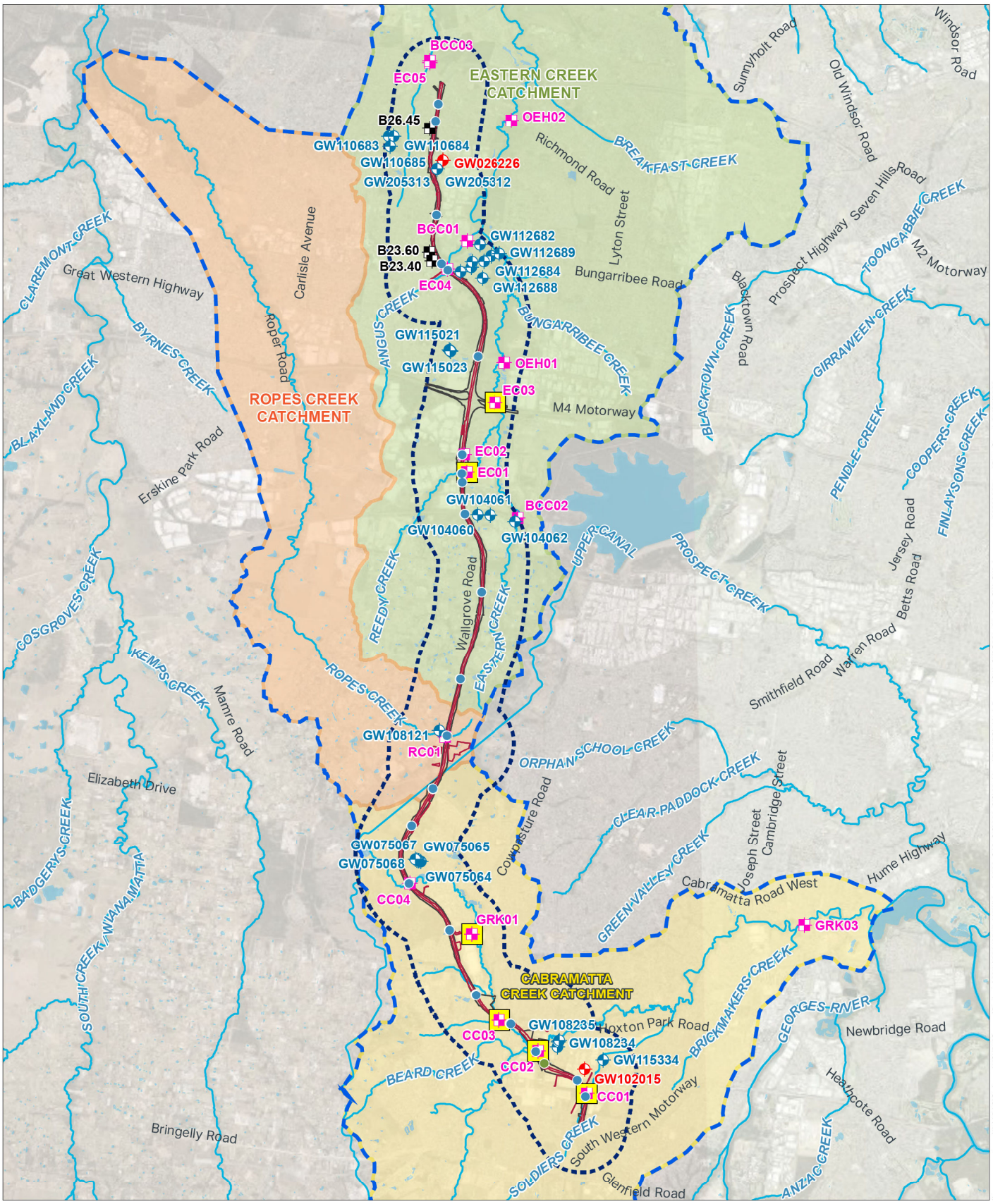

FIGURE 7-35: WESTLINK M7 CATCHMENT PLAN, WATER QUALITY SAMPLING LOCATIONS AND SURFACE WATER AND GROUNDWATER ASSESSMENT STUDY AREA

N 0 1 2 km

AECOM

Legend

- Construction footprint
- Operational footprint (maintenance boundary)
- Groundwater assessment study area
- Surface water assessment study area
- Waterbody
- Watercourse

Proposed bridge widening

- Northbound
- Southbound

Groundwater

- Groundwater bore
- Groundwater bore used for extractive purposes

Surface water

- Water quality sample
- Sensitivity receiving environment
- Stormwater control basin

Groundwater

The scope of the groundwater assessment has included the following:

1. A desktop review and analysis of existing groundwater information including hydrogeology, groundwater quality data, as well as a search for nearby sensitive receptors including existing groundwater users and GDEs
2. Definition of a groundwater assessment study area, described in **Section 7.5.3**
3. Assessment of the potential impacts on groundwater during construction and operation of the proposed modification, including impacts to groundwater recharge/discharge mechanisms, groundwater levels, groundwater quality, surface water - groundwater interactions, and nearby sensitive receptors
4. Identification of appropriate measures to avoid, minimise, and mitigate the potential impacts of the proposed modification on groundwater conditions during its construction and operation.

7.5.3 Study area

The study area for the surface water assessment encompassed the extent of Cabramatta Creek, Ropes Creek, and the Eastern Creek catchments and is shown in Figure 7-35.

The study area for the groundwater assessment is defined by a one kilometre buffer around the construction footprint, and is shown in Figure 7-36.

7.5.4 Existing environment

Surface water

Water catchments

The study area is located within the following water catchments and traversed by the following tributaries:

- Georges River catchment which includes Cabramatta Creek catchment and:
  - Maxwells Creek (second order stream)
  - Cabramatta Creek (fourth order stream)
  - Hinchinbrook Creek (third order stream)
- Hawkesbury-Nepean catchment which includes:
  - Ropes Creek catchment including Ropes Creek (first order stream)
  - Eastern Creek catchment including:
    - Eastern Creek (major tributary of South Creek)
    - Reedy Creek (second order stream)
    - Angus Creek (first order stream)
    - Breakfast Creek (first order stream).

Land uses surrounding the Cabramatta Creek catchment, Ropes Creek Catchment and Eastern Creek Catchment are mainly comprised of medium density residential, industrial and commercial development and therefore adjacent waterways are subject to urban pollution.

Cabramatta Creek is a major tributary of the Georges River. The catchment drains toward Cabramatta Creek upstream of its confluence with the Georges River, Hinchinbrook Creek, Maxwells Creek and Brickmakers Creek. Tributaries of the Cabramatta Creek catchment intersect the study area in both natural and modified forms including a flood mitigation channel and regional detention basins.

Ropes Creek is a major tributary of South Creek, which itself is a tributary of the Hawkesbury Nepean River. The catchment drains towards the north-west.

Eastern Creek is a major tributary of South Creek and its main tributaries comprise Reedy Creek, Eskdale Creek, Angus Creek, Bells Creek and Breakfast Creek. Reedy Creek traverses the Westlink M7 in a largely natural state. Eskdale Creek and Angus Creek traverse the Westlink M7 in significantly modified states. Figure 7-35 shows the extent of the study area and the three catchments and their main tributaries.

Climate and soils

An analysis of climate and soils including a discussion of rainfall, soil landscapes and erosion potential, acid sulfate soils and salinity was undertaken as part of the surface water assessment.

Data captured by the Bureau of Meteorology at the nearby Prospect weather station indicated a rainfall range of 46.2-100.6 mm of rain per month, with a range of 5.6-8.5 days of rain per month during the recorded year.

The 'Soil Landscapes mapping for the Penrith 1:100:000' sheet (Bannerman and Hazelton, 1990) revealed that the proposed modification would be located predominantly within Type D soils. These are defined in 'the Blue Book' as containing fine (less than 0.005 mm) dispersible materials that will not settle without adding chemicals to sediment-laden runoff to facilitate bonding of particles (Landcom, 2004). South Creek soils were identified in a number of creeks as being actively and frequently re-worked by river processes (fluvial soils). The following soil landscapes within the proposed modification footprint are defined in the Blue Book as Type D soils: Picton (colluvial) (COpn), Luddenham (erosional) (ERlu), South Creek (fluvial) (FLsc) and Blacktown (residual) (REbt). One soil landscape, Berkshire Park (alluvial) (ALbp), is defined in the Blue Book as a Type F soil, which contains a significant portion of fine-grained soils that require a longer residence time to settle in a sediment retention basin. High salinity potential, which affects vegetation growth and can increase the vulnerability of soils to erosion were identified at Maxwells Creek, Cabramatta Creek, Hinchinbrook Creek, Reedy Creek and Eskdale Creek where they traverse the Westlink M7. In addition to the soil landscapes listed above there is a relatively localised section of the Westlink M7 to the south of Jedda Road that is identified as disturbed terrain (DTxx). Disturbed terrain is described as an area disturbed by human activity to a depth of at least 100 centimetres below ground level. Most of these areas have been levelled to slopes of less than 5 per cent, and the original vegetation has been completely cleared. The original soils have been removed, greatly disturbed or buried. Landfill included soil, rock, building and waste material (including asbestos).

The Westlink M7 median was constructed as part of the motorway and was subject to cut and fill activities, including potentially imported spoil material (refer to **Appendix L** (Contamination assessment report) for further information.

Erosion potential would increase in proximity to Type D soils (the dominant soil landscape) and South Creek (fluvial soils). Erosion potential would increase again in proximity to Type F soils. The presence of high salinity areas also increases the risk of erosion during construction. As such, the potential for erosion within the construction footprint of the proposed modification is predicted to be generally moderate to high, with higher potential for erosion closer to watercourses and creeks.

Existing drainage infrastructure

Runoff from the section of the Westlink M7 to the north of Elizabeth Drive is controlled by a series of on-site detention basins that are typically provided in combination with water quality basins. Within the Cabramatta Creek catchment (including to the south of Elizabeth Drive), the impact of the motorway on stormwater quantity is addressed by three regional detention basins. These existing basins were designed with additional capacity to cater for a potential increase in runoff from additional paved areas due to future widening of the Westlink M7. The existing stormwater controls are described in Table 7-42.

The design documentation for the Westlink M7 shows that existing on-site and regional detention basins were designed to contain and to mitigate impacts on the natural hydrology of the catchment for all storms up to a 1 per cent Annual Exceedance Probability (AEP) design storm, a flood which has a one in a hundred chance of being exceeded in any year.

The water quality basins reflect a "constructed wetland" that filter suspended sediments and associated contaminants out of the stormwater which are taken up by physical, chemical and biological processes in the wetland. The basins treat the 'first flush' volume based on the initial 13 mm of rainfall and have

temporary storage for sediment. There are both low-flow outlets which slowly release captured runoff over a 24-48 hour period and high flow pits which control the release of elements that have a lower density than water (such as gasoline) through use of a baffle arrangement. Combined water quality and on-site detention basins function with the high-flow pit to limit the rate of discharge from the on-site detention part of the basin.

Table 7-42 Summary of stormwater controls along the Westlink M7

Control Type	Number
Water quality basins	56
On-site detention basins	4
Spill containment basins	4
Combined water quality and on-site detention basins	37
Pollutant control devices	5
Total[1]	**106**

[1]Basin summary does not include regional or compensatory detention basins along the Westlink M7 corridor

Existing surface water quality

The quality of water in the watercourses that receive runoff from study area is heavily impacted due the urban and industrial surrounding land uses and historical processes of urbanisation. Processes such as historical land clearing, agricultural practices and the transition from rural to urban land uses have increased sediment loads and nutrients in waterways.

Water monitoring data was obtained through sampling as well as using monitoring data that has been carried out by the Georges Riverkeeper, Blacktown City Council and the NSW Office of Environment and Heritage. **Appendix G** (Surface water and flooding assessment) presents the water quality data recorded from each of the receiving watercourses located downstream of the Westlink M7. The locations of the water monitoring sampling locations are shown on Figure 7-35.

The following observations about the existing surface water quality were made against the WQOs outlined in **Section 7.5.2.** These were based on sampling undertaken as part of the proposed modification, as well as from longer term monitoring data that has been carried out by the aforementioned authorities:

- The concentrations of TP and TN exceed the recommended limits in the WQOs at all locations
- The level of turbidity and concentrations of TSS are within the range recommended in the WQOs except at:
  - Lower Maxwells Creek (refer water quality- sampling location CC01 on Figure 7-35)
  - Upper Hinchinbrook Creek (refer water quality sampling location CC04 on Figure 7-35)
  - Upper Ropes Creek (refer water quality sampling location RC01 on Figure 7-35)
- Levels of dissolved oxygen are below the levels recommended in the WQOs at all locations
- Data on concentrations of heavy metals in the Cabramatta Creek catchment that have been collected by the Georges Riverkeeper at three locations downstream of the Westlink M7, which showed levels of:
  - Lead and nickel are below the limits set out in the WQOs at all three locations
  - Zinc above the limits set out in the WQOs at all three locations
  - Copper is below the limits in the WQOs at GRK01 and GRK03 and above the limit in the WQOs at GRK02 (see Figure 7-35).

Groundwater

Hydrogeology

Porous, extensive aquifers of low to moderate productivity are mapped within the study area and surrounds. Groundwater is expected to be present in aquifers:

- Unconfined to semi-confined alluvial aquifers associated with quaternary alluvium (water table)
- Likely within the Bringelly Shale, a semi-confined aquifer
- A confined aquifer within the Hawkesbury Sandstone which underlays the Bringelly Shale.

Groundwater monitoring along the Westlink M7 during the operational phase of the approved project indicates groundwater levels ranged between 0.6 and 24.5 metres below ground level (mbgl) (WestLink Services, 2020).

Existing groundwater quality

As part of the approved project (Westlink M7), groundwater monitoring was undertaken at 23 locations prior to and during the construction of the approved project, and two years after commencement of operation (WestLink Services, 2020). Operational data trends were found to be consistent during and after construction of the approved project for depth to water, pH, acid sulfate soils (Department of Land and Water Conservation, 2000) and salinity (medium to high) (NSW DIPNR, 2002).

The probability of occurrence of acid sulphate soils is extremely low (one to five per cent) across the study area, however a small, localised area of high probability of occurrence of acid sulphate soils (greater than 70 per cent) has been identified. Acid sulphate soils and related risks and mitigation measures are further explored in **Section 7.11** (Soils and contamination) of this modification report.

The majority of the proposed modification alignment is dominated by brackish groundwater (water whose salinity is between that of fresh and marine water, often transitional areas where such waters mix), apart from low salinity groundwater conditions at Baulkham Hills and high salinity at Quakers Hill and Eastern Creek.

As summarised in **Section 4.19** of **Appendix L** (Contamination assessment report), there are potential areas of contamination within 100 metres of the proposed modification (within the groundwater assessment study area). Groundwater within these areas may contain contaminants of potential concern (COPC) including heavy metals, petroleum hydrocarbons, polychlorinated biphenyl (PCB), solvents, per- and poly-fluoroalkyl substances (PFAS), pesticides and herbicides.

Groundwater users

A total of two registered groundwater bores used for extraction purposes are located within one kilometre of the construction footprint (within the groundwater assessment study area), as summarised in Table 7-43. Further information is on groundwater bores is available in Annex B of **Appendix L** (Contamination assessment report).

Table 7-43 Registered groundwater bores used for extraction purposes within 1 kilometre of the study area

Bore identification	Purpose	Bore depth (metres)	Approximate distance and direction from the proposed modification	Location	Comments
GW102015	Dewatering	9.0	About 345 metres north east	Concrete plant property at 84 Jedda Road, Hoxton Park	No extraction of groundwater. Sealed off from aquifer.
GW026226	Domestic general use	8.5	About 400 metres east	Industrial park on Cox Place, Glendenning	-

Groundwater dependent ecosystems

High potential and moderate potential terrestrial groundwater dependant ecosystems (GDEs) are mapped from the Bureau of Meteorology's GDE Atlas (BoM, 2021) in numerous areas adjacent and within the study area. There are no mapped aquatic groundwater dependent ecosystems within the groundwater assessment study area. GDEs located within the vicinity of the proposed modification are shown in Figure 7-36.

Runoff and wastewater and potential contaminants from the Westlink M7 are retained within the approved project's existing sedimentation ponds, mitigating the risk of contamination to groundwater, surface water and creeks.

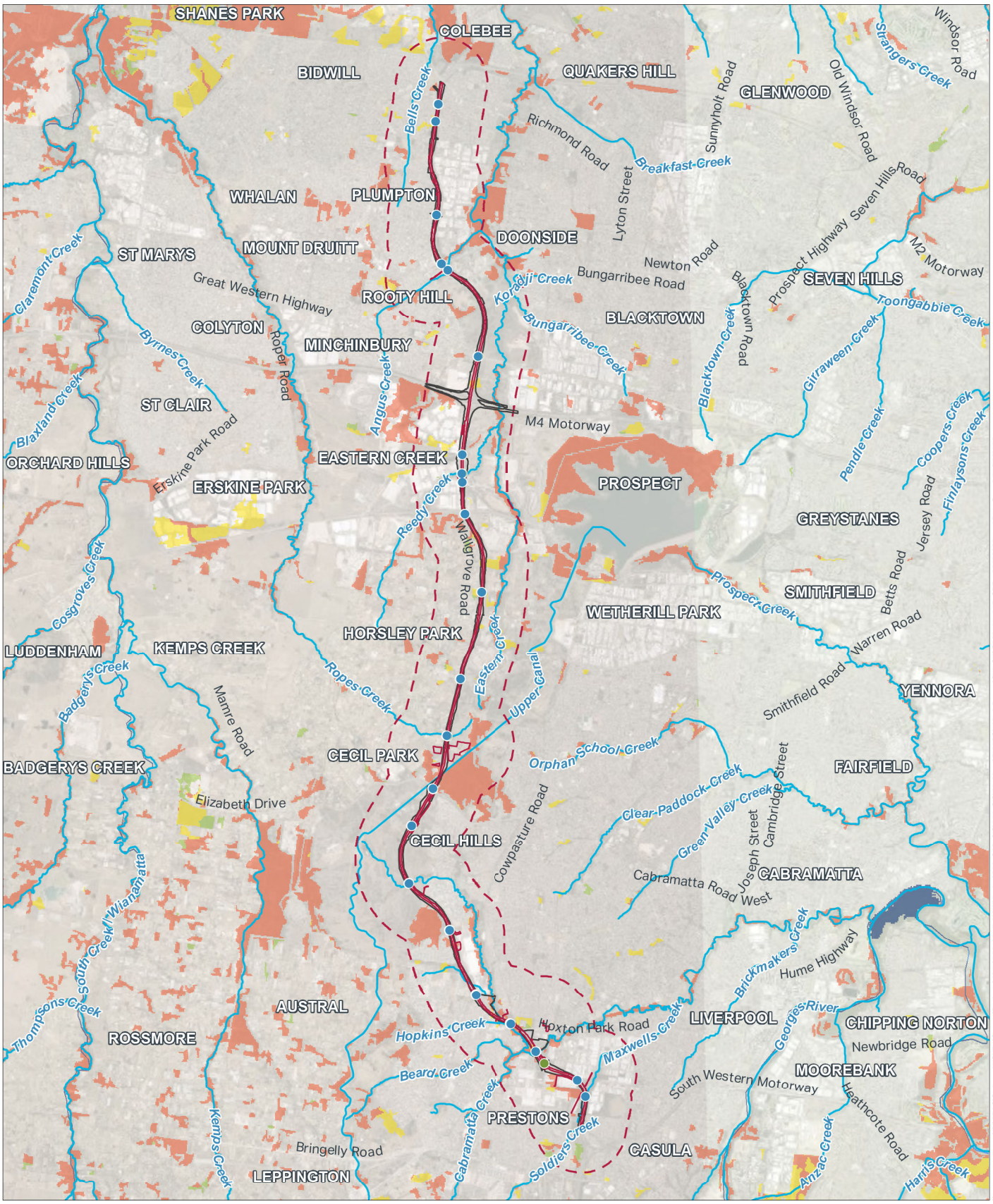

FIGURE 7-36: LOCATION OF MAPPED GROUNDWATER DEPENDENT ECOSYSTEMS

Legend

- Construction footprint
- Groundwater assessment study area
- Operational footprint (maintenance boundary)
- Watercourse

Proposed bridge widening

- Northbound
- Southbound

Terrestrial GDE

- High potential
- Moderate potential
- Low potential

Aquatic GDE

- High potential

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7.5.5 Impact assessment

Construction

Surface water quality

The primary potential for impacts on surface water during construction is through erosion and mobilisation of sediments and associated nutrients, heavy metals and toxicants into waterways.

The following construction activities were identified as having potential to increase erosion and result in the mobilisation of sediments, nutrients, heavy metals and toxins:

- Clearing of vegetation and topsoil to construct road pavement, piers and associated re-shaping of waterways and embankments associated with bridge works, adjustments to the stormwater drainage system and utilities, and temporary construction ancillary facilities
- Earthworks associated with the construction of additional areas of road pavement, the re-shaping of waterways and embankments to accommodate the bridge works, and trenching for new or realigned stormwater drainage and utilities
- The temporary stockpiling of excavated spoil prior to its reuse on site (or removal offsite), or of imported material for the construction of the additional areas of road pavement
- Inadequate revegetation of disturbed areas following construction, which can be exacerbated by the presence of saline soils.

Other potential impacts to surface water quality during the construction of the proposed modification would include:

- The release of petroleum hydrocarbons, oil and grease, machinery containing heavy metals or chemicals into waterways as a result of accidental spills or leaks from plant and machinery
- Contaminants in wash down water from plant and concrete slurries.

Erosion

An assessment of the erosion potential from areas that would be disturbed during construction was undertaken using the Revised Universal Soil Loss Equation (RUSLE) method in the Blue Book. The RUSLE method considers rainfall erosivity based on average rainfall recurrence, soil erodibility, slope length and gradient, type of ground surface material, vegetated ground cover, and total calculated soil loss from the proposed modification. Based on the assessment, the estimated soil loss from the proposed modification correlates to 'Soil Loss Class 2' and a 'Low Erosion Hazard' as per the classifications set out in Table 4.2 of the Blue Book (DPIE, 2004). It is estimated that the average annual soil loss would not exceed the threshold value and therefore would not trigger the need for a sediment retention basin. The implementation of effective local erosion and sediment control measures would be key to controlling sediment movements in the absence of any large-scale sediment retention basins. These include measures such as geotextile filers, installing local sediment controls upstream of stormwater inlet pits, and sandbags to create local check dams. These measures are summarised in **Section 7.5.6**. Subject to the outcomes of the further water quality assessment during detailed design, enhanced erosion and sediment control measures may be required to meet additional site-specific discharge criteria that may be identified. These enhanced erosion and sediment control measures will need to be incorporated into the Soil and Water Management Plan (SWMP). The proposed modification would also trigger the need for a Road Construction Environment Protection Licence from the NSW EPA that would regulate site construction activities to ensure that site discharges/erosion would be managed in accordance with current standards.

Construction discharges against water quality objectives

Erosion and sediment control measures would be implemented and maintained during the construction of the proposed modification so that the WQOs are achieved or improved where they are not being currently met. As mentioned above, construction works including construction discharges would be regulated by the EPA under an Environment Protection Licence with discharge limits informed by the discharge impact assessment. The Blue Book (DPIE, 2004) requires that treated runoff discharging from a construction site contain TSS concentrations of no greater than 50 mg/L and have a pH of between 6.5 and 8.5. Initial modelling shows the TSS concentrations pre-proposed modification and

post-proposed modification at 6.0mg/L, and current pH levels between 6.9 and 7.7. Further detail on these initial assessments are provided in **Section 7.1.3** and **Section 5.6** of **Appendix G** (Surface water and flooding assessment) respectively.

To factor in a full 12 months of surface water monitoring data, an updated water quality assessment will be undertaken during detailed design to inform site-specific construction discharge criteria. These enhanced erosion and sediment control measures will be incorporated in the Soil and Water Management Plan (SWMP).

The SWMP will include consideration of measures such as staging construction works to ensure clean water diversion drains integrated with runoff, staging construction of drainage infrastructure, using surface treatments to control sediment into surrounding roads, locating stockpiled material away from drainage paths, scour protection, monitoring of rainfall forecasts, routine inspection and maintenance and progressive site rehabilitation once operational. In addition, a dewatering management plan would be prepared that sets out the procedures for the discharge of surface water runoff. These measures are summarised in **Section 7.5.6**.

Surface water quantity and geomorphology

Impacts on the rate and volume of surface water runoff during construction has the potential to increase scour (erosion of the sediments that surround the base or support structures) and can exacerbate flooding. An increase in scour can impact on water quality due to an increase in sedimentation, as well as an increase in the rate of bank erosion which can affect the geomorphology of creeks and watercourses. A more detailed discussion of flooding impacts is discussed in **Section 7.4** (Hydrology and flooding).

Impacts to the rate and volume of surface water runoff during construction of the proposed modification would be similar to those under operational conditions on the basis that appropriate erosion and sediment control measures accompany construction activities and that the existing stormwater controls are fully operational during construction of the proposed modification.

River geomorphology is the interaction between sediment, water and vegetation throughout a river catchment. The geomorphology of the creeks that cross the construction footprint could also be impacted by works within their in-bank area, the land alongside or sloping down to a river. Impacts could derive from obstructions such as temporary creek crossings and work platforms for bridge widening works, leading to redirections of flows leading to an increase in velocities and bank erosion. Mitigation measures including minimising disturbance of banks, extent of vegetation removal, bank stabilisation measures and maintaining minimum flows, are proposed to manage these impacts and are summarised in **Section 7.5.6**. Potential impacts of the construction of the bridge widening works on flow velocities in the creeks are discussed further in **Section 7.4** (Hydrology and flooding).

Water demand

Water use during construction would be largely associated with dust suppression and the construction of the widened road pavement (e.g. during compaction). Water would also be used during construction for a range of purposes including but not limited to wheel washing, machinery, curing structures and operation of ancillary facility amenities (toilets, sinks, showers, and drinking).

Over the construction period, it is estimated that about 280 million litres of water would be used to construct the proposed modification, which equals around 93 million litres per annum. The actual water requirement, material sources and methodologies would be confirmed during detailed design, but are likely to include a combination of potable mains supply and recycled (or non-potable) water, drawn from sources internal and external to the construction footprint. Non-potable water would be sourced from construction sediment sumps where it is feasible to reuse this water. Groundwater take is not anticipated given the nature of the proposed modification, low flow rates and construction water demands required.

Groundwater

This section provides an assessment of the potential impact that the proposed modification could have on groundwater conditions during construction. Groundwater may be impacted if construction activities intersect with the groundwater, and/or where construction impacts on the surface water regimes hydraulically connected to shallow groundwater, including:

- Reshaping of waterways and embankments to accommodate the bridgeworks
- Trenching for new or realigned stormwater drainage and utilities
- Fill embankments and cuttings.

Groundwater recharge

Groundwater within the study area is predominantly recharged by rainfall runoff and infiltration through the soil profile. This process is referred to as groundwater recharge. The impervious surface area within the construction footprint is expected to increase due to construction activities such as waterway crossings, construction sites and lay down areas. Groundwater recharge is not expected to be impacted significantly during construction given the increase in impervious areas from construction activities is small relative to the overall aquifer, is temporary in nature, and regional recharge fluctuations are considered negligible.

Groundwater levels and flow

Piles or other structures spaced closely together have potential to influence the natural groundwater flow regime. It is a requirement under Transport's *QA Specification B59* that temporary casing is to be used whilst bridge pilings are being constructed if groundwater is encountered during construction works. The specifications would be outlined in the Soil and Water Management Plan (SWMP). Dewatering may lead to localised groundwater drawdown and cause the surrounding groundwater to flow towards the excavation. The use of casings should reduce the volume of groundwater required to be dewatered during piling. It is assumed that all dewatering works would be temporary, required only whilst the construction activity is being undertaken to provide safe working conditions.

Groundwater quality

Leaks and spills from machinery used to construct the proposed modification could occur following a malfunction of the equipment, during re-fuelling, and in-field maintenance. Small-scale leaks and spills in the order of a few litres would likely remain in the topsoil until the affected soil is recovered and removed. Larger-volume leaks, especially if not immediately observed and contained, may penetrate further into the substrate.

There are potential areas of contamination within 100 metres of the construction footprint (i.e. within the groundwater assessment study area). Groundwater within these areas may be impacted with contaminants of potential concern (COPC) including heavy metals, petroleum hydrocarbons, polychlorinated biphenyl (PCB), solvents, per- and poly-fluoroalkyl substances (PFAS), pesticides and herbicides. There is potential for contaminated groundwater to be encountered whilst bridge pilings are being constructed. It is a requirement under Transport's QA Specification B59 that temporary casings are to be used if groundwater is encountered during construction works. The use of temporary casings would reduce the volume of groundwater required to be dewatered. The extracted groundwater is expected to be disposed of off-site. There are risks associated with landfills located within the construction footprint at Eastern Creek and Horsley Park, including the interception and exposure to landfill leachate by construction workers.

Where groundwater is intersected during construction, potential receptors that may be subject to contaminated groundwater include project construction workers, terrestrial and aquatic ecological receptors within the construction footprint, aquatic ecological receptors down-gradient of the construction footprint, and human receptors adjacent or downgradient of the construction footprint. Residual potential risks of exposure to contaminated water to human health or ecological receptors during construction if discussed in **Section 7.11** (Soils and contamination).

Groundwater users

The closest registered groundwater bore is about 400 metres from the proposed modification. Given the distance of the registered bores from the proposed modification and minimal anticipated groundwater dewatering, it is unlikely that construction activities would impact groundwater users.

Groundwater dependent ecosystems

GDEs within proximity to the proposed modification alignment have the potential to be impacted due to groundwater mounding around embankments leading to changes to groundwater recharge. The proposed modification is not likely to result in changes to water quantity, water quality, aquifer structure or land use to the extent that there may be impacts to GDEs. With the addition of mitigation measures detailed in **Section 7.5.6,** significant impacts to GDEs are not anticipated.

Surface water and groundwater interaction

There may be interaction between surface water and groundwater in close proximity to the watercourses traversed by the indicative modification alignment. Primary interactions between surface water and groundwater in proximity to the study area include:

- surface water acting as recharge to underlying groundwater units, where hydraulic gradients and modified environments (e.g. concrete-lined waterways/channels) permit
- groundwater discharging to surface water as baseflow, especially in areas of low elevation (where hydraulic gradients and modified environments allow).

Surface water and groundwater interactions may be impacted in localised areas during construction activities due to the reshaping of waterways and embankments to accommodate the bridgeworks.

Following the implementation of mitigation measures such as additional investigations to confirm the location and potential impacts to groundwater and GDEs listed in **Section 7.5.6**, significant impacts to groundwater are not anticipated. These measures would form the basis of a Soil and Water Management Plan (SWMP) that would guide construction of the proposed modification.

Operation

Surface water quality

The proposed modification has the potential to increase the generation of the following contaminants that may impact on the quality of surface water runoff discharging from operation of the motorway:

- TSS that build up on paved surfaces
- Toxicants and heavy metals attached to particulates from paved surfaces
- Hydrocarbons, oils and grease from spills or leaks
- Gross pollutants from the motorway corridor
- Nutrients (such as TP and TN) from organic material and potential spills during transportation.

The types of contaminants above are considered the same as those currently generated by the Westlink M7. However, the proposed modification has the potential to lead to an increase in the quantities of these contaminants generated by the Westlink M7 due to the increase in paved areas and increase in vehicle movements. Treatment for runoff of these contaminants is currently provided by the basins noted in **Section 7.5.4**. The existing water quality basins have been sized to accommodate runoff from the additional paved area for future road widening work within the central median. In light of this, it is proposed to utilise the existing stormwater quality controls along the Westlink M7 corridor.

Performance against stormwater quality controls

To demonstrate the performance of the Westlink M7 stormwater quality controls to treat runoff from the motorway after the proposed widening, an assessment was carried out using the MUSIC modelling software. The average annual pollutant loads discharging from the Westlink M7 stormwater quality controls, under existing conditions and conditions following construction of the proposed modification are depicted in Table 7.1 of **Appendix G** (Surface water and flooding assessment).

The following observations were made based on the results:

- The pollutant retention efficiencies of the stormwater quality controls for the proposed modification are within one to two percentage points of the pollutant retention efficiencies under existing conditions
- In comparison to an agricultural land use type that was indicative of conditions before the Westlink M7, the total annual weight of pollutants discharging from the stormwater quality controls under both existing conditions and proposed modification is lower for TSS and TP, but higher for TN
- In comparison to the Council based reduction targets, the retention efficiencies of the stormwater quality control basins under both existing conditions and proposed modification conditions:
    - Exceed the target value for gross pollutants
    - Are within the range of target values for TSS
    - Exceed the range of target values for TP
    - Are less than the range of target values for TN.

Performance against the water quality objectives

The MUSIC model was used to assess potential pollutant concentrations discharging from the stormwater quality controls under existing conditions and the proposed modification. These projections were compared against water quality objective guideline values and the existing water quality in the receiving watercourses. The results of this assessment for each of the catchment areas is presented Table 7-44, Table 7-45 and Table 7-46. The following observations were made based on the results of the pollutant concentrations comparison:

- There are negligible differences between the median pollutant concentrations under both existing conditions and the proposed modification. In some cases, the median pollutant concentrations under the proposed modification conditions are slightly lower, suggesting the proposed modification would work to dilute the concentration of pollutants. On this basis, it can be concluded that there is negligible difference in the ability or otherwise of the stormwater quality controls to meet the water quality objectives between pre- and post-proposed modification conditions. The median pollutant guideline values adopted as the WQOs, stated in Table 7-44-Table 7-46, are based on those for aquatic ecosystem values which are more stringent than those proposed for human health. Given the negligible differences in the median pollutant concentrations from the proposed modification, no risk is anticipated to human health.
- Under both existing conditions and the proposed modification, the median concentrations of TSS and turbidity are below the guideline values set out in the WQOs and are typically less than or similar to the levels recorded in the receiving watercourses. On this basis it can be concluded that the stormwater quality controls achieve the WQOs related to these two indicators.
- Under both existing conditions and the proposed modification, the median concentrations of TP and TN are:
    - Generally above the guideline values set out in the WQOs
    - Within the range of concentration levels for total discharge into the major creek systems of Cabramatta Creek, Ropes Creek and Eastern Creek
    - Below the concentration levels that have been measured in Upper Hinchinbrook Creek, Bells Creek and Angus Creek as part of the sampling undertaken for the proposed modification
    - Below the concentration level of TP that has been measured in Maxwells Creek, Cabramatta Creek, Lower Hinchinbrook Creek and Eskdale Creek as part of the sampling that has been undertaken for the modification, but higher than the corresponding concentration levels of TN.

The ability of the existing operational stormwater quality controls that are located along the Westlink M7 corridor to control runoff from both the existing and widened carriageways would be confirmed during detailed design, following inclusion of the full 12 months of surface water monitoring data. This assessment would include consideration of whether:

- the water quality objectives continue to be met at waterways where they are currently being achieved, or
- existing water quality is improved at waterways where the water quality objectives are not being met.

In the instance that during detailed design it cannot be demonstrated that the existing operational stormwater quality controls would be effective in mitigating potential impacts in accordance with the above requirements, then additional mitigation measures would be identified and implemented. Such measures may include the provision of additional measures such as pollutant control devices upstream of the existing controls or the conversion of a small number of existing water quality basins to bioretention basins that are highly effective in the retention of TP and TN. Mitigation measures identified in **Section 7.5.6** would be implemented.

Table 7-44 Comparison of pollutant concentrations against the WQOs - Cabramatta Creek catchment

Discharge Location and Identifier[1]	Water Quality Objective[2]		Existing water quality in receiving watercourse[3]	Median pollutant concentrations discharging from the Westlink M7 stormwater quality controls[4,5]	
	Indicator	Guideline Value		Pre proposed modification conditions	Post proposed modification conditions
Maxwells Creek (CC01)	TSS (mg/L)	< 50	62	6.0	6.0
	TP (mg/L)	0.025	0.3	0.060	0.060
	TN (mg/L)	0.35	1	1.02	1.02
	Turbidity (NTU)	6-50	70.6	6.0	6.0
Cabramatta Creek (CC02)	TSS (mg/L)	< 50	14	6.0	6.0
	TP (mg/L)	0.025	0.1	0.060	0.060
	TN (mg/L)	0.35	0.9	1.02	1.03
	Turbidity (NTU)	6-50	17.1	6.0	6.0
Lower Hinchinbrook Creek (CC03)	TSS (mg/L)	< 50	31	7.0	6.6
	TP (mg/L)	0.025	0.1	0.068	0.065
	TN (mg/L)	0.35	0.9	1.18	1.18
	Turbidity (NTU)	6-50	28.1	7.0	6.6
Upper Hinchinbrook Creek (CC04)	TSS (mg/L)	< 50	33	6.0	6.0
	TP (mg/L)	0.025	0.11	0.060	0.060
	TN (mg/L)	0.35	1.1	1.01	1.06
	Turbidity (NTU)	6-50	58	6.0	6.0
Total for all water quality controls discharging to Cabramatta Creek	TSS (mg/L)	< 50	9-15	6.5	6.3
	TP (mg/L)	0.025	0.06-0.18	0.064	0.062
	TN (mg/L)	0.35	0.55-1.22	1.12	1.11
	Turbidity (NTU)	< 50	10.4-11.5	6.5	6.3

Refer footnotes on Table 7-46.

Table 7-45 Comparison of pollutant concentrations against the WQOs – Ropes Creek catchment

Discharge Location and Identifier[1]	Water Quality Objective[2]		Existing water quality in receiving watercourse[3]	Median pollutant concentrations discharging from the Westlink M7 stormwater quality controls[4,5]	
	Indicator	Guideline Value		Pre proposed modification conditions	Post proposed modification conditions
Total of all water quality controls discharging to Ropes Creek (Ropes Creek (RC01))	TSS (mg/L)	< 50	1,080	6.03	6.05
	TP (mg/L)	0.025	1.6	0.060	0.061
	TN (mg/L)	0.35	7.6	1.13	1.22
	Turbidity (NTU)	6 – 50	411	6.03	6.05

Refer footnotes on Table 7-46.

Table 7-46 Comparison of pollutant concentrations against the WQOs – Eastern Creek catchment

Discharge Location and Identifier[1]	Water Quality Objective[2]		Existing water quality in receiving watercourse[3]	Median pollutant concentrations discharging from the Westlink M7 stormwater quality controls[4,5]	
	Indicator	Guideline Value		Pre proposed modification conditions	Post proposed modification conditions
Reedy Creek (EC01)	TSS (mg/L)	< 50	14	6.0	6.0
	TP (mg/L)	0.025	0.7	0.060	0.060
	TN (mg/L)	0.35	2.6	1.05	1.03
	Turbidity (NTU)	6-50	18.5	6.0	6.0
Eskdale Creek (EC02)	TSS (mg/L)	< 50	12	6.0	6.0
	TP (mg/L)	0.025	0.1	0.060	0.060
	TN (mg/L)	0.35	0.7	1.01	1.01
	Turbidity (NTU)	6-50	42.8	6.0	6.0

Discharge Location and Identifier[1]	Water Quality Objective[2]		Existing water quality in receiving watercourse[3]	Median pollutant concentrations discharging from the Westlink M7 stormwater quality controls[4,5]	
	Indicator	Guideline Value		Pre proposed modification conditions	Post proposed modification conditions
Eastern Creek (EC03)	TSS (mg/L)	< 50	37	6.0	6.0
	TP (mg/L)	0.025	0.3	0.060	0.060
	TN (mg/L)	0.35	1.6	1.04	1.04
	Turbidity (NTU)	6-50	44.6	6.0	6.0
Angus Creek (EC04)	TSS (mg/L)	< 50	10	6.9	7.0
	TP (mg/L)	0.025	0.1	0.068	0.069
	TN (mg/L)	0.35	1.3	1.11	1.13
	Turbidity (NTU)	6-50	5.4	6.9	7.0
Bells Creek (EC05)	TSS (mg/L)	< 50	15	6.0	6.0
	TP (mg/L)	0.025	0.3	0.060	0.060
	TN (mg/L)	0.35	1.9	1.02	1.03
	Turbidity (NTU)	6-50	21.5	6.0	6.0
Total for all water quality controls discharging to Eastern Creek	TSS (mg/L)	< 50	5.7-13.5(5)	6.0	6.0
	TP (mg/L)	0.025	0.066-0.340	0.069	0.068
	TN (mg/L)	0.35	0.82-1.4	1.14	1.15
	Turbidity (NTU)	6 – 50	5.7-13.5	6.0	6.0

[1]Refer Figure 7- for location of identifiers.

[2]Refer **Section 7.5.2** for background to the establishment of the WQOs for the proposed modification.

[3]Based on the median available water sampling data in the receiving watercourses as summarised in **Section 7.5.4**.

[4]Based on the median pollutant concentration from a flow based sub-sampling of results from the MUSIC modelling to exclude samples of zero flow.

[5]Coloured shading of cells is based on the following:

Meets the guideline value of the WQOs
Exceeds the guideline value of the WQOs but is less than the measured pollutant concentration in the receiving watercourse.
Exceeds the guideline value of the WQOs and is more than the measured pollutant concentration in the receiving watercourse.

Surface water quantity and geomorphology

The proposed modification has the potential to impact on the quantity of stormwater runoff discharging from the Westlink M7 corridor due to an increase in the rate and volume of runoff from the widened road pavement. This in turn could impact on:

- The performance of the on-site detention basins that control the surface water quantity through controlling the rate of runoff, further discussed below
- The depth and velocity of flow in the receiving drainage lines downstream of the Westlink M7 corridor, discussed in **Section 7.4** (Hydrology and flooding)
- The geomorphology of the receiving drainage lines if changes in flow velocities are significant enough to result in an increase in stream bank erosion, discussed in **Section 7.4** (Hydrology and flooding).

An assessment of the on-site detention basins within the study area using the MUSIC modelling software determined that:

- In regard to the impact of the proposed modification on the available freeboard (height above a defined flood level):
    - There would either be no change or a slight reduction in peak water level (and therefore increase in available freeboard) at 24 of the on-site detention basins
    - While the peak water level would be increased at 16 of the on-site detention basins, the resulting reduction in available freeboard would have a negligible impact on the potential for the basin embankment to be overtopped during a 1 per cent AEP event on the basis that: at least 15 of the basins the resulting freeboard would still be more than 0.3 metres and at the remaining basin (B15.04) the available freeboard would be marginally reduced from 0.25 metres to 0.24 metres
- In regard to the impact of the proposed modification on peak discharges:
    - There would be either no change or a slight reduction in peak discharge at 29 of the on-site detention basins
    - Of the remaining 11 on-site detention basins the increase in peak discharge would be less than 10 per cent with the exception of basins B10.55, B12.84, B15.04, B21.70 and B22.10 which would increase by a range of 19-29 per cent.

Given the minor nature of changes in peak flows and velocities downstream of the Westlink M7, further discussed in **Section 7.4** (Hydrology and flooding), it can also be concluded that the proposed modification would also have a minor impact on the geomorphology of the receiving watercourses. Mitigation measures to localise increases in velocities and scour potential around new bridge piers, including measures such as bank stabilisation, channel reshaping, and scour protection would be implemented to limit impacts to geomorphology of nearby creeks. These mitigation measures to manage potential geomorphological impacts are summarised in **Section 7.5.6**.

Groundwater

Groundwater quality has the potential to be impacted by contaminated surface water runoff discharging from the motorway corridor and infiltrating through the soil profile. While the impervious surface area within the operational footprint would increase due to the new paved surfaces, this area is small relative to the overall aquifers and therefore the impact to groundwater quality due to the operation of the proposed modification is considered negligible. Existing stormwater quality controls provide enough capacity to capture, treat and discharge runoff to avoid contamination migration from contaminating activities such as oil, chemical or fuel spills from maintenance plant and equipment or heavy vehicles or accidents from general motorists.

There is potential that constructed embankments may lead to groundwater mounding on one side of the embankment (where pockets of groundwater to expand in some areas and diminish in others). This could lead to poor groundwater recharge to groundwater on the opposite side of the embankment, particularly in flood prone areas where embankments may obstruct natural drainage pathways. Further information on flood prone areas within the construction footprint is located in **Section 7.4** (Hydrology and flooding)).

Groundwater dependent ecosystems

The operation of the proposed modification may lower the groundwater levels within localised areas due to the construction of embankments, however with the implementation of mitigation measures listed in **Section 7.5.6** there are unlikely to be significant operational impacts to GDEs.

7.5.6 Mitigation measures

Based on the findings of the assessment above, Table 7-47 summarises the recommended mitigation measures to manage the potential surface water and groundwater impacts during construction of the proposed modification. Operational mitigation measures would be incorporated into the existing Soil and Water Operational Management Plan where required.

Measures related to minimising impacts to hydrology and flooding and contamination are contained in **Section 7.4** (Hydrology and flooding) and **Section 7.11** (Soils and contamination) respectively.

Table 7-47 Additional mitigations measures

Impact	ID	Mitigation measure	Responsibility	Timing
Soil, surface water and groundwater	SW1	A Soil and Water Management Plan (SWMP) will be prepared as part of the proposed modification. The plan will outline measures to manage soil and water impacts associated with the construction works, including contaminated land. The SWMP will include: • Measures to minimise/ manage erosion and sediment transport both within the construction footprint and offsite, including requirements for the preparation of erosion and sediment control plans (ESCP) for all progressive stages of construction • Measures to manage runoff from spoil and waste storage areas • Procedures to manage unexpected or previously unidentified contaminants • Measures to manage stockpiles, including locations, separation of waste types, sediment controls and stabilisation • Groundwater management measures to limit the risk of exposure to contaminated groundwater • Controls to manage the risk posed to workers from exposure to contaminated groundwater (if encountered)	Construction Contractor	Prior to construction Construction

Impact	ID	Mitigation measure	Responsibility	Timing
		• Processes for dewatering of water that has accumulated on site and from sediment basins, including relevant discharge criteria • Measures to manage potential tannin leachate • Measures to manage accidental spills, including the requirement to maintain materials such as spill kits • Measures to manage potential saline soils • Details of surface water and groundwater quality monitoring to be undertaken prior to, throughout, and following construction • Erosion and sediment control measures will be implemented and maintained at all work sites in accordance with the principles and requirements in *Managing Urban Stormwater – Soils and Construction, Volume 1* (DPIE, 2004) and *Volume 2D* (DECC, 2008a), commonly referred to as the 'Blue Book,' as well as relevant Transport Guidelines.		
	SW2	A dewatering management plan will be prepared and included in the SWMP that sets out the procedures for the discharge of surface water runoff that is retained in sediment controls and exposed excavations. The dewatering management plan will be prepared in accordance with the *Technical Guideline – Environmental Management of Construction Site Dewatering* (Transport, 2011) and would include consideration of the following: • Identification of water quality criteria for the discharge of on-site water and the treatment techniques required to meet these criteria • Methods for achieving the WQOs for any site discharge through best practice erosion and sediment control measures and/ or treatment of water through flocculation prior to discharge from sediment retention sumps • Reuse of stormwater where feasible within the scope of construction activities • Selection of suitable locations for the discharge of captured runoff	Construction Contractor	Prior to construction During construction

Impact	ID	Mitigation measure	Responsibility	Timing
		utilising existing drainage paths where it cannot be reused on site • Procedures for the rectification of sediment controls or site practices should the water quality parameters experience exceedances.		
Sediment Control	SW3	A soil conservation specialist will be engaged for the duration of construction of the proposed modification to provide advice on the planning and implementation of erosion and sediment control measures, including review of ESCPs.	Construction Contractor	Prior to construction Construction
	SW4	Stockpiles will be managed to minimise the potential for mobilisation and transport of dust and sediment in runoff in accordance with *Stockpile Site Management Guideline* (Roads and Maritime, 2015d). This will include: • Minimising the number of stockpiles, the area used for stockpiles and the time that they are left exposed • Locating stockpiles away from drainage lines, waterways and areas where they may be susceptible to wind erosion • Stabilising stockpiles, establishing appropriate sediment controls and suppressing dust as required.	Construction Contractor	During construction
Water Quality	SW5	Updated water quality assessment will be undertaken during detailed design to inform site specific discharge criteria to meet the objective of maintaining existing water quality in the receiving watercourses during operation.	Construction Contractor	Detailed design
	SW6	A water reuse strategy will be developed for the construction of the proposed modification to reduce reliance on potable water. This strategy will be prepared during the detailed design stage and will outline the construction water requirements and potential water sources to supply the water demand in consultation with Sydney Water. Alternative water supply options to potable water will also be investigated, with the aim of reusing water using recycled water where feasible. This includes sourcing non-potable water from construction sediment sumps where it is feasible to reuse.	Construction Contractor	Prior to construction

Impact	ID	Mitigation measure	Responsibility	Timing
	SW7	The following measures will be undertaken to manage activities within watercourses, especially works to widen of bridges: • Disturbance of banks and extent of vegetation removal will be minimised • Implementing bank stabilisation, channel reshaping and scour protection where required to mitigate the impact of additional bridge piers on scour and stability of the bed and banks of watercourses • Maintenance of minimum surface water flows to assist in maintaining the viability of aquatic communities and preventing barriers to fish passage • Construction of temporary creek crossings during low flows and design so that drainage of these crossings does not contribute sediment load to the stream • Taking into consideration the former NSW Department of Industry's *Guidelines for controlled activities on waterfront land* (2018) in the design and construction of works within watercourses	Construction Contractor	Prior to construction Construction
Water Quality	SW8	The performance of the stormwater quality controls that are set out in the Modification Report (comprising the existing stormwater quality control basins and gross pollutant traps along the Westlink M7 corridor) will be verified at detailed design stage to ensure that for waterways that receive runoff from the proposed modification, and to the extent that the proposed modification can influence: • The WQOs continue to be met at waterways where they are currently being achieved, or • Existing water quality is improved at waterways where the WQOs are not being met. In the instance during detailed design that it cannot be demonstrated that the water quality controls are effective in mitigating potential impacts in accordance with the above requirements, a review of measures will be undertaken to improve water quality	Construction Contractor Westlink M7 Operator	Prior to construction Construction Operation

Impact	ID	Mitigation measure	Responsibility	Timing
		outputs from the Westlink M7 over time, including an assessment of the potential benefits and feasibility or reasonableness of converting a select number of existing water quality control ponds to bioretention basins, in consultation with NSW EPA.		
	SW9	A construction water quality monitoring program will be developed and included in the SWMP for the proposed modification to establish baseline conditions, observe any changes in surface water and groundwater during construction, and inform appropriate management responses. Baseline monitoring will be undertaken monthly for a minimum of 12 months prior to the commencement of construction, inclusive of the monitoring that is presented in **Section 5.6** of **Appendix G** (Surface water and flooding assessment). As a minimum, this will include three wet weather sampling events over six months where feasible. Sampling locations and monitoring methodology to be undertaken during construction will be further developed in detailed design in accordance with the *Guidelines for Construction Water Quality Monitoring* (RTA, 2003) and the *ANZECC Water Quality Guidelines* (ANZECC/ ARMCANZ, 2000). The monitoring will include collection of samples for analysis from sedimentation control discharge points, visual monitoring of other points of release of construction waters and monitoring of downstream waterways. The frequency of monitoring will be confirmed during detailed design and will be a minimum of once every month at all sites, as well as additional monitoring following wet weather events. Should the results of monitoring identify that the water quality management measures are not effective in adequately mitigating water quality impacts, additional mitigation measures will be identified and implemented as required.	Construction Contractor	Prior to construction Construction

Impact	ID	Mitigation measure	Responsibility	Timing
	SW10	Further water quality assessment will be undertaken during detailed design to determine whether additional site-specific discharge criteria are required to meet the objective of maintaining existing water quality in the receiving watercourses.	Construction Contractor	Prior to construction
Spills	SW11	The adequacy of the existing spill containment measures along the Westlink M7 corridor, will be verified during the detailed design of the proposed modification to ensure that they are suitable for the capture of spills from the widened road pavement. In the instance during detailed design that it cannot be demonstrated that spill control from the widened road pavement cannot be achieved with existing spill containment measures, then additional spill containment mitigation measures will be identified, implemented and incorporated into existing maintenance procedures.	Westlink M7 Operator	Operation