Airport Link

SURFACE WATER

TECHNICAL REPORT NO 4

- October 2006

Contents

1. Executive Summary

Current water quality within the waterways of the Airport Link Project is considered to be in poor condition. Additional impacts are expected to further reduce the environmental values of the waterways.

Construction impacts from the Airport Link Project may be minimised with the effective implementation of sediment and erosion control devices, especially in high-risk areas along the Project route.

Impacts during operation may be minimised with the implementation of stormwater treatment devices that may reduce the amount of nutrients and pollutants entering waterways and consequently impacts on the aquatic environment. Monitoring programs can ensure that environmental values of the waterways are maintained.

2. Existing Environment

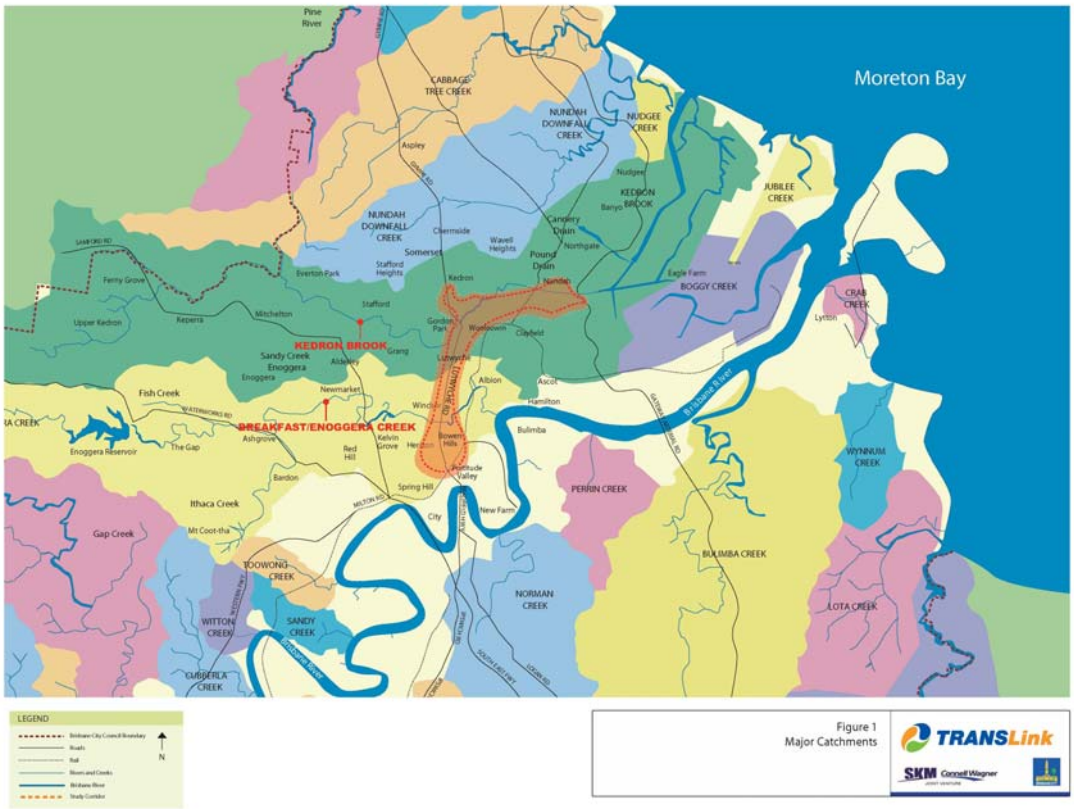
This chapter of the Environmental Management Plan (EMP) outlines the existing surface water quality of the proposed Airport Link Project (the Project) and the potential impacts upon these waters associated with the construction and operation of the Project.

The Project alignment corridor traverses through the northern suburbs of Brisbane from Bowen Hills to Toombul, with a western connection to Gympie Road. Along the alignment corridor, two waterways have been identified that may be affected by the construction and/or operation phase of the Project. The identified waterways are:

- Enoggera/Breakfast Creek; and
- Kedron Brook.

Figure 2-1 illustrates the location of these waterways in relation to the proposed alignment.

- **Figure 2-1 Major Catchments of the Project Corridor**



To determine changes in water quality from construction and operational phases of the Project, existing information has been interpreted and assessed and future recommendations regarding surface water quality are suggested.

2.1 Waterway Descriptions

The following information describes the two major watercourses affected by the Project and their significance in relation to the catchment system in which they occur.

2.1.1 Enoggera Creek/Breakfast Creek

The Enoggera/Breakfast Creek catchment is one of the largest within Brisbane City and covers approximately 90km^2. The main creek channel is approximately 39km, originating in Brisbane Forest Park and discharging into the Brisbane River at Newstead, near the junction of Breakfast Creek Road and Kingsford Smith Drive (BCC, 2000).

The Enoggera Creek catchment has several tributaries including Ithaca Creek and Fish Creek (BCC, 2000).

The upper catchment (Enoggera Creek) is located within Brisbane Forest Park and includes a diverse range of vegetation types. Downstream of the Enoggera Reservoir, land use is predominantly urban residential and parkland adjoining most of the waterway.

Ithaca Creek originates at Mount Coot-tha and progresses through the highly urbanised suburbs of Bardon and Ashgrove before joining with Enoggera Creek in Kelvin Grove.

The current alignment corridor for the Project intercepts with the downstream reaches of Enoggera Creek.

Breakfast Creek is tidal to the weir at Bancroft Park on Kelvin Grove Road and has a history of flooding and drainage problems that has led to flood mitigation measures including widening, straightening and dredging.

The Enoggera Creek catchment and its tributaries are diverse in their uses and importance. Downstream of the catchment is the Brisbane River, one of South East Queenslands largest catchments. These waterways are an important resource with relation to agriculture, industry, cultural significance, biodiversity and recreational use. Although the local value of each of these criteria is not high care must be taken to avoid any actions that could affect those values elsewhere in the catchments.

2.1.2 Kedron Brook

The Kedron Brook catchment is an urban creek in Brisbane City and Pine Rivers Shire covering over 110km^2. Kedron Brook catchment is one of the largest in Brisbane, dominated by urban land use, but includes large areas of remnant waterway vegetation including Brisbane Forest Park, Teralba Park, Grinstead Park and the Boondall Wetlands (EPA *et al*, 2004).

Kedron Brook is a natural waterway that extends from the D'Aguilar Ranges. The uppermost sections of the catchment are ephemeral gullies. Cedar Creek joins Kedron Brook at Ferny Grove. The Brook meanders almost permanently through Arana Hills, Mitchelton, Everton Park and Grange urban areas.

Kedron Brook enters Bramble Bay within Moreton Bay, to the south of the Boondall wetlands, near Nudgee Beach. Bramble Bay extends from the mouth of Brisbane River to north of the Redcliffe Peninsula. Most of the

middle reaches of Kedron Brook catchment are well-established urban areas. Natural vegetation has been fragmented into small remnants, often isolated by urban development.

The Boondall Wetlands, which are approximately 18km north of the Project corridor are currently on the Register of the National Estate and represent one of the largest areas of relatively intact littoral habitat remaining in the Brisbane City area. The mouth of Kedron Brook and the adjacent Boondall and Moreton Bay wetlands are internationally significant breeding grounds.

The environmental organisation *Kedron Brook Catchment Network* is dedicated to maintaining and improving the Kedron Brook water catchment environment, plus numerous Bushcare Groups are responsible for different sections along the catchment.

The current alignment corridor for the Project intercepts at two main points within the downstream reaches of Kedron Brook and includes a number of unnamed wetlands along Kedron Brook catchment.

2.2 Regulatory Framework

2.2.1 Environmental Protection (Water) Policy 1997

In Queensland, the *Environmental Protection (Water) Policy 1997* (EPP(Water)) is the governing piece of legislation in relation to water. The EPP(Water) is subordinate legislation to the *Environmental Protection Act 1994* (EP Act). The objective of the EPP(Water) is to uphold the EP Act objective of protecting "Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (Ecological Sustainable Development)". The EPP (Water) achieves this by:

- Identifying environmental values for Queensland waters;
- Setting water quality guidelines and objectives to enhance or protect environmental values;
- Making consistent and equitable decisions about Queensland waters that promote efficient use of resources and best practice environmental management; and
- Involving the community through consultation and education, and promoting community responsibility.

The policy and legislative framework mentioned above sets the broad goals for design criteria for water quality controls.

This document refers to environmental values and water quality objectives for Brisbane waterways as identified in the EPP(Water) Draft Schedule 1 Document. The *Environmental Protection (Water) Amendment Policy (No. 1) 2006* amends the *Environmental Protection (Water) Policy 1997* from 1 May 2006.

2.2.2 Water Act 2000

The *Water Act 2000* promotes the sustainable management and efficient use of water by establishing a system for the planning, allocation and use of water. The Act advocates the principles of Ecological Sustainable

Development. The Act also sets out a regulatory framework for the water industry within Queensland. The rights to the use, flow and control of all water in Queensland are vested in the State.

One of the primary objectives of the *Water Act 2000* is to protect and improve the physical integrity of watercourses.

2.3 Water Quality Guidelines

Water quality within the Project area is covered by three separate water quality guidelines: ANZECC Water Quality Guidelines 2000; EPA Queensland Water Quality Guidelines 2006 including EPP(Water); and Brisbane City Council 2000 Water Quality Objectives.

Complying with these guidelines will ensure that potentially negative effects to Kedron Brook and Enoggera/Breakfast Creek will be eliminated or minimised and managed appropriately, particularly during the operation and construction phase.

2.3.1 ANZECC 2000

The *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC Guidelines) have been prepared as part of Australia's National Water Quality Management Strategy (NWQMS). The NWQMS is a joint strategy developed by two ministerial councils, namely the Australian and New Zealand Environment and Conservation Council (ANZECC) and the Agriculture and Resources Management Council of Australia and New Zealand (ARMCANZ).

ANZECC developed Guidelines for Fresh and Marine Water Quality to:

- Protect and manage environmental values supported by water resources;
- Outline the management framework recommended for applying the water quality guidelines to the natural and semi-natural marine and freshwater resources in Australia and New Zealand; and
- Provide advice on designing and implementing water quality monitoring and assessment programs.

The document provides water quality guidelines for a variety of uses such as primary industries, recreational uses, drinking water and industrial water, but for the purposes of this EIS the guidelines for protecting aquatic ecosystems was used.

2.3.2 EPP(Water) 2006

The EPA has developed the Queensland Water Quality Guidelines 2006 (QWQG) for Queensland waters. The purpose of these guidelines is to:

- Provide guideline values that are tailored to Queensland regions and water types; and
- Provide a framework for deriving and applying local guidelines for waters in Queensland (ie more specific guidelines than those in the QWQG).

These guidelines have been developed to provide guidelines for the protection of Queensland aquatic ecosystems in the absence of more specific scheduled guidelines.

Schedule 1 of the EPP(Water), updated in March 2006, requires the Bramble Bay Environmental Values and Water Quality Objectives (March 2006) be used when assessing the state of Brisbane creeks including Kedron Brook; and the Brisbane River Environmental Values (March 2006) be used for Enoggera/Breakfast Creek as it is a tributary of the Brisbane River Estuary.

In some regions of Queensland the QWQG Guidelines will still apply however, within the study corridor the EPP(Water) Schedule 1 apply. Refer to Section 2.4 below for more detail on the water quality objectives and environmental values for the study corridor.

2.3.3 BCC WQO 2000

Brisbane City Council (BCC) have developed Water Quality Management Guidelines to provide an understanding of key issues and required measures to effectively manage water quality impacts associated with development activities. The guidelines provide information regarding what key issues must be addressed during the planning, design, construction and operational phases of a development.

BCC Guideline on *Identifying or Applying Water Quality Objectives in Brisbane City'* assists in identifying applicable water quality objectives to protect the environmental values in and around affected receiving waters.

2.4 Environmental Values and Water Quality Objectives

Environmental Values (EV) are the quantities and qualities that the communities consider important to protect. They reflect the ecological, social and economic values and uses of the waterway and are often used to help define appropriate guidelines and objectives for water management strategies.

EPP (Water) promote the sustainable management of water resources by determining EV (or uses) of waterways and corresponding water quality objectives (WQO) (also known as targets) for different indicators of water quality (ie pH, nutrients and toxicants). The EPA has recently released the final EV and WQO for waters in Moreton Bay and South East Queensland (EPA, March 2006). As mentioned in Section 2.3.1 of this report, the EV for Brisbane waterways have been identified in the EPP (Water) Schedule 1. Those for the Enoggera Creek are outlined in the Brisbane River Environmental Values and Water Quality Objectives Report (March 2006); and those for Kedron Brook are outlined in the Brisbane Creeks - Bramble Bay Environmental Values and Water Quality Objectives (March 2006). These EV are summarised in **Table 2-1**. The prevailing WQO for the study corridor are summarised in **Table 2-2**.

These guidelines are based on the EV and WQO produced by BCC in 2000 with additional information for some creek systems, however where there are differences between the documents they take precedence over the BCC Guidelines. The EPA guidelines provide local guidelines for the waterways within the study corridor compared with the more general ANZECC guidelines. As a result these EV and WQO have been adopted as the guidelines for the study corridor.

Table 2-1 Draft Environmental Values for South-East Queensland

Environmental Values	Supporting Details	Kedron Brook	Enoggera Creek
Aquatic Ecosystems		3	3
Primary Industries	Irrigating		
	Farm Use		
	Stock Watering		
	Aquaculture		
	Human Consumption		3
Recreational and Aesthetics	Primary Recreation		3
	Secondary Recreation	3	3
	Visual Appreciation	3	3
Drinking Water	Raw Drinking Water		
Industrial Uses	Industrial Use		
Cultural Heritage	Cultural heritage Values	3	3

Table 2-2 Draft Water Quality Objectives for South-East Queensland

Environmental Value	Enoggera/Breakfast Creek - Mid and upper estuary And Kedron Brook -Mid and upper estuary (within Brisbane City Council)	Kedron Brook Fresh water (within Brisbane City Council)

Aquatic Ecosystem	Physico-chemical
	■ pH – 6.5-8.5
	■ Dissolved Oxygen – 80 to 100 % saturation
	■ Organic matter – NR
	■ Total phosphorus – 60 µg/L
	■ Total nitrogen – 450 µg/L
	■ Chlorophyll-a – 10 µg/L
	■ Turbidity – 20 NTU
	■ Secchi depth > 0.5m
	■ Suspended solids:
	  ■ 30 mg/L for combined wet and dry periods
	  ■ 90%ile <100 mg/L for wet weather periods
	
	Toxicants in Water
	■ Total aluminium – NR
	■ Total iron – NR
	■ Total dissolved iron – 0.5 µg/L if Secchi > 1m or NR if Secchi < 1m
	■ Total arsenic – 50 µg/L
	■ Total cadmium – 2 µg/L
	■ Total chromium – 50 µg/L
	■ Total copper – 5 µg/L
	■ Total nickel – 15 µg/L
	■ Total lead – 5 µg/L
	■ Total zinc – 50 µg/L
	■ TPH – NR
	■ Oils and grease – No visible films or odour
	■ PAH – 3 µg/L
	■ Total chlorine – 0.02 mg/L
		Physico-chemical
		■ pH – 6.5-8.5
		■ Dissolved Oxygen – 80 to 100 % saturation
		■ Organic matter – NR
		■ Total phosphorus – 70 µg/L
		■ Total nitrogen – 650 µg/L
		■ Chlorophyll-a – 8 µg/L
		■ Turbidity – 20 NTU
		■ Secchi depth > 0.2m
		■ Suspended solids:
		  ■ 15 mg/L for combined wet and dry periods
		  ■ 90%ile <100 mg/L for wet weather periods
		
		Toxicants in Water
		■ Total aluminium – 5 µg/L if pH < 6.5 or 100 µg/L if pH > 6.5
		■ Total iron – 300 to 1,000 µg/L (depending upon Fe(II) concentration)
		■ Total arsenic – 50 µg/L
		■ Total cadmium – 0.2 to 2 µg/L (depending on hardness)
		■ Total chromium – 10 µg/L (if it is all chromium (VI))
		■ Total copper – 2 to 5 µg/L (depending on hardness)
		■ Total nickel – 15 to 150 µg/L (depending on hardness)
		■ Total lead – 1 to 5 µg/L (depending on hardness)
		■ Total zinc – 5 to 50 µg/L (if iron not present as FE(II))
		■ TPH – NR
		■ Oils and grease – No visible films or odour
		■ PAH – < 3 µg/L
		■ Total chlorine – 0.03 mg/L

	Litter/gross pollutants – No anthropogenic (man-made) material greater than 5mm in any dimension. Toxicants in water, sediment and biota as per AWQG (2000). Riparian vegetation and habitat - Protect and restore consistent with BCC policy and plans.	
Secondary and Visual Recreation	Objectives as per ANZECC 2000, including median faecal coliforms ,1,000 organisms per 100 mL or median enterococci organisms ,230 organisms per 100 mL and the water being free from: ■ floating debris, oil, grease and other objectionable matter; ■ substances that produce undesirable colour, odour, taste or foaming; and undesirable aquatic life, such as algal blooms, or dense growths of attached plants or insects.	

Environmental Value	Enoggera/Breakfast Creek - Mid and upper estuary And Kedron Brook -Mid and upper estuary (within Brisbane City Council)	Kedron Brook Fresh water (within Brisbane City Council)
Protection of the human consumer (oystering)	Objectives as per ANZECC 2000 and *Food Standards Code,* Australia New Zealand Food Authority, 1996 and updates, including median faecal coliforms <14MPN per 100mL with no more than 10% of samples exceeding 43 MPN per 100mL.	
Protection of the human consumer	Objectives as per ANZECC 2000 and *Food Standards Code,* Australian New Zealand Food Authority, 1996 and updates.	
Protection of Cultural and spiritual values	Protect or restore indigenous and non-indigenous cultural heritage consistent with relevant policies and plans.	
Primary contact recreation	Objectives as per ANZECC 2000 and Queensland Harmful Algal Bloom Operational Procedures (DNRM, 2004), including: ▪ Median faecal coliforms <150 organisms per 100mL or median enterococci organisms <35 per 100mL; and ▪ Secchi >1.2m (measured vertically).	Objectives for blue-green algae as per Queensland Department of Natural Resources, Mines and Water guidelines.
Aquaculture	Objectives as per ANZECC 2000 and *Food Standards Code,* Australia New Zealand Food Authority, 1996 and updates, and the Queensland Department of Primary Industries – Water Quality in Aquaculture – DPI Notes April 2004.	
Industrial Use	No objectives are provided in ANZECC 2000. (Some objectives were given in ANZECC 1992 but objectives vary according to the industry and this value is usually protection by other values, such as intrinsic value of a modified aquatic ecosystem).	

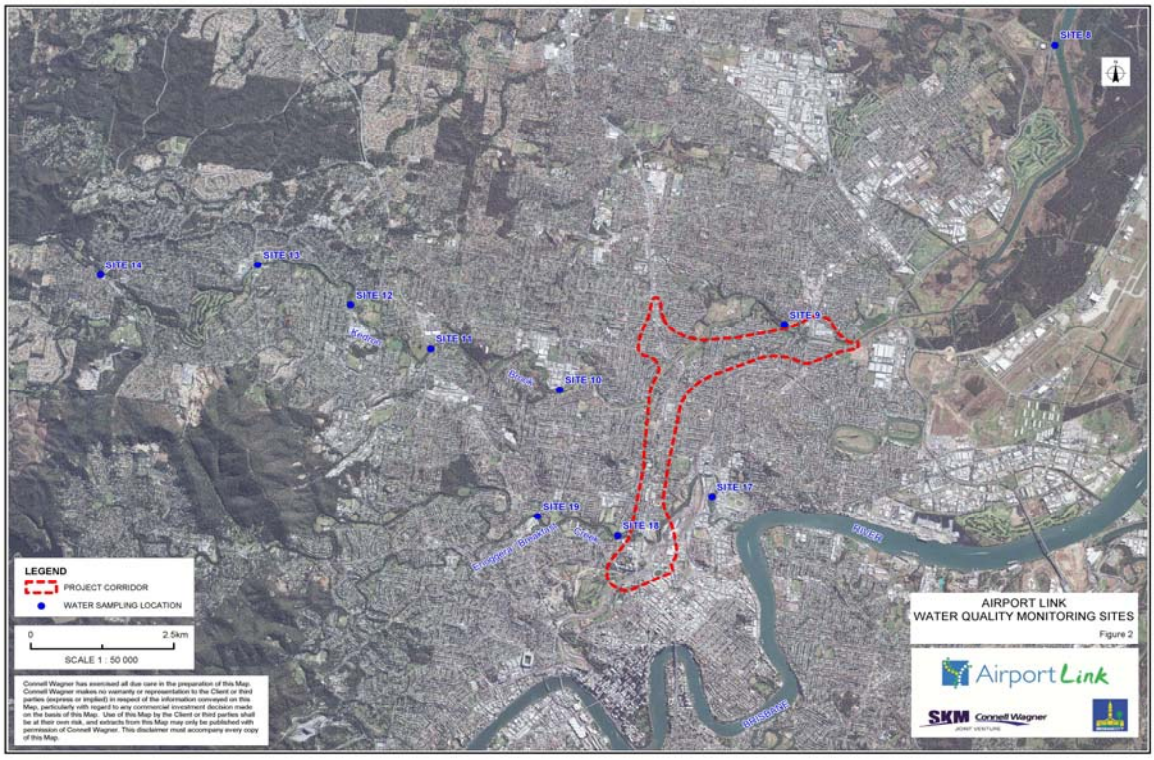
Table Note: NTU – Nephelometric turbidity units. NR – No WQO can be recommended at this stage These WQO are derived from Tables 2-14 in the Bramble Bay Environmental Values and Water Quality Objectives (March 2006) and Table 2-14 in the Brisbane River Environmental Values and Water Quality Objectives Report (March 2006).

2.5 Water Quality Assessment

Existing data was obtained from the EPA monitoring program and associated report: *A city-wide assessment of water quality in Brisbane's creeks October 1999-April 2000* (City-wide assessment). Discussions with the EPA[1] disclosed that data previous to 1994 should be excluded from analysis due to changes in field techniques (eg nitrogen samples taken post 1994 are filtered in the field and it is considered that if this has not occurred the data may be inaccurate). After interrogation of this data, relevant sites were selected and included in the assessment of the existing surface water quality of the waterways potentially affected by the Project. **Figure 2-2** illustrates the previous monitoring locations of the City-wide assessment in relation to the Project corridor.

[1] Communication: Ray Williams, EPA 7th February 2006

Figure 2-2 Water Quality Monitoring Locations



Enoggera Creek and Kedron Brook water quality results from the City-wide assessment are evaluated against the BCC WQO, EPP(Water) WQO and the ANZECC WQO which are summarised in **Table 2-1**.

Table 2-3 Water Quality Objectives Applicable to the Project

Water Quality Indicator		BCC		EPP(Water)		ANZECC	
		Fresh water	Estuarine	Mid and Upper Estuarine	Fresh water	Lowland River	Estuaries
Chlorophyll-a (µg/L)		8	10	10	8	5	4
TP (µg/L)		70	70	60	70	50	30
FRP (µg/ L)		35	25	N/A	N/A	20	5
Organic N		500	380	N/A	N/A	N/A	N/A
SS (mg\L)		15	30	30	15	N/A	N/A
TN (µg/L)		650	450	450	650	500	300
NO_x (µg/L)		130	25	N/A	N/A	40	15
NH_4 (µg/L)		35	40	N/A	N/A	20	15
Turbidity (NTU)		20	20	20	20	50	10
DO % Sat	Lower	80	80	80	80	85	80
	Upper	105	100	100	105	110	110
pH	Lower	6.5	6.5	6.5	6.5	6.5	7.0
	Upper	8.5	8.5	8.5	8.5	8.0	8.5

Table Note: DO – Dissolved Oxygen; Organic N – Organic Nitrogen; NA – Not Available; FRP – Filterable Reactive Phosphate; TN – Total Nitrogen; TP – Total Phosphorus; NOx – Oxides of Nitrogen; NH4 – Ammonium; % Sat - % Saturation; SS – Suspended Solids

2.5.1 Enoggera Creek

Water quality results from the City-wide assessment evaluated against the BCC WQO are summarised in **Table** 2-4. Values for each sampling site and median values for each parameter are listed in Appendix A.

Table 2-4 Enoggera Creek WQ Evaluation with BCC WQO

Parameter	Site 17 Median Value - Estuarine	Site 18 Median Value - Estuarine	Site 19 Median Value - Estuarine
Organic N	Met	Not Met	Not Met
NH4	Met	Met	Not Met
NOx	Not Met	Not Met	Not Met
TN	Not Met	Not Met	Not Met
FRP	Not Met	Not Met	Not Met
TP	Not Met	Not Met	Not Met
Chlorophyll-α	Met	Met	Met
SS	Met	Met	Met
Turbidity	Met	Met	Met
pH	Met	Met	Met
DO	Met	Not Met	Met

Table Note: Notes: Data period: October 1999 – May 2002. Median calculated from all available data (0.2m depth)

Table 2-4 indicates overall non-compliance with BCC WQO, specifically for nitrogen and phosphorous components indicating poor water quality. The median values for chlorophyll-*a*, SS, turbidity and pH however, met the guidelines at all three Enoggera Creek monitoring sites.

Water quality results from the City-wide assessment evaluated against EPP(Water) are summarised in **Table 2.5**. Values for each sampling site and median values for each parameter are listed in Appendix A.

Table 2-5 Enoggera Creek WQ Evaluation with EPP(Water)

Parameter	Site 17 Median Value - Estuarine	Site 18 Median Value - Estuarine	Site 19 Median Value - Estuarine
TN	Not Met	Not Met	Not Met
TP	Not Met	Not Met	Not Met
Chlorophyll-α	Met	Met	Met
Turbidity	Met	Met	Met
SS	Met	Met	Met
pH	Met	Met	Met
DO	Met	Not Met	Met

Table Note: Data period; October 1999 – May 2002. Median calculated from all available data (0.2m depth).

Table 2-5 indicates overall non-compliance with EPP(Water), specifically for nutrients indicating poor water quality. The median values for turbidity, SS, chlorophyll-*a* and pH, however, met the guidelines at all three Enoggera Creek monitoring sites.

Water quality results from the City-wide assessment is evaluated against the ANZECC WQO are summarised in **Table 2-6**. Values for each sampling site and median values for each parameter are listed in Appendix A.

Table 2-6 Enoggera Creek WQ Evaluation with ANZECC WQO

Parameter	Site 17 Median Value - Estuarine	Site 18 Median Value - Estuarine	Site 19 Median Value - Estuarine
NH4	Not Met	Not Met	Not Met
NOx	Not Met	Not Met	Not Met
TN	Not Met	Not Met	Not Met
FRP	Not Met	Not Met	Not Met
TP	Not Met	Not Met	Not Met
Chlorophyll-α	Met	Not Met	Not Met
Turbidity	Not Met	Not Met	Not Met
pH	Met	Met	Met
DO	Met	Not Met	Met

Table Note: Data period: October 1999 – May 2002. Median calculated from all available data (0.2m depth).

Table 2-6 indicates overall non-compliance with ANZECC WQO, specifically for nitrogen and phosphorous indicating poor water quality. The median values for pH, however, met the guidelines at all three Enoggera Creek monitoring sites.

In comparison to the BCC WQO, the EPP(Water) and the ANZECC WQO, Enoggera Creek's water quality is considered poor. Most parameters at the three sites exceeded the relevant guideline objectives. Nitrogen and phosphorous consistently were non-compliant with all guidelines.

2.5.2 Kedron Brook

Water quality results from the City-wide assessment evaluated against the BCC WQO are summarised in **Table 2-7**. Values for each sampling site and median values for each parameter are listed in Appendix A.

Table 2-7 Kedron Brook WQ Evaluation with BCC WQO

Parameter	Site 8 Median Value - Estuarine	Site 9 Median Value - Freshwater	Site 10 Median Value - Freshwater	Site 11 Median Value - Freshwater	Site 12 Median Value - Freshwater	Site 13 Median Value - Freshwater	Site 14 Median Value - Freshwater
Organic N	Not Met	Met	Met	Met	Met	Met	Met
NH4	Met	Met	Met	Met	Met	Met	Not Met
NOx	Met	Met	Met	Met	Not Met	Met	Met
TN	Met	Met	Met	Met	Met	Met	Met
FRP	Not Met	Met	Met	Met	Met	Met	Met
TP	Not Met	Met	Met	Met	Met	Met	Met
Chlorophyll-α	Met	Met	Met	Met	Met	Met	Met
SS	Met	Met	Met	Met	Met	Met	Met
Turbidity	Met	Met	Met	Met	Met	Met	Met
pH	Met	Met	Met	Met	Met	Met	Not Met
DO	Not Met	Met	Met	Met	Met	Not Met	Not Met

Table Note: Data period: October 1999 – May 2002. Median calculated from all available data (0.2m depth).

Table 2-7 indicates overall compliance with BCC WQO and good level of water quality. The median values for all parameters are met at most sites.

Water quality results from the City-wide assessment evaluated against the EPP(Water) are summarised in **Table** 2-8. Values for each sampling site and median values for each parameter are listed in Appendix A.

Table 2-8 Kedron Brook WQ Evaluation with EPP(Water)

Parameter	Site 8 Median Value - Estuarine	Site 9 Median Value - Freshwater	Site 10 Median Value - Freshwater	Site 11 Median Value - Freshwater	Site 12 Median Value - Freshwater	Site 13 Median Value - Freshwater	Site 14 Median Value - Freshwater
TN	Met	Met	Met	Met	Met	Met	Met
TP	Not Met	Met	Met	Met	Met	Met	Met
Chlorophyll-α	Met	Met	Met	Met	Met	Met	Met
Turbidity	Met	Met	Met	Met	Met	Met	Met
SS	Met	Met	Met	Met	Met	Met	Met
pH	Met	Met	Met	Met	Met	Met	Not Met
DO	Not Met	Met	Met	Met	Met	Not Met	Not Met

Table Note: Data period: October 1999 – May 2002. Median calculated from all available data (0.2m depth).

Table 2-8 indicates overall compliance with EPP(Water) and good level of water quality. The median values for all parameters are met at most sites. Site 14 however had low pH and DO values.

Water quality results from the City-wide assessment evaluated against the ANZECC WQO are summarised in **Table 2-9**. Values for each sampling site and median values for each parameter are listed in Appendix A.

Table 2-9 Kedron Brook WQ Evaluation with ANZECC WQO

Parameter	Site 8 Median Value - Estuarine	Site 9 Median Value - Freshwater	Site 10 Median Value - Freshwater	Site 11 Median Value - Freshwater	Site 12 Median Value - Freshwater	Site 13 Median Value - Freshwater	Site 14 Median Value - Freshwater
NH4	Met	Met	Met	Met	Met	Met	Not Met
NOx	Met	Met	Met	Met	Not Met	Met	Met
TN	Not Met	Met	Met	Met	Met	Met	Met
FRP	Not Met	Met	Met	Met	Met	Met	Met
TP	Not Met	Met	Met	Met	Met	Met	Met
Chlorophyll-α	Not Met	Met	Met	Met	Met	Met	Met
Turbidity	Not Met	Met	Met	Met	Met	Met	Met
pH	Met	Met	Met	Met	Met	Met	Not Met
DO	Met	Met	Met	Met	Met	Not Met	Not Met

Table Note: Data period: October 1999 – May 2002. Median calculated from all available data (0.2m depth).

Table 2-9 indicates overall compliance with ANZECC WQO. The median values for all parameters are met at most sites. TP however exceeds the objectives at all sites and DO is below the objective for the sites in the upper reaches of the study area.

In comparison to the BCC WQO, the EPP(Water) and the ANZECC WQO, Kedron Brook's water quality is considered average. Most parameters at the seven sites were within the relevant guideline objectives with some exceptions. The most notable site was Site 8 with consistent non-compliance. Site 8 is located in the estuarine stretch of the waterway and is subject to tidal fluctuations that may have contributed to the high values for

nitrogen, phosphorous and turbidity. This is due to the fact that any estuary can be described as a nutrient trap, physically and biologically. Retention and rapid recycling of nutrients by benthos, formation of organic aggregates and detritus and the recovery of nutrients from deep sediments by microbial activity create a self-enriching system. Pollution, including agricultural runoff (fertilisers) also accumulates within the estuary and as a result elevates the nutrient concentrations.

2.6 Document Review

2.6.1 Healthy Waterways Partnership EHMP

The Ecosystem Health Monitoring Programme (EHMP) is one of the most comprehensive marine, estuarine and freshwater monitoring programs in Australia. It delivers a regional assessment of the ambient ecosystem health for the 18 major catchments in SEQ.

Water quality monitoring in the lower Brisbane River catchment occurs on a regular basis through the EHMP, which is facilitated by the Moreton Bay and Catchment Partnership. The EHMP is a regional program involving the EPA, DNRM, local councils and research organisations.

The EHMP Annual Report 2002-2003 states that the tributaries of the lower Brisbane River, including Enoggera Creek and Kedron Brook are generally in poor condition. Physical and chemical indicators reflected moderate to good water quality. Water quality differed between seasons with lowered values for DO minimum in spring as opposed to autumn, and higher conductivities in spring than autumn. Heavy metals are not monitored within the EHMP.

Since 2000, Healthy Waterways have released Annual Report Cards, which indicate the level of water quality in each catchment, as illustrated in **Table 2-10**.

Table 2-10 EHMP Annual Report Card Summary

Year	Catchment Description	Assessment	Grade
2000	Brisbane River	consistently high turbidity high sediment and nutrient loads	D
2001	Brisbane River	massive increase in turbidity during flood highest sediment and nutrient loads in region	D-
2002	Lower Brisbane River	most creeks in fair to poor condition creeks are chocked with introduced weeds	D
2003	Lower Brisbane River	streams in generally poor conditions non-native dominate fish communities invertebrate communities reflect moderate to poor stream health	F

The information available from the EHMP Annual Report Cards and the Annual Reports consists of analysed data and does not contain raw data.

24-hour period changes in water temperature, like rates of production and respiration were generally low in Brisbane's creeks. The Annual EHMP assessment states the riparian vegetation present at most sites, albeit

woody weeds, limits natural light penetration and buffer temperature changes, and prevents the health of these streams from diminishing further.

2.6.2 City Wide Assessment of Water Quality in Brisbane's Creeks

A City-wide assessment of water quality in Brisbane City creeks was conducted by the EPA and BCC, between October 1999 – March 2000. Results were assessed for a number of water quality indicators in terms of compliance with BCC WQO.

The City-wide assessment covered seven sites in Kedron Brook and three sites in Enoggera Creek, within the Project corridor (refer Figure 2.2).

Water quality was poor at the three study sites in Enoggera/Breakfast Creek, where concentrations of most nutrient fractions exceeded objectives, and DO concentrations were below objectives. The major source of nutrients at these sites is suggested to be water from the Brisbane River, via tidal exchange. Potential sources of nutrient loading within the Brisbane River catchment include anthropogenic sources (wastewater treatment and urban run-off) and natural processes (refer to Section 6.2). In contrast water quality was good at the three freshwater sites, although DO concentrations were below objectives.

In section 6 of this report, water quality of Kedron and Enoggera Creek from the City-wide assessment has been compared to appropriate guidelines.

2.6.3 Breakfast/Enoggera Creek Waterway Management Plan

To improve the management of Enoggera Creek, BCC has prepared a Waterway Management Plan (WMP). The WMP provides an integrated assessment of the Enoggera Creek catchment and its major tributaries (Ithaca and Fish Creeks) that will assist BCC to manage these waterways and their corridors.

The Breakfast/Enoggera Creek Waterway Health Assessment was undertaken to provide a technical basis for the WMP. The assessment was completed by BCC in June 2003. Ambient water quality sampling occurred at a number of sites within the catchment over a five-month period between September 2001 to February 2002. Two storm events (17 October and 7 December 2001) were also sampled during the study.

Key findings of the report indicate 3 sites in the study corridor vicinity (see **Figure 2-2**) rated as having poor water quality, with concentrations of TN, TP and lead exceeding BCC WQO. Fertilisers and detergents were suggested as the source of elevated nutrient levels, with lead likely coming from adjacent industrial activities.

The water quality assessment of these sites is consistent with the findings of the BCC Breakfast/Enoggera Creek Waterway Health Assessment, with water quality assessed as poor due to elevated levels of TN and TP.

2.6.4 SEQ Regional Water Quality Management Strategy (Moreton Bay Waterways and Catchments Partnership, 2001)

The SEQ Regional Water Quality Management Strategy (MBWCP, 2001) water quality assessment for the Brisbane River estuary is summarised below.

Dieldrin is the main toxicant of concern, dieldrin concentrations in sediment exceeded the *ANZECC Ocean Disposal Guidelines Final Draft* (1988) maximum level at Breakfast Creek (Newstead House) and the screening level in eastern Moreton Bay. Dieldrin in water samples collected from Breakfast Creek ranged from 0.51 to 1.4 ng/L. These values are below the guideline for the protection of aquatic biota as specified in the ANZECC WQO (10 ng/L).

The study reported water quality in Enoggera Creek to be poor for high nutrient concentrations due to tidal exchange with the Brisbane River.

2.6.5 Brisbane River Water Resource Plan

The Water Resource Plan (WRP) for Brisbane River has not yet been completed. A draft WRP is expected in June 2006 with the final plan to be prepared by 2007 (DNRM *pers comm.*, 2006).

The *Water Act 2000* requires the preparation of WRP, and when necessary, resource operation plans, which ensure that water is equitably managed to preserve our quality of life and our aquatic ecosystems. A WRP details what the government aims to achieve for a catchments social, economic and environmental needs.

The WRP for Moreton Bay region (Brisbane River) will aim to achieve these objectives:

- Allow transparent sharing of water to protect environmental and human interests;
- Secure water entitlements for the life of the WRP;
- Ensure that new entitlements will be issued only if they can be sustained with out undue environmental harm;
- Establish a basis for water allocations in nominated areas to be permanently traded (transferred to another site or use), subject to important safeguards; and
- Protect the health of rivers and underground water reserves.

2.6.6 Kedron Brook Waterway Health Assessment

WBM Oceanics Australia was commissioned by BCC to compile a Waterway Health Assessment of Kedron Brook. The study objectives were to characterise the Brook, identify problems and assist in the development and prioritisation of management actions.

This study assessed the water quality, macroinvertebrate communities and riparian vegetation status of Kedron Brook between October 1998 and March 1999 and also reviewed existing water quality information. WBM Oceanics undertook monitoring at seven locations along Kedron Brook: Sandgate Road, Kalinga Park, Emerson Park, South Pine Road, Osborne Road, Dawson Road and Ferny Way.

Monitoring showed water quality in wet periods was much poorer than in dry conditions, with very high concentrations of bacteria, nutrients and SS and some metals concentrations. The general trend in metals across all sites was that dry weather surveys showed lower concentrations than wet weather surveys. Comparison of ambient water quality data with the desired EV of the creek (aquatic ecosystem protection, visual amenity,

secondary contact recreation and swimming) revealed that swimming objectives were not met throughout the creek, and secondary contact (ie canoeing) achievement was only moderate to poor. Aquatic ecosystem protection was generally good in the lower reaches, and poor in the upper reaches of the creek.

The study also illustrated riparian areas were highly disturbed and had relatively poor condition as a result of a variety of activities such as urbanisation, floodplain clearing and weed infestation.

Macroinvertebrate communities were studied on two occasions. Results showed poor to moderate status at all sites, with pool habitats in mid-creek being generally poorer than vegetated (macrophyte) areas. This may be due to poorer water quality in pools or increased scouring in the more exposed pool areas. The second survey showed depleted organism numbers, which was attributed to a recent flood.

2.7 Existing Environment Summary

Following a review of available literature, both waterways have been disturbed and are considered urban waterways. Previous water quality monitoring assessments of Enoggera Creek and Kedron Brook indicate variability throughout the physical, chemical and biological parameters, with various parameters exceeding the relevant guidelines particularly in Enoggera Creek. Overall, the two watercourses were given a poor rating of water quality. These watercourses although currently a disturbed ecosystem will be sensitive to impacts due to further disturbance. This may be in the form of high sediment loads, increased nutrient runoff and elevated toxicants involved in the construction and operation of road construction and transportation movement.

Water quality impacts can be mitigated providing appropriate measures are implemented and a holistic approach is adopted in relation to sustainable water quality management.

3. Impacts and Mitigation

This section provides an assessment of the potential impacts on surface water quality that may occur during both construction and operation of the Project and recommends practical management measures to mitigate against these impacts. The assessment is considered in terms of:

- Impacts from construction, worksites and spoil placement; and
- Impacts from operation and supporting infrastructure.

3.1 Enoggera Creek Potential Impacts

Potential impacts on Enoggera Creek for the Project include both direct and indirect impacts. Direct impacts include excavation and vegetation removal associated with constructing new bridges over Enoggera Creek. The key activities associated with direct potential impacts near Enoggera Creek are:

- Areas of cut and cover structure near drainage lines (CH800-900); and
- Construction of bridges and associated works over Enoggera Creek (CH500-600).

Indirect impacts include sedimentation and erosion, changes to water quality during construction and operation from road runoff and potential pollutants from vehicles. The quality of water leaving the construction site will differ to that experienced during the operational phase of the Project, and as such different management measures will be required.

The potential impacts on the natural and created environments caused by contamination of waters include the following:

- Degradation of the quality of runoff discharging to Enoggera Creek, Brisbane River and Moreton Bay;
- Contamination of underlying soils and eventually groundwater;
- Vegetation and fauna inhabiting surface water environments, including freshwater and estuarine and marine ecosystems; and
- Increased sedimentation and flooding.

3.1.1 Potential Construction Impacts

The potential sources of groundwater and/or surface water contamination during the Project construction, which will require appropriate measures to avoid or minimise potential water quality impacts, are as follows:

- Disturbance of acid sulfate soils (ASS);
- Sediment from disturbed areas;
- Disturbance of instream sediments in Enoggera Creek;
- Hydrocarbon or chemical leaks and small scale spill from vehicles;
- Hydrocarbon or chemical spills from storage areas;

- Discharges from temporary sewerage and site facilities;
- Storage and disposal of waste material including spoil placement; and
- Degradation of EV associated with loss of riparian vegetation.

The potential for soil erosion and sedimentation is the main construction related impact. This generally occurs after vegetation removal and/or during excavation and earthworks. Sediment is transported offsite by runoff into the drainage network, into receiving waters and onto adjacent properties.

Increased sedimentation from earthworks, hazardous/chemical substances (such as hydrocarbons from oil spills, asphalt prime, solvents, cement slurry and wash waters) and litter are potential pollutants if not managed properly. Eutrophication (the process of excessive nutrient enrichment) of receiving waters often stems from nitrogen and phosphorus bound to the surface of deposited soil particles. This over enrichment of a water body with nutrients can result in excessive growth of organisms (ie blue/green algae) and depletion of oxygen within the water column. This can impact upon waterways by increasing turbidity, reducing aesthetics and amenity of an area, alter water quality due to increased nutrients or pollutants associated with sediment and impact the flora and fauna communities. Acid drainage (from ASS) is a potential impact that can impact upon groundwater and surface water quality.

The following potential impacts are discussed in other sections of the EMP:

- ASS and contaminated soils (refer Chapter 6)
- Groundwater quality (refer Chapter 7); and
- Downstream aquatic values (refer Chapter 11).

3.1.2 Potential Operational Impacts

Traffic modelling for this EIS indicates that when constructed, the Project will carry a higher volume of traffic than surrounding roads do currently. This means there will be an increase in impact on the surrounding environment including the surface water quality.

The key locations where potential impacts may occur from operation are areas where runoff from the Project can enter Enoggera Creek and drainage lines (including but not limited to CH600-900).

The operational impacts of road runoff include elevated levels of sediment, heavy metals, petroleum hydrocarbons and polynuclear aromatic hydrocarbons. Motor vehicles are the predominant source of road runoff pollutants. Secondary contributors include gross pollutants from motor vehicle users and other users within the road catchment, pavement wear, fertilisers, pesticides and atmospheric sources. These potential contaminants result from a combination of the breakdown, spillage and normal operational emission of automotive components. These include tyres, clutch and brake linings, hydraulic fluids, automotive fuels or lubricants, particulates from exhaust emissions and materials (eg soils, mud and litter) tracked, carried, washed, blown or thrown from the under body or payload of vehicles. Also present are windblown soils and vegetative matter from roadside plantings and vegetation.

Many of the potential chemical contaminants in road runoff (in particular metals and some lubricants) become bound or strongly adsorbed to the soil particles. Therefore whilst the quantities of sediment and soil particles lost from developed road surfaces are much smaller than comparable roads undergoing construction, the pollutants exported from the roadway catchment in runoff may potentially be of much higher toxicity and thus increase the risk to aquatic fauna.

There is also an elevated potential for a chemical/fuel spill to occur. A chemical/fuel spill has the potential to cause significant damage to the terrestrial and downstream waterways, and public health. The potential environmental damage from a spill may be long term and, in the case of groundwater, the effects may persist for many years.

The Project during the operational phase has the potential to effect water quality within Enoggera Creek and downstream waterways. The identified potential impacts are:

- Elevated levels of sediment, heavy metals, petroleum hydrocarbons and polynuclear aromatic hydrocarbons due to increased volume of motor vehicles;
- Gross pollutants from motor vehicle users and other users within the road catchment, and
- Increase nutrient loads from fertilisers, pesticides and atmospheric sources.

Provided mitigation strategies are developed the potential environmental impacts identified above are likely to be minimised.

3.2 Kedron Brook Potential Impacts

Direct impacts to Kedron Brook include vegetation removal and erosion and sedimentation associated with new bridges, widening bridges and culvert extensions.

The key locations for potential construction and operation related impacts include areas close to creeks and drainage lines:

- The construction of bridges over Kedron Brook (CH3800-4000); and
- Cut and covers and transition structures (CH3600-3800, 4000-4400 and 5900-6900).

Potential indirect impacts include sedimentation and erosion, changes to water quality during construction and operation from road runoff, and potential pollutants from vehicles. The quality of water leaving the site during the construction phase will differ to that experienced during the operation phase of the Project, and as such different management measures will be required.

3.2.1 Potential Construction Related Impacts

The potential sources of groundwater and/or surface water contamination during the Project construction, which will require appropriate measures to avoid or minimise potential water quality impacts, are as follows:

- Disturbance of ASS;
- Sediment from disturbed areas;
- Disturbance of instream sediments in Kedron Brook and tributaries;
- Hydrocarbon or chemical leaks and small scale spill from vehicles;
- Hydrocarbon or chemical spills from storage areas;
- Discharges from temporary sewerage and site facilities;
- Storage and disposal of waste material including spoil placement; and
- Loss of riparian vegetation

Details of the potential impacts are provided in Section 3.1. The following potential impacts are discussed in other sections of the EMP:

- ASS and contaminated soils (refer Chapter 6);
- Decrease in groundwater quality (refer Chapter 7); and
- Decrease in downstream aquatic values (refer Chapter 11).

3.2.2 Potential Operation Related Impacts

The potential operational impacts from road runoff are provided in Section 3.1.2.

The management of stormwater from the pavement in this section is an important issue due to the area being on a floodplain and the potential for runoff and associated contaminants to easily enter waterways.

3.3 Summary of Potential Impacts

Overall, existing water quality in the two watercourses was given a poor rating of water quality (refer Section 2.7). These watercourses although currently disturbed ecosystems, will be sensitive to further disturbance. This may be in the form of high sediment loads, increased nutrient runoff and elevated toxicants as a result of the construction and operational phases of the Project. Therefore the potential impacts from the Project will contribute to worsen the water quality within these systems unless sufficient mitigation measures are implemented.

The large quantity of earthworks during construction near drainage lines and creeks has the potential to increase turbidity and vegetation removal on riverbanks has the potential to promote sedimentation and erosion. These activities could potentially supply waterways with nutrients and pollutants attached to sediment, which would further degrade water quality and impact upon flora and fauna.

To ensure that potential impacts are minimised, mitigation measures need to be implemented for all phases of the Project as discussed below.

3.4 Mitigation Measures

3.4.1 Design

A number of management options exist for the management of road runoff during the operational phase of the Project. The potential physical, chemical and biological impact of the Project from road runoff entering a receiving environment, depends heavily upon the contaminants in the runoff. Effective treatment measures for road runoff include source reduction (eg emissions from cars) and other roadside management practices (which is outside the scope of this EMP) and stormwater design controls that remove some pollutants from runoff prior to discharge into a waterway.

A high level of water quality treatment control is required at areas that represent the highest risk of decreasing water quality and waterway values. These areas are identified by development and changes to the surrounding environment, proximity to sensitive receiving environment and the likelihood of contaminants entering waterways. For the Project, areas requiring high level treatment control include:

- Pavement runoff discharged into Enoggera Creek and Kedron Brook and associated vegetation;
- Culvert extensions located along route;
- The Southern Connection;
- The Gympie Road Connection;
- The East – West Connection;
- All proposed construction sites; and
- Spoil placement locations.

Major road projects typically have well defined drainage. As such, runoff can be relatively easily collected and treated prior to final discharge. Therefore road runoff generated should be targeted for treatment prior to discharge to the environment.

Water Sensitive Urban Design (WSUD) integrates water cycle management into urban planning and design. This is the preferred approach by most local councils to stormwater treatment and management. By using a number of stormwater management measures in a sequence, or “treatment train” approach, the overall performance of a water quality treatment system is improved. The optimum treatment train approach utilises primary, secondary and tertiary treatment devices in succession. A primary device removes gross pollutants and coarse sediment, a secondary device removes finer sediment and pollutants while a tertiary device removes extremely fine or soluble material. A variety of stormwater management measures can be incorporated into the design to create a treatment train. For appropriate water quality discharge limits, refer to ANZECC 2000)

The following stormwater management measures should be incorporated and further developed as part of the detail design of the Project:

- Grassed/vegetated swales located alongside roads and ramps;
- Batter slopes to be grassed/vegetated and rock check dams be installed where appropriate;

- Permanent settlement ponds and detention basins to be constructed if required at key locations along the route;
- All permanent water quality treatment control devices must be designed for the adequate control of pollution and sediment and other coarse materials in the 2 year Average Recurrence Interval peak flow (minimum), and also designed for the stability of these devices in the 50 year Average Recurrence Interval peak storm event;
- Gross pollutant traps to be installed at key locations along the route;
- Oil/grit separators installed at key locations to remove hydrocarbon and coarse sediment before entering further treatment train options;
- Planning and development of specific fuelling sites, concrete or bitumen waste containment areas and installation of temporary sediment basins; and
- First flush surface runoff from new bridge decks will not be directly discharged into any roadway below or into any stream or watercourse, but will be diverted to the end of the structure, collected and treated to conform to the requirements of the design WQO in Table 3.1.

3.4.2 Construction

During construction, the management of drainage is the most critical aspect of maintaining water quality. A range of erosion and sediment control devices, including sedimentation basins, should be utilised during the construction phase. During the construction phase of the Project, it will be important to implement stringent erosion and sediment control devices in higher risk areas. These areas include but are not limited to all creek crossings, areas with steep slopes and other areas of construction and excavation (refer to Section 3.1.1).

Piling operations present challenges for sediment erosion and control often due to the limited space available for removal and/or containment of excavated materials, particularly where piling is located within or adjoining an existing drainage line or watercourse. In such instances, the following should be implemented:

- Isolation of the working area by temporary fencing, bunding, or sheetpiling to prevent the loss of erodable soils to surrounding receiving waters or drains; and
- Alternative drainage or flow bypass mechanisms such as pipes, culverts or geofabric liners may be temporarily required to divert drainage flows through the workspace whilst preventing or minimising their erosive potential on unvegetated soils surrounding piling operations.

3.4.3 Construction Water Quality Monitoring Program

A water quality monitoring program will need to be implemented during the construction phase to ensure that WQO are met and that potential impacts to water quality are monitored and mitigated during construction. Replicate water samples should be collected from sampling sites upstream and downstream of the construction area. Recommended sites are listed below, however, if sampling sites are located a reasonable distance upstream and downstream from construction areas (ie between 100m-200m) they will be satisfactory.

Samples should be taken on two occasions (minimum 2-week interval) at the sampling sites detailed below prior to commencement of construction to provide additional background data. One occasion should follow a rainfall event where possible. Monitoring should take place fortnightly and during or immediately following storm events equal to or greater than 25mm/hour.

Recommended monitoring points are as follows:

- Enoggera Creek:
  - One sample 100-200m upstream and one sample 100-200m downstream of CH700 where it crosses Enoggera Creek;
- Kedron Brook:
  - One sample 100-200m upstream and one sample 100-200m downstream of CH3900 where it crosses Kedron Brook;
  - One sample 100-200m upstream and one sample 100-200m downstream of CH6400, where construction of the Sandgate Road Connection occurs;
- Additional monitoring points should be sampled by an appropriately qualified person if visual evidence of site impacts extends beyond these points; and
- If measured levels exceed the recommended water quality guidelines, then the contractor should identify the point source and implement strategies to achieve an acceptable downstream water quality.

3.4.4 Operation

Environmental impacts and associated controls to contain discharges resulting from emergency situations will be detailed in the EMP (Maintenance).

All runoff water from the structures to be constructed should be collected and treated using a treatment train approach incorporating gross pollutant traps, oil/water separators, sediment basins and other properly constructed and/or configured treatment devices such as grassed filter strips, swale drains and bioretention basins. The precise nature of such treatment devices will be a function of locally specific factors such as access to stormwater infrastructure, available space, and maintenance costs.

4. Conclusions

Current water quality within the waterways of the Project is considered to be in poor condition. Construction and operational impacts from the Project may be minimised with the effective implementation of sediment and erosion control devices, especially in high risk areas along the Project route, and the implementation of other stringent mitigation measures. Impact on the aquatic receiving environments from stormwater discharges may be minimised due to the implementation of appropriate stormwater treatment devices along the length of the Project route.

Direct impact to the water quality during construction would be short term within and adjacent watercourses. Impacts during operation may be minimised with the implementation of stormwater treatment devices that will reduce the amount of nutrients and pollutants entering waterways. Monitoring programs will ensure that the EV of Kedron Brook and Enoggera Creek are maintained.

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Appendix A Water Quality Summary

Surface Water Report
Airport Link
Raw Data Site 14

LOCATION_NAME Fresh Water	SURVEY DATE	Nitrogen (organic) as N (ug/L)	Nitrogen (ammonia) as N (ug/L)	Nitrogen (oxidised) as N (ug/L)	Nitrogen (total) as N (ug/L)	Phosphorus (dissolved reactive) as P (ug/L)	Phosphorus (total) as P (ug/L)	Chlorophyll-a (ug/L)	Solids (mg/L)	Turbidity (NTU)	pH (Unit)	Oxygen per cent saturation (%)
Median		190	71.5	17	271.5	2	29	1.9873	12.75	17	6.275	31.75
BCC	Upper	500	35	130	650	35	70	8	15	20	8.5	105
	Lower	-	-	-	-	-	-	-	-	-	6.5	80
EPP(Water)	Upper	N/A	N/A	N/A	650	N/A	70	8	15	20	8.5	105
	Lower										6.5	80
ANZECC	Upper	N/A	20	40	500	20	50	5	N/A	50	8	110
	Lower	N/A									6.5	85

LATITUDE_GDA9	LONGITUDE_GDA94
-27.399722	152.934167