# Airport Link

## Phase 2 – Detailed Feasibility Study

CHAPTER 8

SURFACE WATER QUALITY

- October 2006

# Contents

# 8. Surface Water Quality

*This Chapter addresses surface water aspects of Section 5.3 of the Terms of Reference; groundwater management were addressed separately in Chapter 6. A detailed technical paper on surface water quality is provided as Technical Paper No 4 – Surface Water Quality in Volume 3 of the EIS.*

*Watercourses in and adjacent to the study corridor are described in the context of their catchment areas. The quality of water in these waterways is assessed from past or existing monitoring programs. Potential impacts on the Environmental Values of the waterways are assessed and Water Quality Objectives are defined in line with existing local, state and national guidelines. Mitigation measures and/or management strategies are defined for identified potential negative impacts.*

## 8.1 Description of Existing Environment

### 8.1.1 Description of Waterways

The waterways intersecting the study corridor that could be affected by the construction and/or operation of the project and their catchments are shown in **Figure 8-1**. These are:

- Enoggera Creek; and
- Kedron Brook.

#### Enoggera Creek

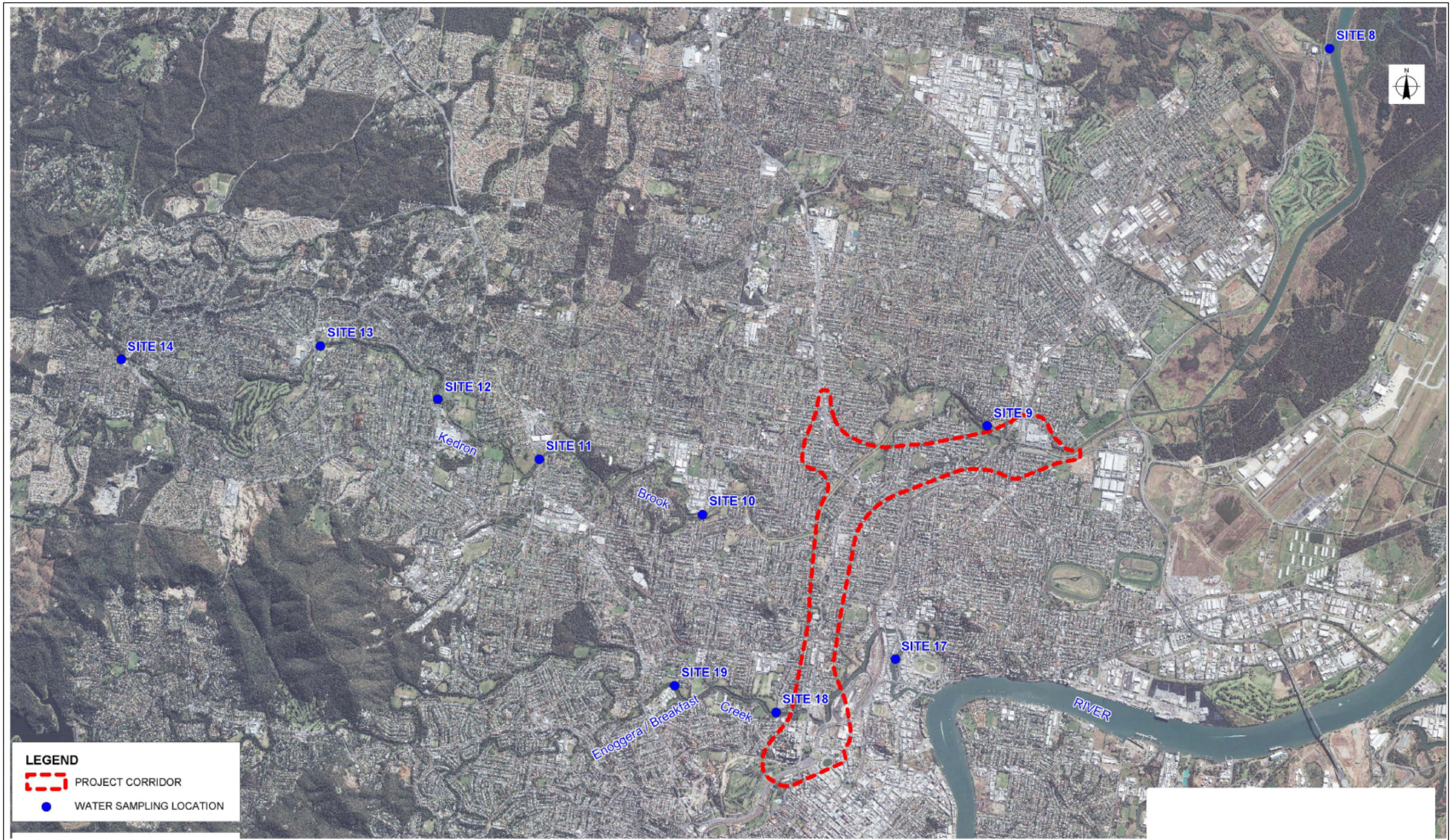
The Enoggera Creek catchment covers approximately 90km$^2$. Upstream of Hudson Road the creek is Enoggera Creek, whereas downstream to Brisbane River it is known as Breakfast Creek. The main channel is approximately 39km long, originating in Brisbane Forest Park and discharging into the Brisbane River at Newstead. The catchment comprises several tributaries, the largest of which are Ithaca and Fish Creeks.

The upper catchment of Enoggera Creek is located within Brisbane Forest Park and is predominantly vegetated by a diverse range of vegetation types. Downstream of the Enoggera Reservoir to Lutwyche Road land use is predominantly urban residential, with parkland adjoining most of the waterway. Ithaca Creek drains the eastern face of Mount Coot-tha and progresses through highly urbanised Bardon and Ashgrove before joining with Enoggera Creek in Kelvin Grove. Enoggera/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. Land use in the lower reaches of Enoggera Creek, where it traverses the study corridor, is predominantly commercial and industrial.

#### Kedron Brook

The Kedron Brook catchment covers over 110km$^2$ and extends into the Pine Rivers Shire in its upper section. It is dominated by urban land use, but includes large areas of remnant waterway vegetation in Brisbane Forest Park, Teralba Park, Grinstead Park and the Boondall Wetlands (EPA *et al*, 2004).

Kedron Brook is predominantly a natural waterway that rises in the D'Aguilar Ranges on Camp Mountain and Ferny Hills, flows through Arana Hills, Michelton, Everton Park, Grange, Wooloowin and Nudgee urban areas to enter Moreton Bay, to the south of the Boondall wetlands, near Nudgee Beach. The uppermost sections of the catchment are ephemeral gullies. Cedar Creek, the only significant tributary, joins Kedron Brook at Ferny Grove. Natural vegetation has been fragmented into small remnants, often isolated by urban development. Tidal influence extends upstream to just west of Sandgate Road.

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**AIRPORT LINK - Figure 8-1**

**Water Quality Monitoring Sites**

0 2.5km

Scale 1:50,000

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Airport Link

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JOINT VENTURE

Downstream sections of Kedron Brook have been diverted a number of times since European settlement. Early flood mitigation works were undertaken from where Sandgate Road crosses it at Clayfield to where it met up with the Serpentine Creek system. When the new Brisbane Airport was built in the early 1970s, the Serpentine Creek system was filled in, and Kedron Brook was diverted into a specially built floodway, directed just to the south of Nudgee Beach. In May 1997, the floodway was re-dredged to its original profile, to assist in flood mitigation.

Upstream of Sandgate Road has also changed to varying degrees. Through Kalinga Park, the Kedron Brook alignment is much as it always was. However, from Shaw Park to its headwaters, it varies from “natural looking” to drain-like.

### Study corridor

As shown on **Figure 8-1** the study corridor encompasses two sections of the lower reaches which are not natural waterway:

- In the vicinity of the north-western connection at Kedron the stream was straightened and contained in concrete channelling as flood mitigation measures after 1974; and
- In the vicinity of the north-eastern connection, Kedron Brook east of Sandgate Road underwent extensive earthworks in early flood mitigation measures to straighten and channel the brook which resulted in this section becoming known as Schulz Canal.

## 8.1.2 Environmental Values and Water Quality Objectives

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

The National Water Quality Management Strategy (NWQMS) and *Environmental Protection (Water) Policy 1997* (Water EPP) promote the sustainable management of water resources by determining EVs (or uses) of waterways and corresponding water quality objectives (also known as targets) for different indicators of water quality (i.e. pH, nutrients and toxicants). Environmental values for Brisbane waterways have been identified by the Environmental Protection Agency (EPA, 2006). These EVs are summarised in **Table 8-1**. To coincide with the EVs, the EPA has developed Water Quality Objectives (WQOs) and these are illustrated in **Table 8-2** as applicable to water types within the Airport Link study corridor.

### Table 8-1 Environmental Values for south-east Queensland (ρ=present)

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

**Table 8-2 Water Quality Objectives for Waters in the Study Corridor**

| Environmental Value | Parameter | Kedron Brook at the Northwestern Connection – Freshwaters (within Brisbane City) | Enoggera Creek and Kedron Brook at the Northeastern Connection - Mid and upper estuary (within Brisbane City) |
|---|---|---|---|
| Aquatic Ecosystems –slightly to moderately disturbed | Physico-chemical | ▪ pH – 6.5-8.5<br>▪ Dissolved Oxygen – 80-105 % saturation<br>▪ Organic matter – NR<br>▪ Total phosphorus – 70 µg/L<br>▪ Total nitrogen – 650 µg/L<br>▪ Chlorophyll-$\alpha$ – 8 µg/L<br>▪ Turbidity – 20 NTU<br>▪ Secchi depth > 0.2 m<br>▪ Suspended solids:<br>  ▪ 15 mg/L for combined wet and dry periods<br>  ▪ 90%ile <100 mg/L for wet weather periods | ▪ pH – 6.5-8.5<br>▪ Dissolved Oxygen – 80-100 % saturation<br>▪ Organic matter – NR<br>▪ Total phosphorus – 60 µg/L<br>▪ Total nitrogen – 450 µg/L<br>▪ Chlorophyll-$\alpha$ – 10 µg/L<br>▪ Turbidity – 20 NTU<br>▪ Secchi depth > 0.5 m<br>▪ Suspended solids<br>▪ 30 mg/L for combined wet and dry periods<br>▪ 90%ile <100 mg/L for wet weather periods |
| | Toxicants in Water | ▪ Total aluminium – 5 µg/L if pH<6.5 or 100 µg/Lif pH>6.5<br>▪ Total iron – 300-1000 µg/L (depending on Fe(II) concentration#<br>▪ Total arsenic – 50 µg/L<br>▪ Total cadmium – 0.2-2 µg/L (depending on hardness) #<br>▪ Total chromium – 50 µg/L (if it is all chromium (VI)#)<br>▪ Total copper – 2-5 µg/L (depending on hardness #)<br>▪ Total nickel – 15-150 µg/L (depending on hardness #)<br>▪ Total lead – 1-5 µg/L (depending on hardness #)<br>▪ Total zinc – 5-50 µg/L (if iron not present as Fe(II)#)<br>▪ TPH – NR<br>▪ No visible oil films or odours<br>▪ PAH – 3 µg/L<br>▪ Total chlorine – 0.02 mg/L | ▪ Total aluminium – NR<br>▪ Total iron – NR<br>▪ Total dissolved iron – 0.5 µg/L if Secchi > 1m or NR if Secchi < 1m<br>▪ Total arsenic – 50 µg/L<br>▪ Total cadmium – 2 µg/L<br>▪ Total chromium – 50 µg/L<br>▪ Total copper – 5 µg/L<br>▪ Total nickel – 15 µg/L<br>▪ Total lead – 5 µg/L<br>▪ Total zinc – 50 µg/L<br>▪ TPH – NR<br>▪ Oils and grease – No visible films or odour<br>▪ PAH – 3 µg/L<br>▪ Total chlorine – 0.02 mg/L |
| | Toxicants in water, sediment and biota | as per AWQG (2000). | as per AWQG (2000). |
| | Litter/gross pollutants | No anthropogenic (man-made) material greater than 5mm in any dimension | No man-made material greater than 5mm in any dimension |
| | Riparian vegetation and habitat | Protect and restore consistent with BCC policy and plans | Protect and restore consistent with BCC policy and plans |
| Secondary and Visual Recreation | Objectives as per ANZECC 2000, including:<br>▪ Median faecal coliforms <1,000 organisms per 100 mL or median enterococci <230 organisms per 100 mL; and<br>▪ Water being free from:<br>  ▪ Floating debris, oil, grease and other objectionable matter;<br>  ▪ Substances that produce undesirable colour, odour, taste or foaming; and<br>  ▪ Undesirable aquatic life, such as algal blooms, or dense growths of attached plants or insects. | | |

| Environmental Value | Parameter | Kedron Brook at the Northwestern Connection – Freshwaters (within Brisbane City) | Enoggera Creek and Kedron Brook at the Northeastern Connection - Mid and upper estuary (within Brisbane City) |
|---|---|---|---|
| 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 100 mL. | | |
| Protection of the human consumer | Objectives as per ANZECC 2000 and *Food Standards Code,* Australian New Zealand Food Authority, 1996 and updates. | | |
| Primary contact recreation | Objectives as per ANZECC 2000 and Queensland Harmful Algal Bloom Operational Procedures (DNRM, 2004), including:<br>▪ Median faecal coliforms <150 organisms per 100 mL or median enterococci organisms <35 per 100 mL; and<br>▪ Secchi >1.2m (measured vertically). | | |
| 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). | | |
| Water Supply, Irrigation, Stock Watering, Farm Supply | N/A | | Objectives as per ANZECC 2000 |

**Table Note**: NTU – Nephelometric turbidity units. MPN – Most Probable Number. NR – No WQO level has been set as yet* - These WQOs are based on the ANZECC 2000 and reference site values from EPA, 2006.

### 8.1.3 Water Quality Monitoring Programs

#### Citywide Water Quality Monitoring Program

The EPA and BCC undertook the citywide water quality monitoring program (EPA, 2001b) in Brisbane's creeks October 1999 – May 2002. The citywide program covered seven sites in Kedron Brook and three sites in Enoggera Creek, within the study corridor. Monitoring occurred approximately 6 times a year at 0.2m depth. This programme is the most extensive spatial assessment of water quality that has been conducted in the Brisbane area.

#### Healthy Waterways Partnership EHMP

Water quality monitoring in the lower Brisbane River catchment occurs on a regular basis through the Ecosystem Health Monitoring Program (EHMP), which is facilitated by the Moreton Bay and Catchment Partnership. The EHMP, a regional program involving the EPA, DNRM, local councils and research organisations, is a comprehensive marine, estuarine and freshwater monitoring program that delivers a regional assessment of the ambient ecosystem health for the 18 major catchments in SEQ.

In the 2005 Report Card, the lower Brisbane Catchment, which includes Breakfast Creek, Kedron Brook and associated tributaries, received a D, which was an improvement from an F in the previous year. This improvement was due to changes in nutrient cycling and macroinvertebrate indicators, but the water quality in this catchment remains generally in poor condition. Physical and chemical indicators reflected moderate to good water quality. Water quality differed between seasons, with lowered values for minimum dissolved oxygen in spring compared with autumn, and higher conductivities in spring than autumn.

### Brisbane City Council Breakfast/Enoggera Creek Health Assessment

To improve the management of Breakfast/Enoggera Creek, Brisbane City Council (BCC) has prepared a draft Waterway Management Plan (WMP). 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 and includes ambient water quality sampling at 15 sites within the catchment for a five-month period between September 2001 and February 2002. Two storm events (17 October and 7 December 2001) were also sampled during the study.

Key findings of the report indicate all three sites in Breakfast Creek rated as having poor water quality, with concentrations of total nitrogen, total phosphorus and lead exceeding BCC Water Quality Objectives. Fertilisers and detergents were suggested as the source of elevated nutrient levels, with lead considered likely to have come from adjacent industrial activities.

### Kedron Brook Waterway Health Assessment

Brisbane City Council commissioned a Waterway Health Assessment of Kedron Brook (WBM Oceanics, 1999). The study examined the freshwater sections of the Brook over a six month period, including:

- Characterisation of water quality;
- A riparian vegetation assessment;
- Benthic ecology monitoring; and
- Development of a catchment pollutant export and instream water quality model.

Monitoring showed water quality in wet periods was much poorer than in dry conditions, with very high concentrations of bacteria, nutrients, suspended solids and some metals. Comparison of ambient water quality data with the desired Environmental Values 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 (i.e. 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.

Macroinvertebrate communities were described as poor to moderate at all sites, with pool habitats in mid-creek being generally poorer than vegetated (macrophyte) areas.

## 8.1.4 Water Quality Assessment

Data from the Environmental Protection Agency monitoring program (EPA, 2000b) were evaluated against the BCC Water Quality Objectives (BCC WQOs), Queensland Water Quality Guidelines 2005 (QWQGs) and the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC Guidelines), which are summarised in **Table 8-3**.

### Table 8-3 Water Quality Objectives applicable to the Airport Link Project

| Water Quality Indicator | | BCC | | QWQG | | | ANZECC | |
|---|---|---|---|---|---|---|---|---|
| | | Fresh water | Estuarine | Mid Estuarine | Upper Estuarine | Lowland Streams | Lowland River | Estuaries |
| Chlorophyll-a (цg/L) | | 8 | 10 | 4.0 | 8.0 | 5.0 | 5 | 4 |
| TP (цg/L) | | 70 | 70 | 25 | 30 | 50 | 50 | 30 |
| FRP (цg/ L) | | 35 | 25 | 6 | 10 | 20 | 20 | 5[j] |
| Organic N | | 500 | 380 | N/A | N/A | N/A | N/A | N/A |
| Suspended Solids | | 15 | 30 | N/A | N/A | N/A | N/A | N/A |
| TN (цg/L) | | 650 | 450 | 300 | 450 | 500 | 500 | 300 |
| $NO_x$ (цg/L) | | 130 | 25 | 10 | 15 | 60 | 40 | 15 |
| $NH_4$ (цg/L) | | 35 | 40 | 10 | 30 | 20 | 20 | 15 |
| Tubidity (ntu) | | 20 | 20 | 8 | 25 | 50 | 6-50 | 0.5-1.0 |
| DO % Sat | Lower | 80 | 80 | 85 | 80 | 85 | 85 | 80 |
| | Upper | 105 | 100 | 100 | 100 | 110 | 110 | 110 |
| pH | Lower | 6.5 | 6.5 | 7.0 | 7.0 | 6.5 | 6.5 | 7.0 |
| | Upper | 8.5 | 8.5 | 8.4 | 8.4 | 8.0 | 8.0 | 8.5 |

**Table Notes**:

NA – Not Available
FRP – Filterable Reactive Phosphate
DO – Dissolved Oxygen
TN – Total Nitrogen
TP – Total Phosphorus
NTU – nephelometric turbidity units
$NO_x$ – Oxides of Nitrogen
$NH_4$ – Ammonium
ug/L – micrograms per litre
% Sat – % Saturation

## Enoggera Creek

Water quality results from EPA (2000b) evaluated against the BCC WQOs are summarised in **Table 8-4**. The sample sites identified (17, 18 and 19) are shown in **Figure 8-1**.

### Table 8-4 Enoggera Creek WQ Evaluation with BCC WQOs

| Parameter | Site 17 Median Value | Site 18 Median Value | Site 19 Median Value |
|---|---|---|---|
| Nitrogen (organic) as N | Met | Not Met | Not Met |
| Nitrogen (ammonia) as N | Met | Met | Not Met |
| Nitrogen (oxidised) | Not Met | Not Met | Not Met |
| Nitrogen (total) as N | Not Met | Not Met | Not Met |
| Phosphorus (dissolved reactive) P | Not Met | Not Met | Not Met |
| Phosphorus (total) as P | Not Met | Not Met | Not Met |
| Chlorophyll-$\alpha$ | Met | Met | Met |
| Solids (Suspended) | Met | Met | Met |
| Turbidity | Met | Met | Met |
| pH | Met | Met | Met |
| Oxygen per cent saturation | Met | Not Met | Met |

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

**Table 8-4** indicates overall non-compliance with BCC WQOs, specifically for N and P components indicating poor water quality. The median values for chlorophyll-*a*, suspended solids, turbidity and pH however, met the guidelines at all three Enoggera Creek monitoring sites.

Water quality results from EPA (2000b) evaluated against QWQOs are summarised in **Table 8-5**.

### Table 8-5 Enoggera Creek WQ Evaluation with QWQOs

| Parameter | Site 17 Median Value | Site 18 Median Value | Site 19 Median Value |
|---|---|---|---|
| Nitrogen (ammonia) as N | Met | Not Met | Not Met |
| Nitrogen (oxidised) | Not Met | Not Met | Not Met |
| Nitrogen (total) as N | Not Met | Not Met | Not Met |
| Phosphorus (dissolved reactive) as P | Not Met | Not Met | Not Met |
| Phosphorus (total) as P | Not Met | Not Met | Not Met |
| Chlorophyll-$\alpha$ | Met | Not Met | Not Met |
| Turbidity | Met | Met | Met |
| pH | Met | Met | Met |
| Oxygen per cent saturation | Met | Not Met | Met |

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

**Table 8-5** indicates overall non-compliance with QWQOs, specifically for nutrients indicating poor water quality. The median values for turbidity and pH, however, met the guidelines at all three Enoggera Creek monitoring sites.

Water quality results from EPA (2000b) evaluated against the ANZECC Guidelines are summarised in **Table 8-6**.

### Table 8-6 Enoggera Creek WQ Evaluation with ANZECC Guidelines (2000) WQOs

| Parameter | Site 17 Median Value | Site 18 Median Value | Site 19 Median Value |
|---|---|---|---|
| Nitrogen (ammonia) as N | Not Met | Not Met | Not Met |
| Nitrogen (oxidised) | Not Met | Not Met | Not Met |
| Nitrogen (total) as N | Not Met | Not Met | Not Met |
| Phosphorus (dissolved reactive) P | Not Met | Not Met | Not Met |
| Phosphorus (total) as P | Not Met | Not Met | Not Met |
| Chlorophyll-$\alpha$ | Met | Not Met | Not Met |
| Turbidity | Not Met | Not Met | Not Met |
| pH | Met | Met | Met |
| Oxygen per cent saturation | Met | Met | Met |

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

**Table 8-6** indicates overall non-compliance with ANZECC Guidelines (2000) WQOs, specifically for nutrients indicating poor water quality. The median values for pH and dissolved oxygen, however, met the guidelines at all three Enoggera Creek monitoring sites.

In comparison with the BCC WQOs, the QWQG and the ANZECC guidelines, Enoggera Creek's water quality is considered poor. Most parameters at the three sites exceeded the relevant guideline objectives. Nutrients consistently did not comply with all guidelines.

## Kedron Brook

Water quality results from EPA (2000b) evaluated against the BCC WQOs are summarised in **Table 8-7**. The sample sites (8 – 14) are shown in **Figure 8-1**.

### Table 8-7 Kedron Brook WQ Evaluation with BCC WQOs

| Parameter | Site 8 Median Value | Site 9 Median Value | Site 10 Median Value | Site 11 Median Value | Site 12 Median Value | Site 13 Median Value | Site 14 Median Value |
|---|---|---|---|---|---|---|---|
| Nitrogen (organic) as N | Not Met | Met | Met | Met | Met | Met | Met |
| Nitrogen (ammonia) as N | Met | Met | Met | Met | Met | Met | Not Met |
| Nitrogen (oxidised) | Met | Met | Met | Met | Not Met | Met | Met |
| Nitrogen (total) as N | Met | Met | Met | Met | Met | Met | Met |
| Phosphorus (dissolved reactive) P | Not Met | Met | Met | Met | Met | Met | Met |
| Phosphorus (total) as P | Not Met | Met | Met | Met | Met | Met | Met |
| Chlorophyll-$\alpha$ | Met | Met | Met | Met | Met | Met | Met |
| Solids (Suspended) | Met | Met | Met | Met | Met | Met | Met |
| Turbidity | Met | Met | Met | Met | Met | Met | Met |
| pH | Met | Met | Met | Met | Met | Met | Not Met |
| Oxygen per cent saturation | Not Met | Met | Met | Met | Met | Not Met | Not Met |

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

**Table 8-7** indicates overall compliance with BCC WQOs and good level of water quality. The median values for all parameters are met at most sites.

Water quality results from EPA (2000b) evaluated against the QWQOs are summarised in **Table 8-8**.

### Table 8-8 Kedron Brook WQ Evaluation with QWQOs

| Parameter | Site 8 Median Value | Site 9 Median Value | Site 10 Median Value | Site 11 Median Value | Site 12 Median Value | Site 13 Median Value | Site 14 Median Value |
|---|---|---|---|---|---|---|---|
| Nitrogen (ammonia) as N | Met | Met | Met | Met | Met | Met | Not Met |
| Nitrogen (oxidised) | Met | Met | Met | Not Met | Met | Met | Met |
| Nitrogen (total) as N | Met | Met | Met | Met | Met | Met | Met |
| Phosphorus (dissolved reactive) as P | Met | Met | Met | Met | Met | Met | Met |
| Phosphorus (total) as P | Met | Met | Met | Met | Met | Met | Met |
| Chlorophyll-$\alpha$ | Met | Met | Met | Met | Met | Met | Met |
| Turbidity | Met | Met | Met | Met | Met | Met | Met |
| pH | Met | Met | Met | Met | Met | Met | Not Met |
| Oxygen per cent saturation | 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 only).

**Table 8-8** indicates overall compliance with BCC WQOs and good level of water quality. The median values for all parameters are met at most sites.

Water quality results from EPA (2000b) evaluated against the ANZECC Guidelines are summarised in **Table 8-9**.

### Table 8-9 Kedron Brook WQ Evaluation with ANZECC Guidelines (2000) WQOs

| Parameter | Site 8 Median Value | Site 9 Median Value | Site 10 Median Value | Site 11 Median Value | Site 12 Median Value | Site 13 Median Value | Site 14 Median Value |
|---|---|---|---|---|---|---|---|
| Nitrogen (ammonia) as N | Met | Met | Met | Met | Met | Met | Not Met |
| Nitrogen (oxidised) | Met | Met | Met | Met | Not Met | Met | Met |
| Nitrogen (total) as N | Not Met | Met | Met | Met | Met | Met | Met |
| Phosphorus (dissolved reactive) as P | Not Met | Met | Met | Met | Met | Met | Met |
| Phosphorus (total) as P | Not Met | Not Met | Not Met | Not Met | Not Met | Not Met | Not 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 |
| Oxygen per cent saturation | 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 only).

**Table 8-9** indicates overall compliance with ANZECC Guidelines (2000) WQOs. The median values for all parameters are met at most sites. Total phosphorus, however, exceeds the objectives at all sites and dissolved oxygen meets the objective for the sites in the upper reaches of the study area.

In comparison with the BCC WQOs, the QWQG and the ANZECC guidelines, 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 nutrients and turbidity.

## 8.2 Potential Impacts and Mitigation Measures

### 8.2.1 Potential Impacts

Potential impacts on receiving waterways may be either direct or indirect. Possible direct impacts may result from excavation works in or near drainage lines, including the southern connection work site, and the construction of works (bridges) over waterways. Possible direct impacts on Enoggera Creek include:

- Clearing for the southern connection work site;
- Excavation for cut and cover road structure near drainage lines at the southern connection; and
- Construction of bridges and associated works over Enoggera Creek.

Possible direct impacts to Kedron Brook include vegetation removal and erosion and sedimentation associated with the construction work site, new bridges, widening bridges and culvert extensions. Potential construction and operation related impacts include:

- Bridge construction at Gympie Road crossing of Kedron Brook; and
- Construction work sites and cut and cover and transition structures at the northwestern and northeastern connections.

Indirect impacts include water contamination due to sedimentation, erosion, changes to quality of road runoff during construction and operation and potential pollutants from vehicles. The quality of water leaving the construction site would differ from that leaving the same site during operation so different management measures will be required.

Potential impacts due to water runoff contamination include:

- Degradation of the quality (with sediment or pollutants) of water quality in the receiving waters;
- Contamination of underlying soils and groundwater; and
- Effects on vegetation and fauna inhabiting surface water environments, including freshwater, estuarine and marine ecosystems.

### Potential Construction Impacts

The potential sources of water contamination, which would require mitigation measures to avoid or minimise water quality impacts, are:

- Disturbance of acid sulphate soils;
- Sediment from disturbed areas;
- Disturbance of instream sediments;
- Hydrocarbon or chemical leaks and small scale spill from vehicles;
- Hydrocarbon or chemical spills from storage areas;
- Discharges from temporary sewerage and site facilities; and
- Storage and disposal of waste material including spoil placement.

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 may be 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/or phosphorus bound to the surface of deposited soil particles. This over-enrichment of a water body with nutrients can result in excessive growth of blue/green algae, which leads to depletion of oxygen within the water column. This can impact upon waterways by increasing turbidity, reducing aesthetics and amenity of an area, altering water quality due to increased nutrients or pollutants associated with sediment and affecting floral and faunal communities. Acid drainage (from acid sulphate soils) is a potential impact that can affect groundwater and surface water.

### Potential Operational Impacts

The potential impacts of surface road runoff to receiving waterways include elevated levels of sediment, heavy metals, petroleum hydrocarbons and/or polyaromatic hydrocarbons (PAH). 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 soil particles. Therefore, while 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.

The potential operational impacts from surface road runoff are the same for Kedron Brook and Enoggera Creek, although the management of stormwater from pavements of connecting roads outside the tunnels at the northwestern and northeastern connections is an important issue due to the area being on a floodplain and the potential for runoff and associated contaminants to easily enter waterways.

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

### Summary of Potential Impacts

Existing water quality in the two watercourses is rated as poor. These watercourses, although disturbed ecosystems, would be sensitive to further disturbance. This may be in the form of high sediment loads, increased nutrient runoff and elevated toxicants from construction and operation. Therefore potential impacts from the Airport Link Project have the potential to worsen the water quality within these systems, unless mitigation measures are implemented.

## 8.2.2 Mitigation Measures

### Design

A number of options exist for management of road runoff during operation of the Airport Link Project. The potential physical, chemical and biological impacts of the project from road runoff entering a receiving environment depends heavily upon the contaminants in the runoff. Effective measures for road runoff include stormwater design controls which remove some pollutants from runoff prior to discharge into a waterway.

Water treatment control is required at areas that represent the highest risk of decreasing water quality and waterway values. For the Airport Link Project, areas considered for treatment were:

- Pavement runoff discharged into Enoggera Creek and Kedron Brook;
- Culvert extensions located along the route;
- Southern Connection;
- North-western Connection;
- North-eastern Connection;
- Construction sites; and
- Spoil placement locations.

This road project would have a typically well defined drainage and, accordingly, runoff would be able to be collected and treated prior to final discharge. The following stormwater management measures would be considered for incorporation and further developed as part of the detail design of the Airport Link Project:

- Grassed/vegetated swales 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 where appropriate;

- All permanent water quality treatment control devices to be designed for the adequate control of pollution and sediment and other coarse materials in the 2 year Average Recurrence Interval (ARI) peak flow (minimum), and also designed for the stability of these devices in the 50 year ARI 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 water quality objectives in **Table 8-1**.

### Construction

During construction, drainage is the most critical aspect of maintaining water quality. A range of erosion and sediment control devices, including sedimentation basins, would be considered for use. During construction, appropriate erosion and sediment control devices would be provided in higher risk areas. These areas would include creek crossings, steep slopes and other areas of construction and excavation.

Piling operations present challenges for sediment erosion and control 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 would be considered for implementation, if appropriate:

- 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 which may be temporarily required to divert drainage flows through the workspace, whilst preventing or minimising their erosive potential on unvegetated soils surrounding piling operations.

A water quality monitoring program during construction would be established to measure compliance with water quality objectives and to enable potential impacts to water quality to be asessed and mitigated. An appropriate monitoring program is discussed in Technical Paper No. 4 – Surface Water Quality in Volume 2.

### Operation

Environmental impacts and associated controls to contain discharges resulting from emergency situations would be detailed in the Operational EMP.

All runoff water from new structures would be collected and treated using a treatment train approach that may incorporate elements selected from 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 would depend on locally specific factors such as access to stormwater infrastructure, available space, and maintenance costs. Devices would be designed to treat water to a standard outlined in **Table 8-2**.

The EPA supplied existing data available for analysis. Although useful for the analysis of physical and nutrient parameters, it is lacking in the analysis of toxicants. Road infrastructure is a large contributor of heavy metals and other toxicants to local waterways. The proposed project could impact on water quality in Kedron Brook and Enoggera Creek. Appropriate water quality monitoring programs will be established in consultation with relevant Government agencies. Any monitoring programs would need to follow the requirements of:

- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000*;
- *Queensland Water Quality Guidelines (Draft) 2006;* and
- *EPA Water Quality Sampling Manual 1999.*

## 8.3 Conclusions

Current water quality within the waterways adjacent to proposed Airport Link Project is considered to be poor. Further impacts from construction and operation of the Airport Link Project would, however, be minimised with effective implementation of sediment and erosion control devices and other mitigation measures. Impacts on the aquatic receiving environments would be minimised by appropriate stormwater treatment devices. Long term monitoring programs would contribute to maintenance of environmental values of Kedron Brook and Enoggera Creek.