North Central Waterwatch

Community Monitoring

Water Quality Data Report 2010

WATERWATCH North Central Communities Caring for Catchments

NORTH CENTRAL Catchment Management Authority Connecting Rivers, Landscapes, People

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Loddon River at Wombat State Forest (Stephen Malone Photography)
Miriam Rotstien at Trentham Falls (North Central CMA)
John and Ruth Penny at Salisbury West, Loddon River (North Central CMA)
Heather McNaught and Britt Gregory, QA/QC Week (North Central CMA)
David Merrick and Tamsin Byrne, Sutton Grange (North Central CMA)

Foreword

This Water Quality Data report has been developed for the North Central Catchment Management Authority (CMA) and community volunteers within the North Central CMA region. The report presents water quality data collected from over 100 sites in the North Central region by dedicated community members from January 2010 to January 2011.

I would like to take this opportunity to thank all community monitors for actively and enthusiastically participating in the North Central Waterwatch program. Your invaluable time, skills and knowledge have enhanced the journey for improving our natural waterways. The data you provide creates a link from a community perspective to natural resource managers (NRM). This vital link helps guide decision making and provides NRM with information about the trends and quality of our waterways.

Without these essential community volunteers, it would be impossible to collect such a wide range of data from such a large landscape due to costs, time and human resources. Therefore community volunteers involved in the North Central Waterwatch program help to provide invaluable data and quality information about North Central CMA catchments. This program also enables people in communities to develop the skills necessary to effectively contribute to NRM initiatives in terms of planning onground works.

Thank you again for a successful year of monitoring. I look forward to working with you all into the future, with the continued common goal of protecting our natural assets.

Cass Davis
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Executive Summary

The North Central CMA Waterwatch program is part of the state-wide community program. By being involved, community Waterwatch monitors contribute important regional scientific information about river health to the state-wide database.

In the North Central region, over 100 sites were monitored for water quality by 50 community members (individuals and Landcare groups) throughout the monitoring period; from January 1st 2010 to January 1st 2011. The monitoring data was then collated and compared to regional baseline water quality 'standards' – the North Central Waterwatch Water Quality General Guidelines (the Guidelines) – in order to determine a rating for each parameter. These ratings can range from 'degraded' to 'excellent'.

Analysis of the data collected indicates that the regional catchment water quality condition generally varies between good to poor when compared to the Guidelines.

In the Campaspe catchment, most parameters tested are good to fair. However, electrical conductivity and turbidity at one site each give a poor rating.

The Loddon catchment data reveals a generally good condition. However, electrical conductivity at two sites can be considered poor. Turbidity for all sites in the Loddon varies, although overall turbidity could be considered as poor.

Electrical conductivity and turbidity in the Avoca and Avon/Richardson catchments could be considered as poor. No records have been included for reactive phosphorus due to insufficient data collection; however, pH was considered good to excellent.

Introduction

The North Central CMA's Rivers, Creeks and Wetlands

The North Central Catchment Management Authority's (CMA) region is an area of diverse landscapes and land-use. Covering 13 per cent of the state it services the north central areas. The region is bordered by the Murray River to the north, the Great Dividing Range to the south and the Mt Camel range to the east, covering approximately three million hectares.

The region is rich in Indigenous and European cultural heritage. There are over 330,000kms of rivers and creeks in Victoria. The North Central CMA region contains 37 per cent of these within four major catchments: the Campaspe, Loddon, Avoca and part of the Avon/Richardson.

North Central CMA vision

A well-informed, resourced and actively committed community; protecting and improving the natural resources for the environmental, social and economic benefit of our region.

The Statement of Obligations under the *Catchment and Land Protection Act 1994*, states that all Authorities should actively pursue community engagement. The North Central CMA is committed to community engagement as a priority. The benefit of prioritising community engagement is the wealth of information our community volunteers provide through their extensive onground knowledge.

Waterwatch is just one of many community engagement activity programs associated with the CMA. In particular, Waterwatch is a leader in educating the community and school children about the health of our waterways and how every individual's efforts can help to make a positive difference to our environment.

Waterwatch understands that our efforts are futile without the community support we receive and the vital knowledge our community volunteers arm us with when protecting and maintaining our waterways.

The Waterwatch Program

Waterwatch Victoria is a community engagement program connecting local communities with river and wetland health and sustainable water management issues.

The North Central CMA Waterwatch Program is part of the state-wide community program. By being involved, community Waterwatch monitors provide important regional scientific information about river health to a state-wide database.

The aim of the North Central Waterwatch program is to protect and enhance the health, as well as to improve community understanding of the four major river systems and associated waterbodies within the North Central region.

Specific aims are to:

- Educate and raise awareness of river health issues in the region.
- Build the capacity of communities to monitor the health of local rivers and wetlands by providing equipment, support and technical advice to water quality monitors.
- Bring together various stakeholders.
- Contribute vital data to Victoria's *Waterwatch Water Quality Database.*
- Provide water quality data to agencies and organisations through data requests.
- Contribute to planning in Natural Resource Management.

With the important facilitation of community members, the program implements monitoring of onground works to collect significant and timely Water Quality Data, which contributes to outcomes of NRM.

Introduction

Water Quality Data Report

This Water Quality Data Report has been developed to provide a visual representation of water quality data collected by community monitors in the North Central CMA region. The report presents data that will be used to assess water quality and assist NRM in making decisions for local waterway management.

The report covers all four catchments and outlines sites, codes and water quality from 1 January 2010 to 1 January 2011. The report explains each physical and chemical parameter that is used by community monitors to measure river health, along with *Water Quality Guidelines* for the North Central CMA region. These have been included to give the reader an indication of river health on a site-by-site basis.

Community Monitoring -

Choosing a monitoring site

A community monitoring site can be chosen for a range of different reasons. The most common reason is to foster a site that is 'special' to the monitor. Some other reasons are to gain ownership and understanding of a site or to aid a Landcare Group with future management actions for revegetation; and/or to monitor significant changes over time. Other community groups may monitor sites for NRM outcomes and therefore monitor specific sites for Local Government or CMA priority asset areas.

Data that is collected by community monitors can be confidently used as an invaluable resource for demonstrating changes and trends in catchment condition.

Quality in Data Confidence

Waterwatch Victoria conducts an annual Quality Assurance and Quality Control week (QA/QC). The North Central Waterwatch program takes part in the annual QA/QC week and involves community monitors testing a mystery water quality sample to ensure that data collected meets quality and national standards. QA/QC sessions check equipment used by monitors and the methods for monitoring to ensure the up-to-date quality of the collection of reliable long-term water quality data.

Water Quality General Guidelines

It is always a little bit dangerous in the scientific world to categorise isolated data as being "good", "bad" or "average". Ideally, you need to build up a comprehensive long term data set in order to make assessments on what's happening within an aquatic system. Therefore, it is recommended that assumptions for water quality should not be made based on any one particular data "grab".

Some general guidelines have been developed as they relate to each parameter. This can help to identify where long-term data sits in terms of general water quality. These guidelines have been developed by North Central Waterwatch and are based on:

State Environment Protection Policies Waters of Victoria (SEPP WoV), Environmental Protection Authority, Victoria.

Australian & New Zealand Environment Conservation Council (ANZECC) Water Quality Guidelines (1992)

Historical water quality data in the North Central region, developed by North Central Waterwatch.

Due to the diversity of environmental condition even within the North Central CMA region, the SEPP WoV and ANZECC have deliberately assessed waterways in segments. For example the upper catchments are separated from the lower catchments and are broken into these segments for the purpose of this report.

Kirra Meeks at Sheepwash Creek, Mandurang;
Photo by Cass Davis North Central CMA

Introduction

Interpreting Results in this Report

This report contains water quality data that have been collected over the past 12 months. The data are highlighted in individual tables within catchments, for example: the Campaspe catchment results have been presented under electrical conductivity, pH, turbidity and reactive phosphorus – each parameter is displayed as monthly 'raw' water quality data and highlights any major changes in trends over the testing period. Below each table a graph has been developed to show the average for each parameter collected at each site over the testing period.

Upper and Lower Segments

Catchments have been divided into upper and lower segments. For example, water quality changes as you go downstream – small shallow headwater streams change to bigger deeper lowland rivers; and the geological features of the landscape also change, representing biological regions.

Upland reaches in the Campaspe, Loddon and Avoca catchments fall within Segment 4 *Cleared Hills and Coastal Plains* while their lower reaches fall within Segment *5 Murray and Western Plains.* Data in this report has been divided into upper and lower segments to best represent water quality to help enable the reader to compare data with the Water Quality General Guidelines.

Physical and Chemical Parameters Monitored

A number of physical and chemical parameters are measured on a monthly or ad hoc basis by the community; these are electrical conductivity, pH, turbidity and reactive phosphorus.

Rivers, creeks and wetlands within the Campaspe catchment and sites that are considered to be North Central CMA asset areas are usually targeted. However, Waterwatch is a community program and therefore supports the community in monitoring local or private dams, urban wetlands, and stormwater and drainage systems throughout the entire North Central CMA region.

pH

pH measures the acidity or alkalinity of water. The scale ranges from 0 to 14, with 7 being neutral. This can be measured by using pH strips or a meter.

A pH of less than 7 is becoming more acidic and contains more positive Hydrogen (H+) ions, while greater than 7 is becoming more alkaline and contains more negative hydroxide (OH-) ions.

The expected range for most freshwater systems is 6.5 – 8.5. A large increase or decrease in pH can dramatically effect the abundance or diversity of species found within a waterway. Affects of altered pH levels on aquatic organisms may include: interruptions to breeding cycles and migration; altered development; and decreased health or death.

pH can change in response to an increase or decrease in carbon dioxide levels due to respiration and photosynthesis of plants; pollutants such as chemicals and fertilisers introduced through stormwater; exhaust fumes; sewage; increases/decreases in salinity; soil type and disturbance through erosion.

General guidelines for pH in the upper and lower catchments

pH Units	**Excellent**	**Good**	**Poor-Degraded**
Upper/Lower catchment	7	6-8.5	0-5;9-14

Electrical Conductivity

Electrical conductivity (EC) is a relative measure of salinity and measures the amount of dissolved ions present in water. An EC meter is used to measure how much salt is present by detecting the flow of electricity between two electrodes. Different units can be used to report EC; however, micro-siemens per centimetre (µS/cm) is the most commonly accepted. Salt is a natural component of the environment derived through three main processes: weathering of rocks; ancient inland seas; and rainfall.

Variation in salinity levels can be due to: geological weathering; groundwater interactions; land use changes; waste and stormwater runoff; and altered rainfall patterns. Impacts of increasing salinity include: loss of species diversity and abundance; loss of productive land; degraded water quality; reduced health of fauna and flora;

limited uses for the water; and damage to infrastructure.

Methods used to reduce the impact of saline water include: planting trees in high recharge areas to lower the watertable; improved land management practices; and monitoring of groundwater and surface water.

General guidelines for electrical conductivity in the upper and lower catchments

Electrical Conductivity (uS/cm)	**excellent**	**Good**	**Fair**	**Poor**	**Degraded**
Upper catchment	<250	250-500	500-1000	1000-1500	>1500
Lower catchment	<500	500-1500	1500-2500	2500-4000	>4000

Turbidity

The standard unit of measurement is the Nephelometric Turbidity Unit (NTU) and is measured using a turbidity tube or meter.

Turbidity levels can rise in response to an increased amount of inorganic and organic matter in a water body such as algae, soil, pollution or bacteria. High turbidity levels are most commonly encountered immediately following, or during, large storm events where water runs off the land.

Turbidity levels can lower as salinity levels increase, due to saline water being denser and causing particles to fall out of suspension.

High turbidity causes the water to appear murky or cloudy and can impact the amount of light penetrating the water column. This results in reduced plant growth, reduced biodiversity, reduced visibility and increased infrastructure damage/blockage. Turbidity can be improved by increasing plant cover along banks and margins of water bodies and installing sediment traps.

General guidelines for turbidity in the upper and lower catchments

Turbidity (NTUs)	**excellent**	**Good**	**Fair**	**Poor**	**Degraded**
Upper catchment	<5	5-15	15-25	25-35	>35
Lower catchment	<20	20-40	40-50	50-70	>70

Reactive Phosphorus

Phosphorous is a nutrient that occurs naturally in water and is essential for life. It is derived from the weathering of rocks and through the decomposition of organic matter.

This parameter can be measured using a colour comparator test kit or colorimeter. The unit of measurement is milligrams per litre (mg/L).

Elevated phosphorus levels may result from: erosion and the subsequent introduction of sediment containing phosphorus; accidental sewage discharge; detergents; urban stormwater drains; animal waste; industrial waste; rural runoff containing fertilisers; and animal or plant matter.

When phosphorus is in large supply it can lead to excessive plant growth such as blue green algae blooms. Blooms can choke up the waterway and dramatically lower oxygen levels, which can impact on the survival of aquatic fauna species.

It is quite difficult to directly reduce phosphorus levels in waterways due to the many sources and inputs. However, improved land management practices such as reduced fertiliser application; planting vegetative buffer strips; and advanced stormwater systems could help to alleviate the problem to some degree.

General guidelines for reactive phosphorus in upper and lower catchments

Reactive Phosphorus (mg/L)	**excellent**	**Good**	**Fair**	**Poor**	**Degraded**
Upper/Lower catchment	<0.008	0.008-0.03	0.03-0.05	0.05-0.1	>0.1

Campaspe Catchment

Catchment Description

The Campaspe River catchment lies within the eastern portion of the North Central CMA region. It extends from the Great Dividing Range in the south to the Murray River in the north, and covers approximately 4,000 square kilometres (approximately 17% of the North Central CMA region). The catchment is about 150 kilometres long and has an average width of approximately 25 kilometres (North Central RHS 2005).

The major waterway is the Campaspe River itself which flows to its confluence with the Murray River at Echuca. Therefore, the Campaspe River has a direct influence on the health of the Murray River, including flows, water quality and exchange of aquatic species such as native migratory fish. The Campaspe's major tributary is the Coliban River. Other significant tributaries include the Axe, McIvor, Mount Pleasant, Wild Duck and Pipers creeks.

Community Monitoring Sites

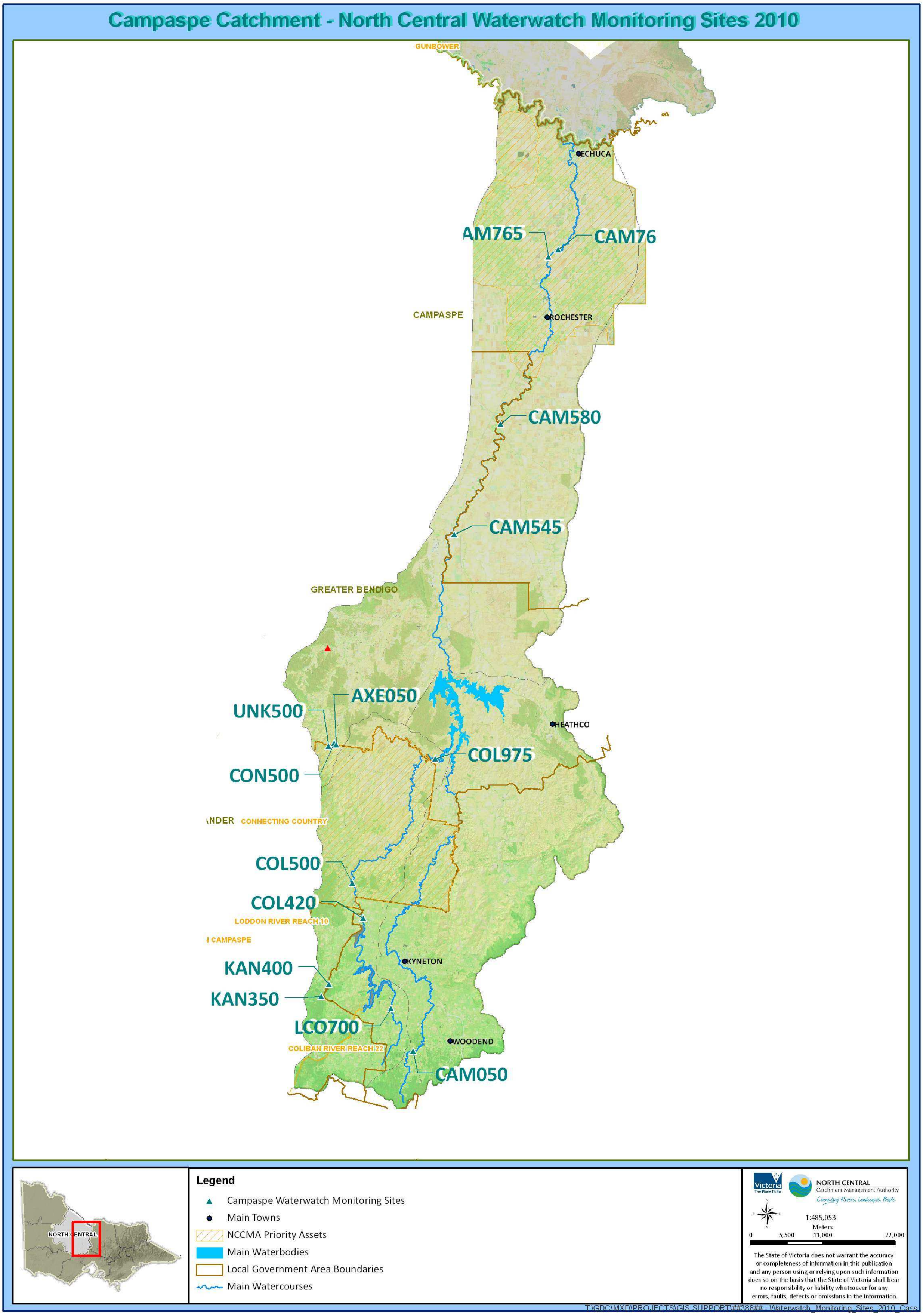
During the sampling period, a total of 15 sites within the Campaspe catchment were monitored by 16 local community volunteers who, on a monthly basis, attended their sites to collect timely and critical water quality information. Site codes and locations are outlined in Table 1; and a map of sites is provided on page 6, Figure 1 Campaspe Catchment – North Central Waterwatch Monitoring Sites 2010-11.

Table 1 Campaspe Catchment Site Codes and Site Descriptions

Site Codes	Site Description
LCO700	Little Coliban River
CAM768	Campaspe River
MYR250	Myrtle Creek at Bendigo-Sutton Grange Road
CAM545	Campaspe River Goornong Rocky Crossing Rd
CAM580	Campaspe at Elmore Primary School
COL975	Coliban River-south of Raeburns Road
COL500	Coliban River at Todd's Bridge, Metcalfe-Taradale Road
KAN400	Kangaroo Creek
KAN350	Kangaroo Creek , 50m upstream from Spring Hill Road
COL420	Coliban River just north of Malmsbury
CAM050	Campaspe River, north of Einsporne Rd, Woodend
CAM765	Campaspe River, Roadside park, Strathallan
CON500	Contribution Creek, tributary of Axe Creek
UNK500	Unnamed Creek - Wilkons Croft
AXE050	Axe Creek at bottom of Contribution Creek

Campaspe Catchment

Figure 1 Campaspe Catchment - North Central Waterwatch Monitoring Sites 2010/11



Campaspe Catchment

Upper Campaspe Catchment – Monitoring Outcomes

pH

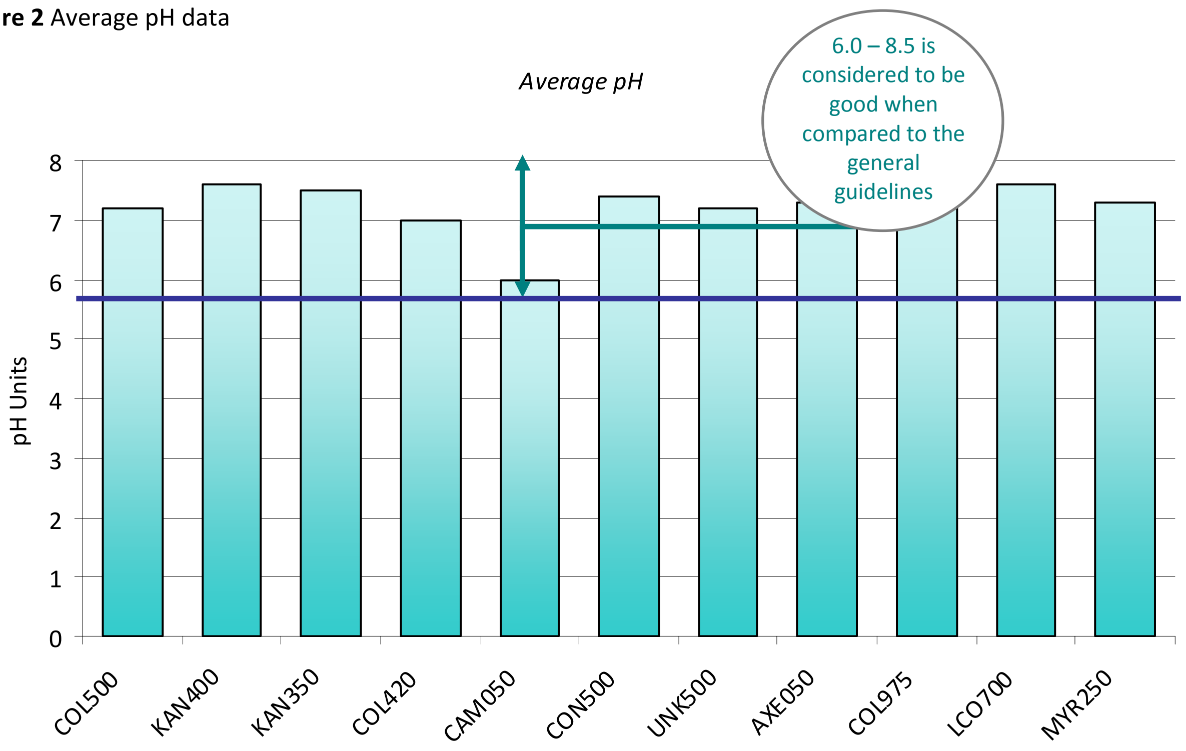
Sites monitored for pH in the Upper Campaspe are considered good–excellent. However, monthly pH readings for LCO700 have peaked above the accepted range, and could be considered poor–degraded.

Table 2 pH raw data

Site Code	January	February	March	April	may	June	July	August	September	October	November	December
COL500	7.1			7.4		7.4	7.2	7.4		7.1	7.2	
KAN400								7.6				
KAN350								7.5			7.6	
COL420					7							
CAM050						6	6	6	6.5	6	5.5	6
CON500	7.5		7.6	7.2	7.3	7.3	7.5	7.3	7.4		7.3	7.6
UNK500			7.6	7.2	7.2	7.3	7.2	7.3			7.1	7.2
AXE050				7.4	7.5	7.2	7.5	7.2			7.3	7.3
COL975	7.6	7.4		7.7		8	7	7.3	6.9	7.2	6.7	
LCO700	8.2	7.5	7.5	7	7		7.5		8.8	7	8.7	
MYR250	6.7		6.6	7	6.6	7.3		8.2	8		7.5	7.6

* * *

Figure 2 Average pH data



Electrical Conductivity

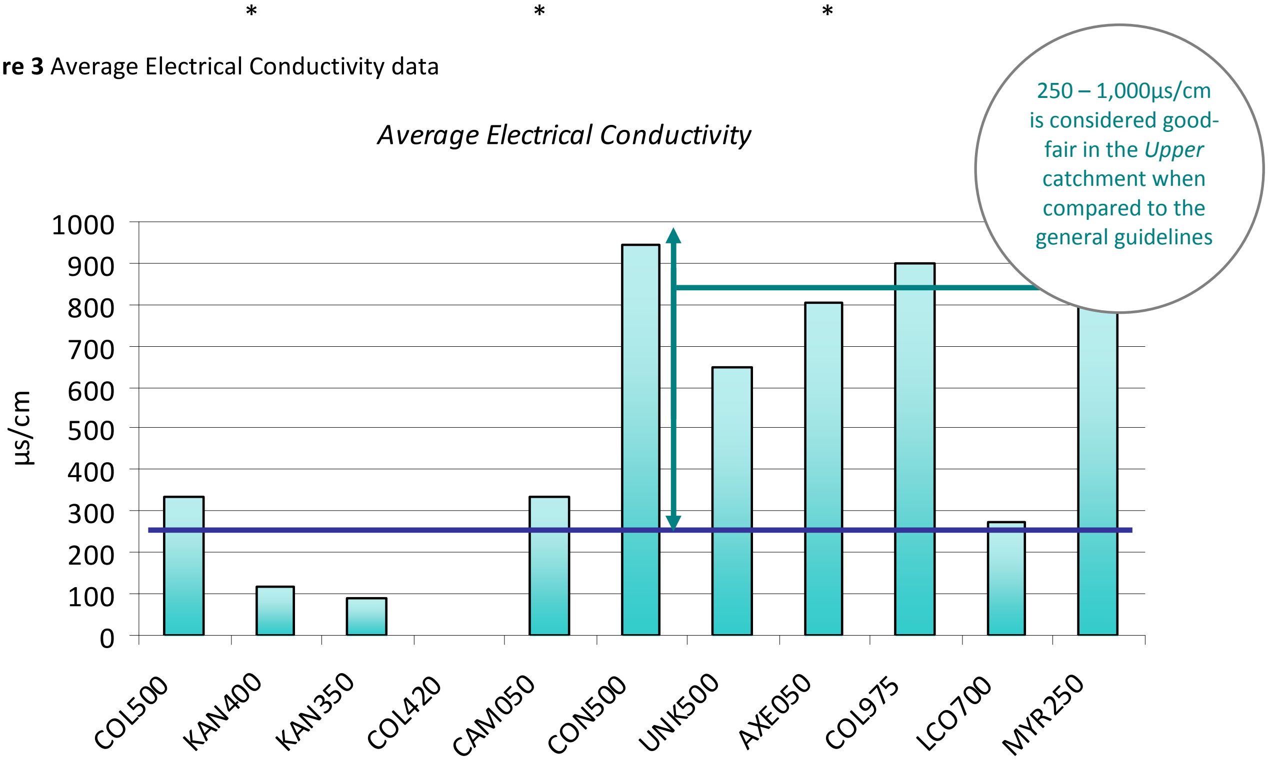
Sites monitored for electrical conductivity in the Upper Campaspe are good–fair. However, CON500 has variable salinity readings throughout the year; therefore, it could be considered as poor.

Table 3 Electrical Conductivity raw data

Site Code	January	February	March	April	may	June	July	August	September	October	November	December
COL500	307			292		491	393	327		374	156	
KAN400								116.				
KAN350								88.5			94.1	
COL420					82.9							
CAM050	307			292		491	393	327		374	156	
CON500	1820		530	1770	1600	1490	340	1240	155		260	250
UNK500			605	675	720	640	245	1900			200	200
AXE050				835	925	870	450	1965			290	290
COL975	1818	2000		527			801	408	849	548	223	
LCO700	239	468	478	318	323		174.		155.	168.	116.	
MYR250				1296	1545	1096		250	259		311	

* * *

Figure 3 Average Electrical Conductivity data



Campaspe Catchment

Turbidity

Sites monitored for turbidity in the Upper Campaspe are generally good. MYR250 has an average of 35 NTU and this could be considered as poor; however, the site’s long term pattern ranges between 10 and 50NTU indicating a range of good–poor.

Table 4 Turbidity raw data

Site Code	January	February	March	April	may	June	July	August	September	October	November	December
COL500	10			10		10	20	20		20	20	20
KAN400								12				
KAN350								<10			<10	
COL420					<10							
CAM050						<10	<10	<10	<10	15	10	<10
CON500	<10		18	<10	<10	<10	30	<15	<10	<10	<10	<10
UNK500			20	<15	22	<10	20	<30			16	16
AXE050				<10	<10	<10	15	<30			12	12
COL975	<10	<10		<10		<15	12	23	<1	<15	<20	
LCO700	10	10	10	10	10		10		10	10	10	
MYR250	20		<10	40	50	<10		<15	<10			<10

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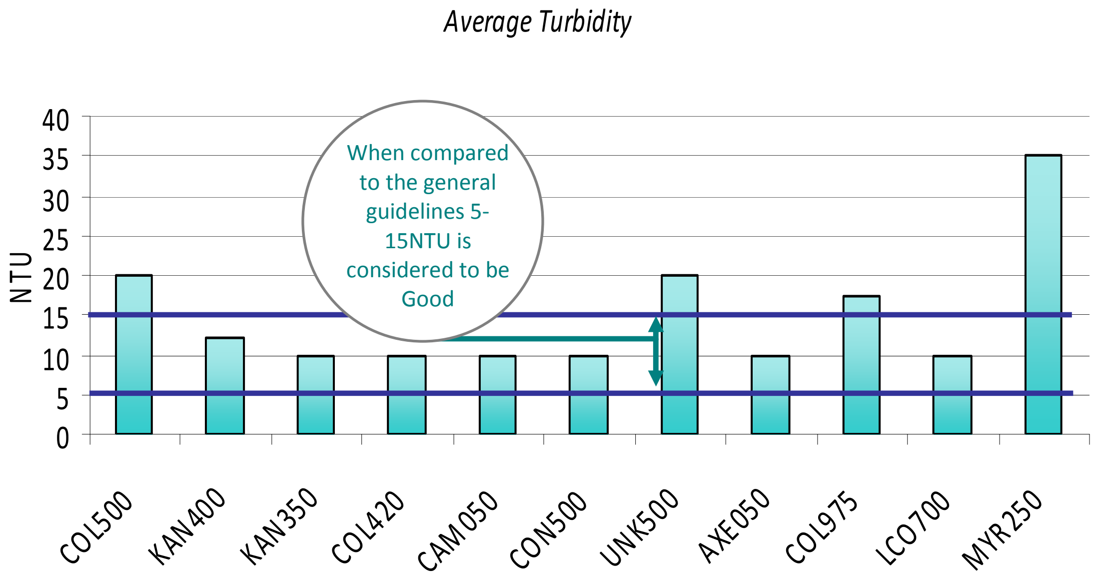
Figure 4 Average Turbidity data



Campaspe Catchment

Reactive Phosphorus

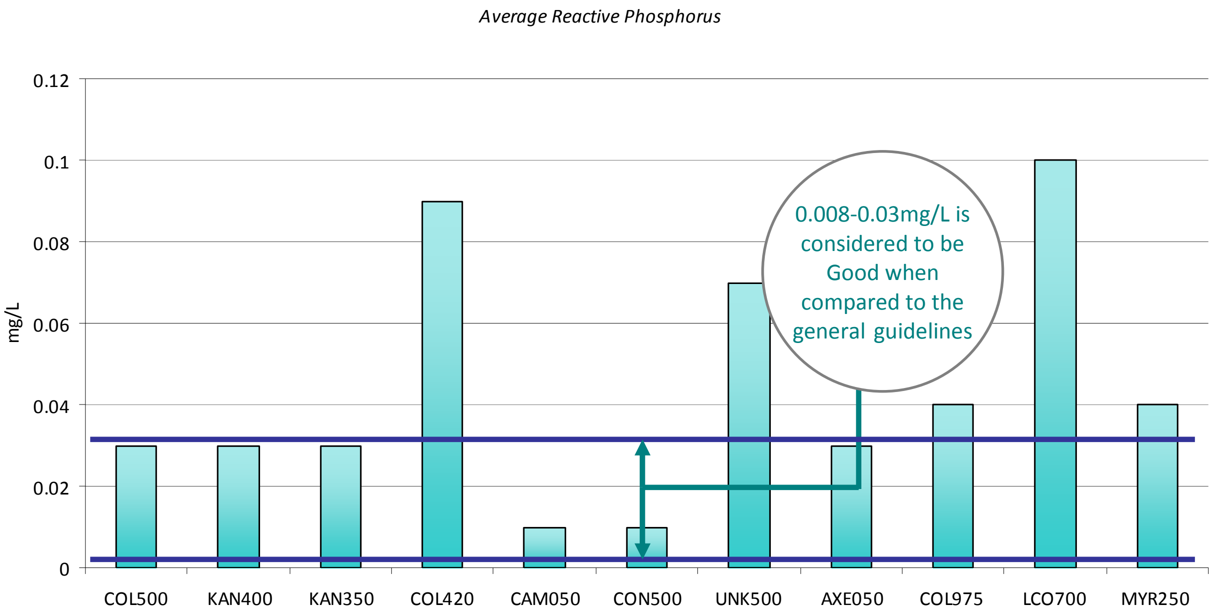
Sites monitored in the Upper Campaspe for reactive phosphorus on average are considered to be good.

Table 5 Reactive Phosphorus raw data

Site Code	January	February	March	April	may	June	July	August	September	October	November	December
COL500	.05					.02	.02	.03		.03	.05	
KAN400								.03				
KAN350								.01			.05	
COL420					.09							
CAM050							.01	.01		.01	.01	.03
CON500				.01	.01							
UNK500			.25	.07	.07		.03				.02	.02
AXE050				0.02	0.07		0.02					
COL975	.05	.03		.02		.02	.07	.07	.03	.05	.03	.05
LCO700	.01	.01	.01	.01	.01		.02		.01	.02	.02	
MYR250	.01			.07	.07	.01		.01	.02		.1	.1

* * *

Figure 5 Average Reactive Phosphorus



Campaspe Catchment

Lower Campaspe Catchment – Monitoring Outcomes

pH

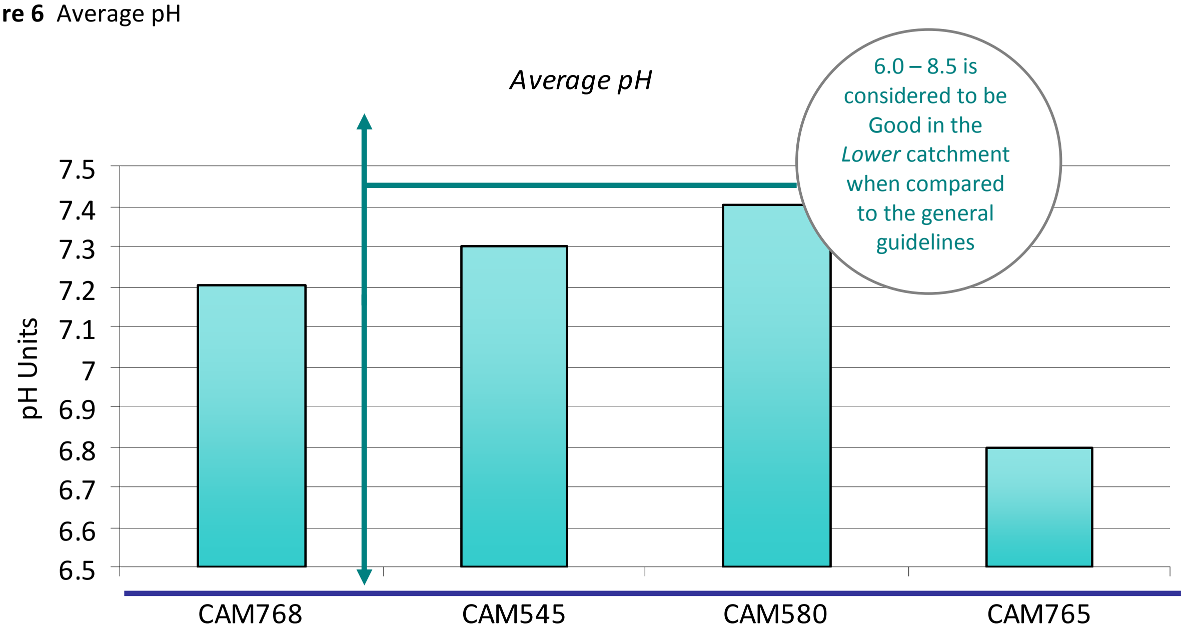
All sites monitored in the Lower Campaspe for pH were considered to be good.

Table 6 pH raw data

Site Code	January	February	March	April	may	June	July	August	September	October	November	December
CAM768	7.3	7.5	7.2	7.3	7.2	7.3	7.3	7.3	7.1	7.2	7.1	6.9
CAM545	7.4	7.4	7.2	7.2	7.3	7.7	7	7.3	7			
CAM580	7.4	8.2	7.3	7.6	7.8	7.6	7.2	7.2	6.9			
CAM765	7	7	7	7	7	7	7	6.5	6.5		7	6.5

* * *

Figure 6 Average pH



Electrical Conductivity

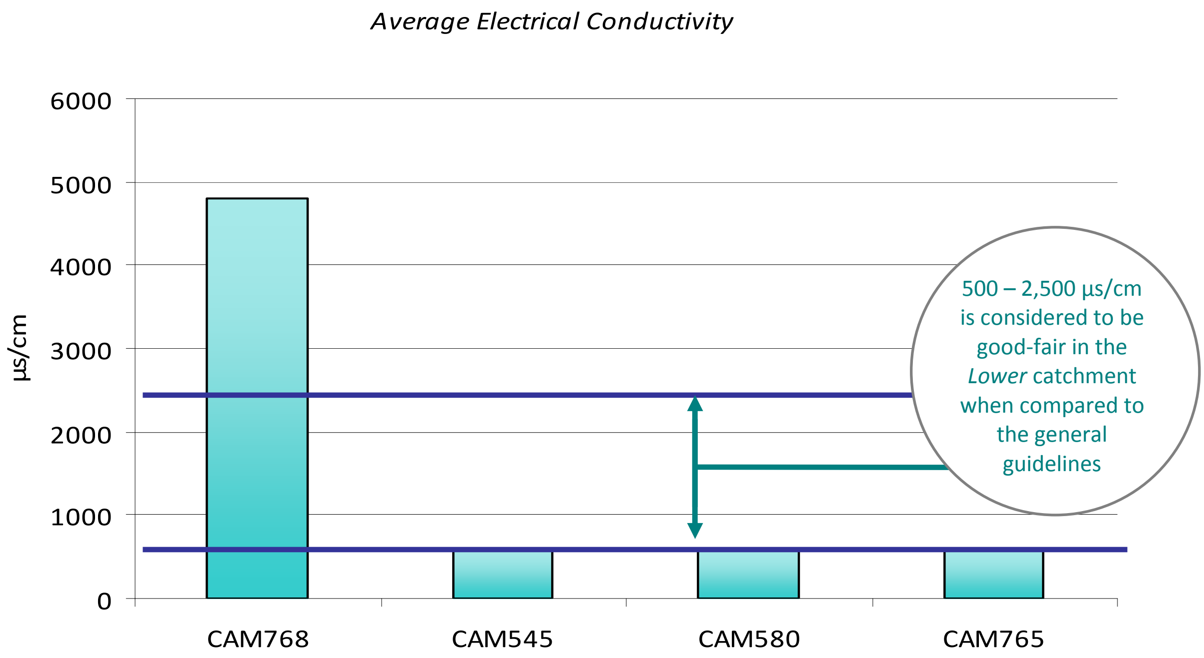
Electrical conductivity for sites monitored in the Lower Campaspe is generally good. CAM768 has variable salinity readings throughout the year.

Table 7 Electrical Conductivity raw data

Site Code	January	February	March	April	may	June	July	August	September	October	November	December
CAM768	1648	6470	7030	4710	5580	1132	6260	2790	5000	6930	6150	3850
CAM545	777	669	646	570	590	590	430	340	890			
CAM580	839	683	653	670	490	580	140	250	630	890		
CAM765		814	798	190	539	1068	661	320	303		688	327

* * *

Figure 7 Average Electrical Conductivity



Turbidity

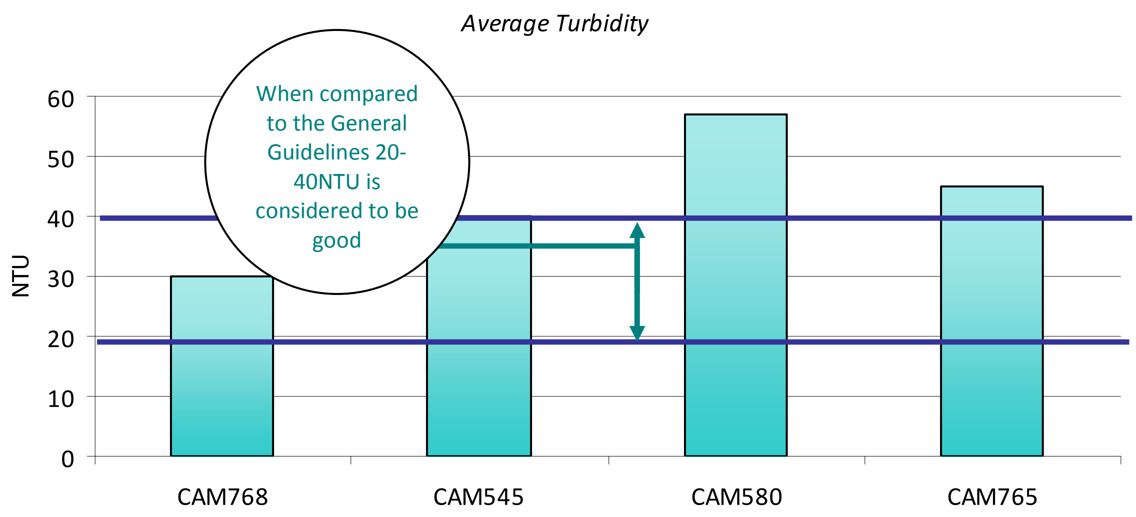
Sites monitored for turbidity in the Lower Campaspe are considered to be good. The month of August shows an increase in turbidity at all four sites listed.

Table 8 Turbidity raw data

Site Code	January	February	March	April	may	June	July	August	September	October	November	December
CAM768	<30	<30	<20	<20	<10	<15	<15	<150	<40	<30	<60	<30
CAM545	<15	<10	<10	<10	<10	<20	<100	<100	<30			
CAM580	<30	<30	<30	<20	<40	<30	<150	<150	<60	<30		
CAM765	<30	16	<30	<40	14	15	20	150	80		<60	30

* * *

Figure 8 Average Turbidity



Reactive Phosphorus

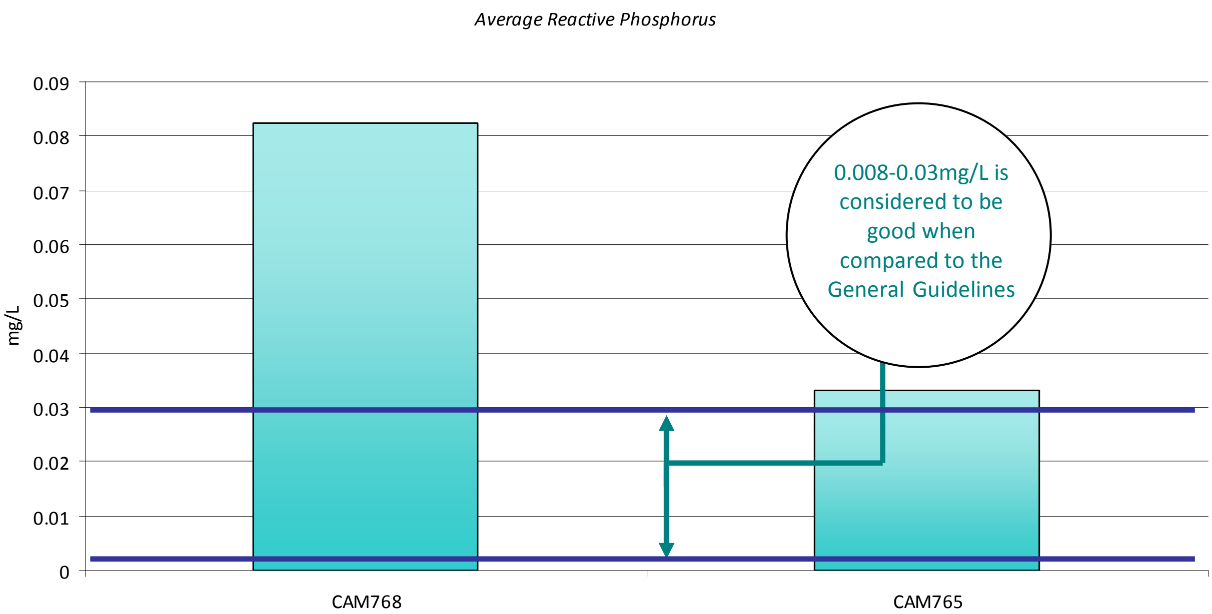
Only two sites in the Lower Campaspe were consistently monitored throughout the monitoring period. CAM768 phosphorus levels rose in August – this could be considered to be poor in quality.

Table 9 Reactive Phosphorus raw data

Site Code	January	February	March	April	may	June	July	August	September	October	November	December
CAM768	.07	.05	.02	.02	.04	.03	.01	.1	.1	.1	.15	.2
CAM545												
CAM580												
CAM765	.02	.01	.01		.01		.01				.05	.07

*   *   *

Figure 9 Average Reactive Phosphorus



Loddon Catchment

Catchment Description

The Loddon River catchment, home to two-thirds of the North Central CMA region's population, covers 1,531,998 hectares (approximately half of the North Central CMA region) or about 6.8% of the area of Victoria. The catchment extends about 310km from the Great Dividing Range in the south to the Murray River in the north. Mount Alexander is the highest point in the catchment at 741 metres, situated just north of Castlemaine. The northern two-thirds of the catchment are the alluvial plains of the Murray Valley, with granite outcrops at Mount Terrick Terrick, Mount Hope and Pyramid Hill rising some 80 to 100 metres above sea level.

The Loddon River is the principal watercourse. It flows north from near Daylesford on the Great Dividing Range to the Murray River near Swan Hill. Therefore, the Loddon has a direct influence on the health of the Murray River, including salinity, flows and exchange of aquatic species such a native migratory fish. Major tributaries of the Loddon are Tullaroop and Bet Bet creeks in the southwest of the catchment, and Bullock and Bendigo creeks in the east. The Murray River anabranch of Gunbower and Pyramid creeks flow across the northern floodplain. A pump station located along the lower reaches of Barr Creek pumps water to the storage basin of Lake Tutchewop to manage flows and salinity levels in the Loddon River and Murray River. There are several high value wetlands, including the internationally recognised Ramsar-listed Kerang Lakes and Gunbower Forest.

Community Monitoring Sites

During the sampling period, a total of 43 sites within the Loddon catchment were monitored by 21 local community volunteers who, on a monthly basis, went down to their sites to collect timely and critical water quality information. Site Codes and site locations are outlined in Table 10 below:

Table 10 Loddon Catchment Site Codes and Site Descriptions

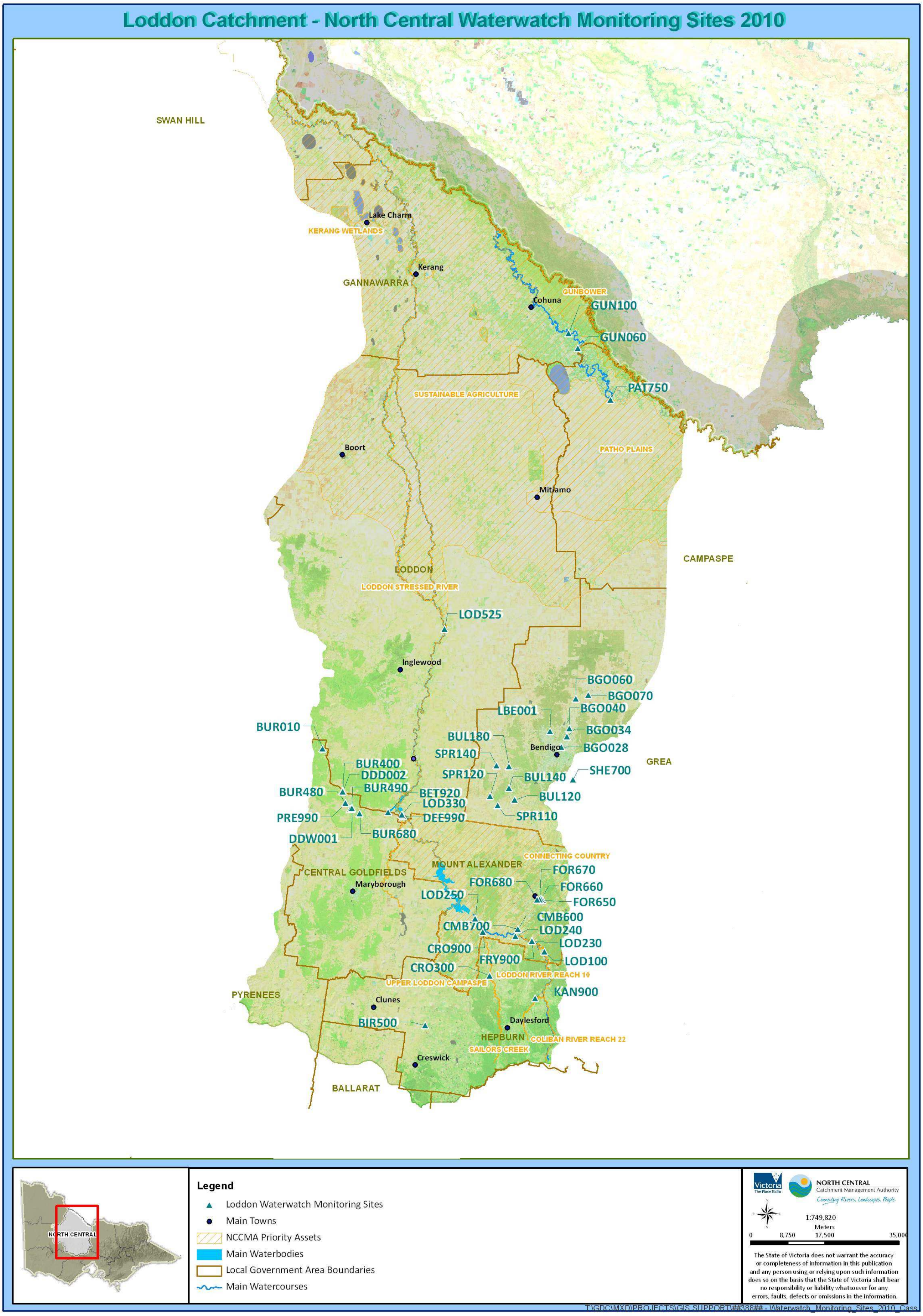
Site Codes	Site Description
BGO070	Bendigo Creek, Kamarooka Rd, Huntly -
BGO060	Bendigo Creek, Millwood Rd. Huntly -
BGO040	Bendigo Creek, Howard St,. Epsom
BGO034	Bendigo Creek , Scott St, White Hills
LBE001	Lake Tom Thumb, Eaglehawk
BIR500	Birch Creek
KAN900	Kangaroo Creek, Tropy's Lane, Glenlyon
BUR400	Burnt creek- Burnt Creek Lane, Dunolly
BUR680	Burnt Creek- Betley Bromley Road
BUR010	Burnt Creek at Bendigo St Arnaud Road intersection
PRE990	Pretty Jane Creek on Separation Road, Dunolly
DDD002	Property dam, Dunolly
SHE700	Sheepwash Creek @ Tannery Heights Crossing
BET920	Bet Bet Creek at Fremantles Bridge 2
DEE990	Deep Creek at back of lucerne mill
LOD330	Loddon River at Eddington Bridge
LOD525	Loddon River, Salisbury West, Penny Lane
GUN100	Gunbower Creek, Moffat's Road, Gunbower
GUN060	Gunbower Creek at Findlays Road, Leitchville
PAT750	Patho Creek 400m downstream Murray Valley Hwy bridge
LOD100	Terra-Thunder farm Co-operative
CRO300	Jim Crow Creek (West of Franklinford)
BGO028	Bendigo Creek , Weeroona Ave

Loddon Catchment

FOR650	Forest Creek @ Colles Rd bridge
FOR660	Forest Creek - 100m upstream of Moonlight Creek
FOR670	Forest Creek-very deep pool across from sharp bend in Happy Valley Rd
FOR680	Forest Creek @ Greenhill place footbridge
CMB600	Campbell's Creek at Jessie Kennedy Reserve
CMB700	Campbell's Creek - Yapeen
CRO900	Jim Crow Creek
FRY900	Fryers Creek.
LOD230	Loddon River, upstream of Tarilta Creek.
LOD240	Loddon River, upstream of Campbell's Creek.
LOD250	Loddon River, downstream of Muckleford Creek.
BUL120	Bullock Creek. B3
BUL140	Bullock Creek, B6
BUL180	Bullock Creek. B10
SPR110	Spring Creek, McGlashens Road, S1
SPR120	Spring Creek, Floods Road. S2
SPR140	Spring Creek., S4
DDW001	Big dam
BUR480	Burnt Creek near silo
BUR490	Burnt Creek

Loddon Catchment

Figure 10 Loddon Catchment - North Central Waterwatch Monitoring sites 2010/11



Upper Loddon Catchment – Monitoring Outcomes

pH

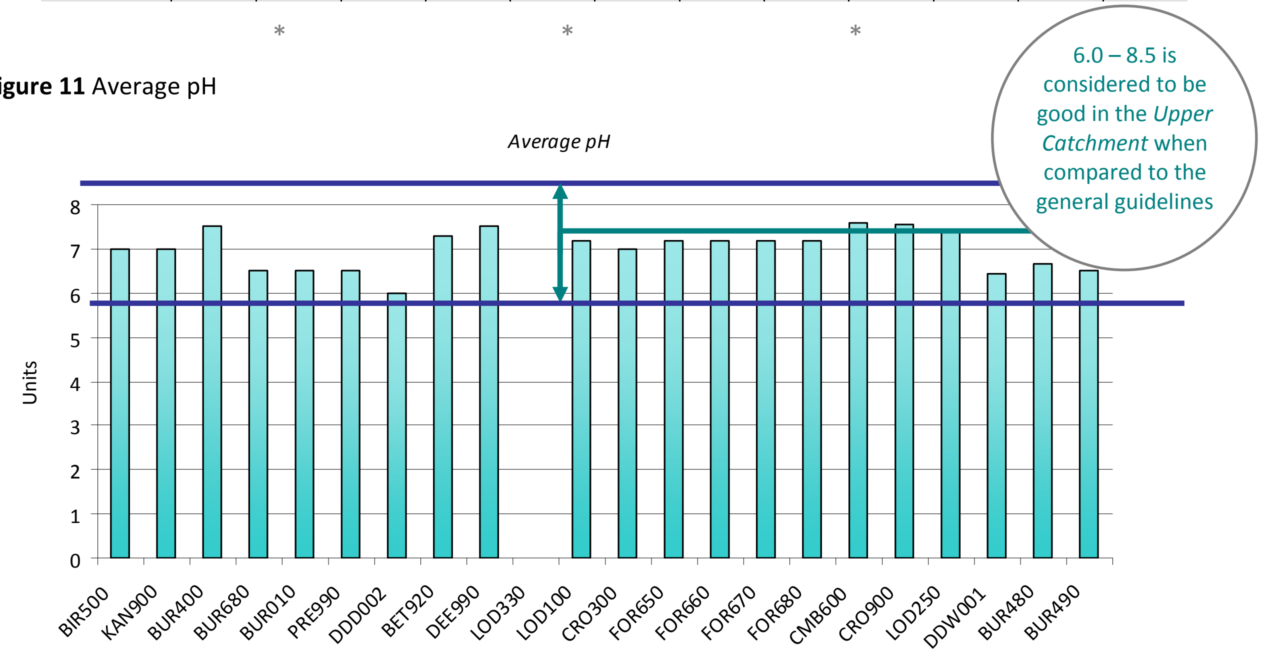
Sites monitored in the Upper Loddon for pH are consistent and can be good–excellent.

Table 11 pH raw data

Site Code	January	February	March	April	may	June	July	August	September	October	November	December
BIR500		7	7	7	7	7	7	7	7	7	7	7
KAN900								7.2				
BUR400									7.5	7.5	6.5	7.5
BUR680									6.5	6.5	6	7
BUR010									6		6.5	
PRE990			6						6	6.5	6.5	6.5
DDD002			6			6.5	6		6.5	6.5	6	6
BET920					7.4		7.3		7.1	7.3	7.4	
DEE990		7		7.6	7.6		7.8		7.2	7.5	7.3	
LOD330												
LOD100								7.4	7.2	7.1		7.3
CRO300	7.5			7.5	7.5	7.5	7.5	7	7	7		7
FOR650							6.8	7.5	7.2	7.2		
FOR660			7	7.2	7.1		7.1	7.6	7.7	7.4		
FOR670			6.8	7.2	7.2		7.2	7.6	7.7		7.5	
FOR680			6.7	7	7.1		7.2	7.3	7.7	7.5		
CMB600					7.9	7.3						
CRO900					7.4	7.7						
LOD250					7.4							
DDW001		6.5	6.4	6.3		7.4						
BUR480	7	6.5		7.5	6.3	6.1		7.5		6.7	6.6	
BUR490			6.6					6.9		6.2	6.4	

* * *

Figure 11 Average pH



Electrical Conductivity

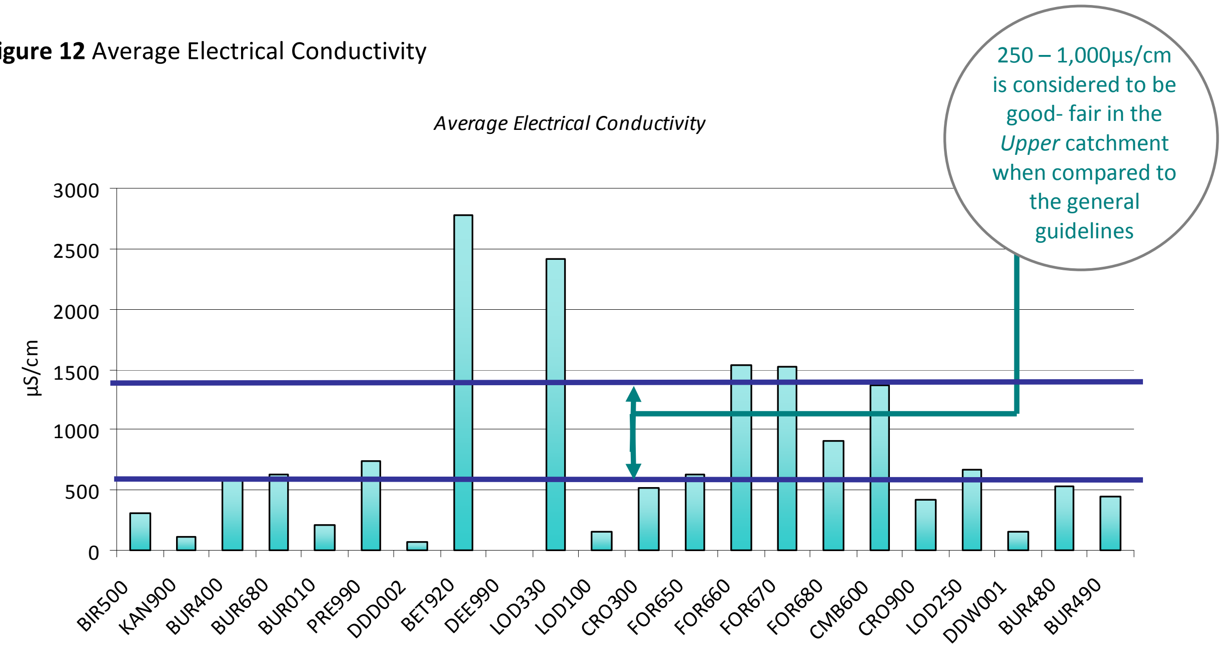
Electrical conductivity in the Upper Loddon is generally good. However, some sites such as BET920 and LOD330 range within poor–degraded.

Table 12 Electrical Conductivity raw data

Site Code	January	February	March	April	may	June	July	August	September	October	November	December
BIR500	363		438	363	362	380	265	216	205	187.2		
KAN900								113.4				
BUR400									450	935	476	550
BUR680									1645	216	424	235
BUR010									270		163.1	
PRE990			174.1						779	1171	317	1275
DDD002	91.7					55.6	59.8		49.6	66.5		55.3
BET920					2200		1250		2130	7220	1074	
DEE990		2090										
LOD330		1132		1312	1225		1640		6010	4990	576	
LOD100								145.4	144.1	147	164.4	148.9
CRO300	467			523	363	352	277	209	210	225		206
FOR650							837	436	594	626		
FOR660			2530	2240	2370		890	446		706		
FOR670			2400	2350	2260		936	453		738		
FOR680			1123	824	1389		946	465	771	789		
CMB600					1331	1322						
CRO900					433	403						
LOD250					658	668						
DDW001		193	138.6	142		141						
BUR480	436	660	331	270	471	368		1286		704	220	
BUR490			509					222		536	515	

* * *

Figure 12 Average Electrical Conductivity



Loddon Catchment

Turbidity

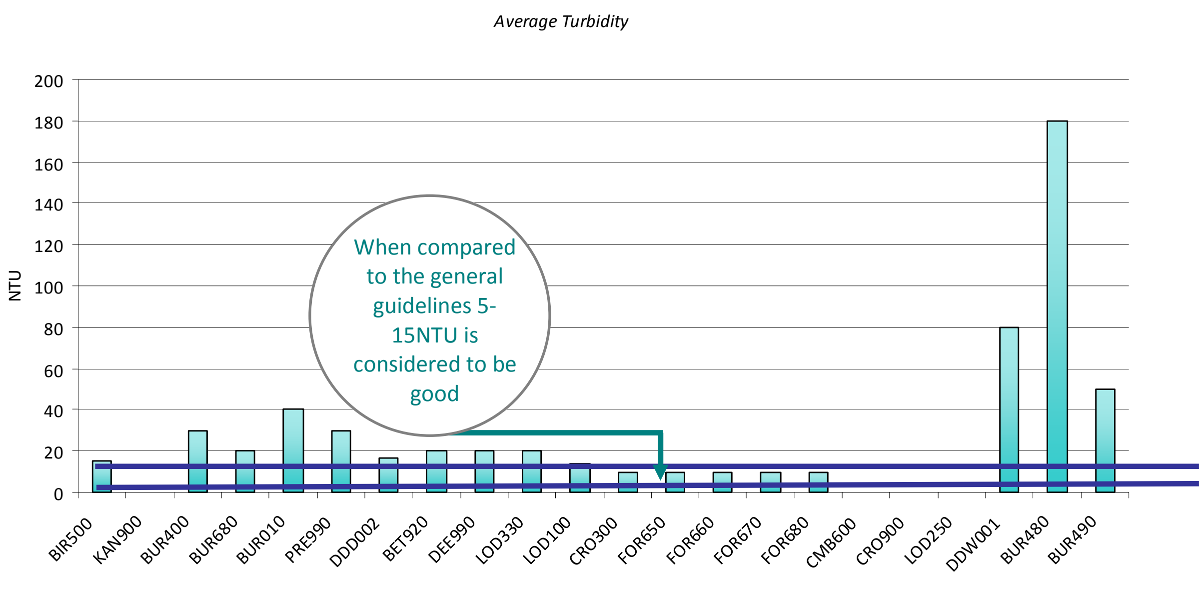
Turbidity in the Upper Loddon varies throughout the monitoring period. Average data indicates turbidity is generally higher than the Guidelines.

Table 13 Turbidity raw data

Site Code	January	February	March	April	may	June	July	August	September	October	November	December
BIR500		22	20	10	10	10	10	30	13	10	15	20
KAN900								14				
BUR400									15	40	48	12
BUR680									10	10	48	15
BUR010									30		48	
PRE990			70						30	15	49	20
DDD002			30			23	17		10	10	15	
BET920					20		30		20	50	22	
DEE990		40		20	20		20		20	30	20	
LOD330		55		13	20		15		20	30	30	
LOD100								10	10	10	10	30
CRO300	10			10	10	10	10	10	10	10		20
FOR650							10	10	10	10		
FOR660			10	10	10		15	10	10	10		
FOR670			10	10	10		30	10	10		10	
FOR680			10	10	50		10	10	10	10		
CMB600												
CRO900												
LOD250												
DDW001		100	80	80		90						
BUR480	70	300	400	400	100			80		20	70	
BUR490			60					80		30	60	

* * *

Figure 13 Average Turbidity



Loddon Catchment

Reactive Phosphorus

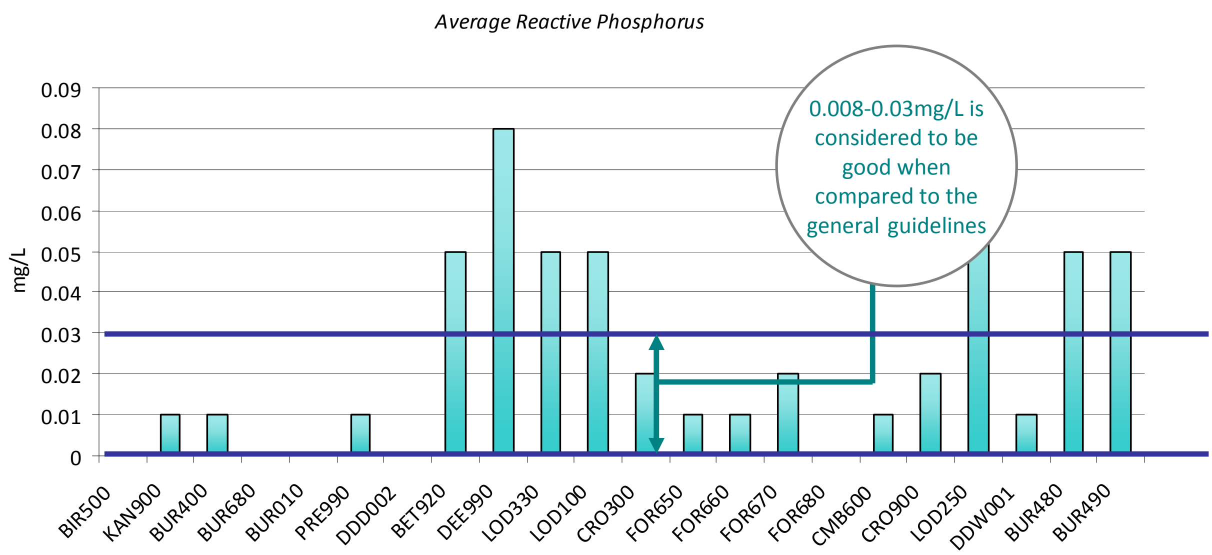
Reactive phosphorus in the Upper Loddon is generally good–poor. However, average data shows that phosphorus is poor–degraded.

Table 14 Reactive Phosphorus raw data

Site Code	January	February	March	April	may	June	July	August	September	October	November	December
BIR500									0.07		0.2	
KAN900								0.01				
BUR400												0.01
BUR680												
BUR010												
PRE990												0.01
DDD002												
BET920									0.07		0.2	
DEE990		0.07		0.15	0.05		0.05		0.07	0.07	0.15	
LOD330		0.03		0.01	0.01		0.07		0.02	0.1	0.1	
LOD100								0.05	0.05	0.05	0.05	0.05
CRO300	0.07			0.05	0.01	0.01	0.01	0.01	0.01	0.01		0.07
FOR650							0.01			0.01		
FOR660			0.01	0.01	0.02		0.01					
FOR670				0.02	0.02							
FOR680			0.02	0.02	0.01		0.02					
CMB600					0.1	0.1						
CRO900					0.02	0.02						
LOD250					0.07	0.07						
DDW001	0.07			0.05	0.01	0.01	0.01	0.01	0.01	0.01		0.07
BUR480			0.03			0.15				0.02		
BUR490			0.1			0.01				0.07		

* * *

Figure 14 Average Turbidity



Loddon Catchment

Lower Loddon Catchment – Monitoring Outcomes

pH

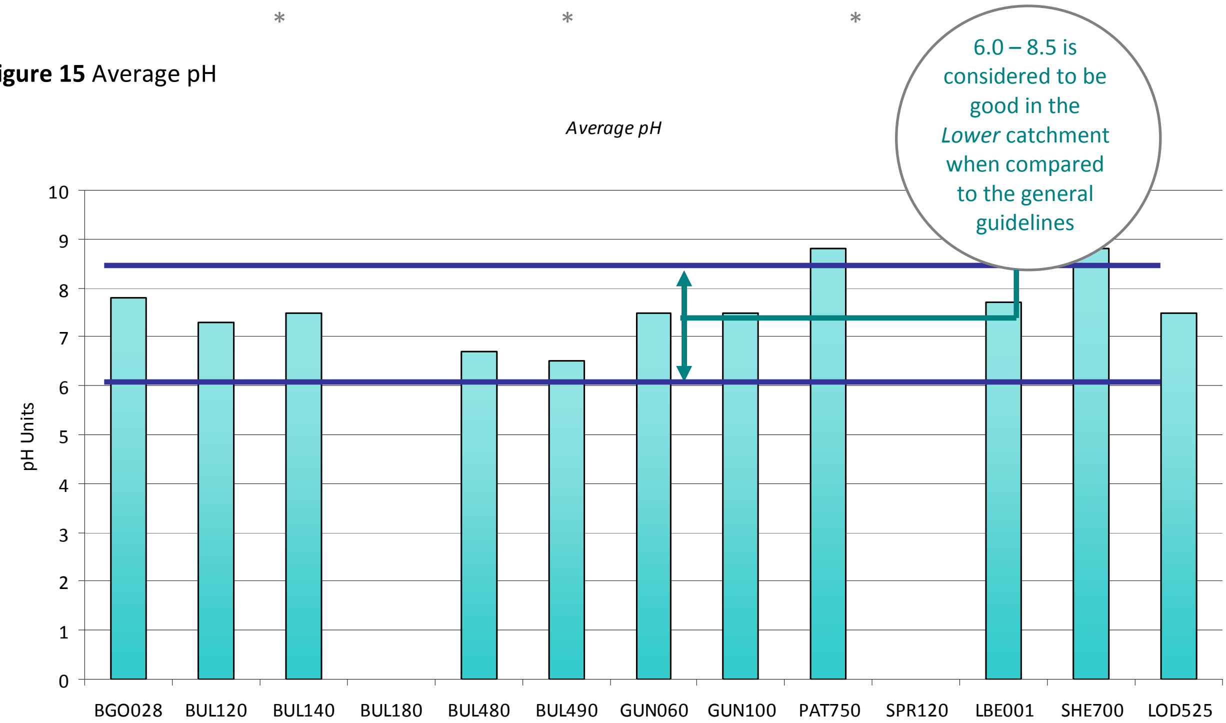
Sites monitored in the Lower Loddon for pH are consistent and can be good–excellent.

Table 15 pH raw data

Site Code	January	February	March	April	may	June	July	August	September	October	November	December
BGO028				7.3	8	7.7	7.6	7.7	7.5		7.9	8
BUL120							7.7			7		
BUL140							7.5			7		
BUL180										7		
BUL480	7	6.5		7.5	6.3	6.1		7.5		6.7	6.6	
BUL490			6.6					6.9		6.2	6.4	
GUN060	7.5	7.2	7.2	7.4	7.3	8.7	9.1	6.9			7.4	7.1
GUN100	7.5	7.2	7.1	7.5	7.2	8.6	8.5	7.1			7.5	7
PAT750	9	8.2	8.9	9.3	8.6	8.9						
SPR120	7.2											
LBE001	7	7.5	7.5	9.3		7.7	7.8	7.6	7.7		7.4	
SHE700					8		7.5		10.9			
LOD525	7.9	7.8	7.5	7.8	7.8	7.8	8	7.3	7.4	7.4	7.2	7.2

*   *   *

Figure 15 Average pH



Loddon Catchment

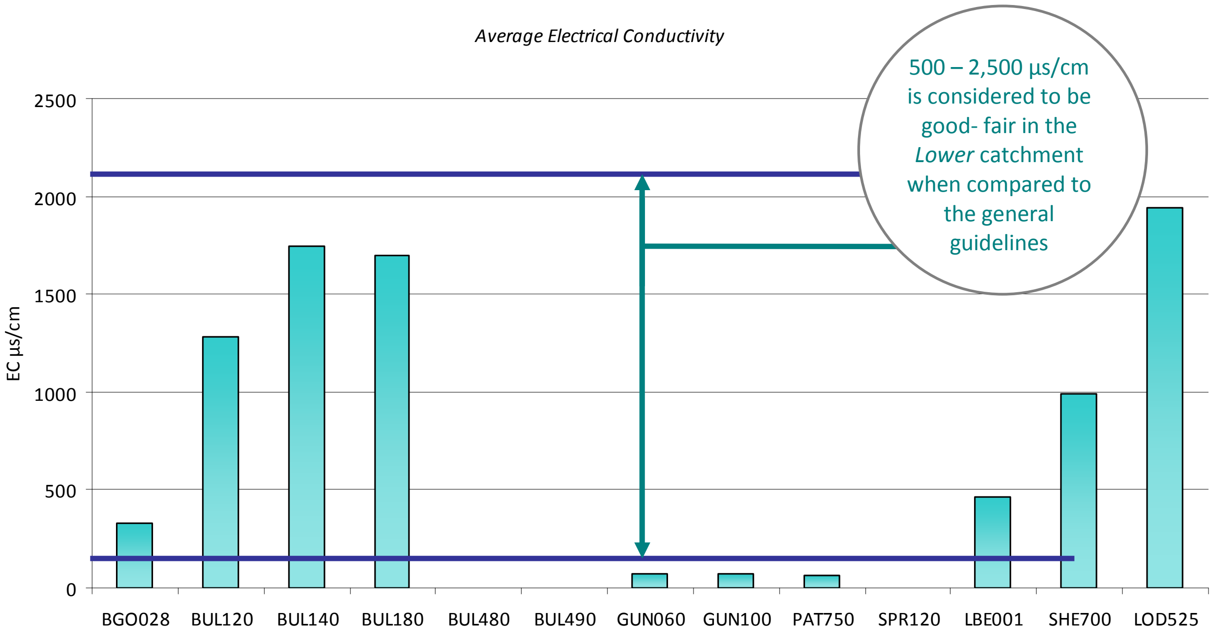
Electrical Conductivity

Electrical conductivity in the Lower Loddon is, on average, generally good.

Table 16 Electrical Conductivity raw data

Site Code	January	February	March	April	may	June	July	August	September	October	November	December
BGO028			82.5	286	389	1974	1719	393	886		46.4	327
BUL120							1280			1280		
BUL140							1670			1820		
BUL180							1600			1800		
BUL480												
BUL490												
GUN060	57	65.5	57.6	52.6	45.3	56.8	66/5	69.7			84.4	138
GUN100	58.2	59.7	57	52.3	45.1	56.5	70.8	69.2			84.7	138.8
PAT750	81.2	125	105.1	70.2	73.9	104.8						
SPR120												
LBE001	382	312	340	647		389	430	466	763		423	
SHE700					659		839		1470			
LOD525	3050	3020	2920	2930	2690	2460	2090	523	1087	808	339	1426
		*			*				*			

Figure 16 Average Electrical Conductivity



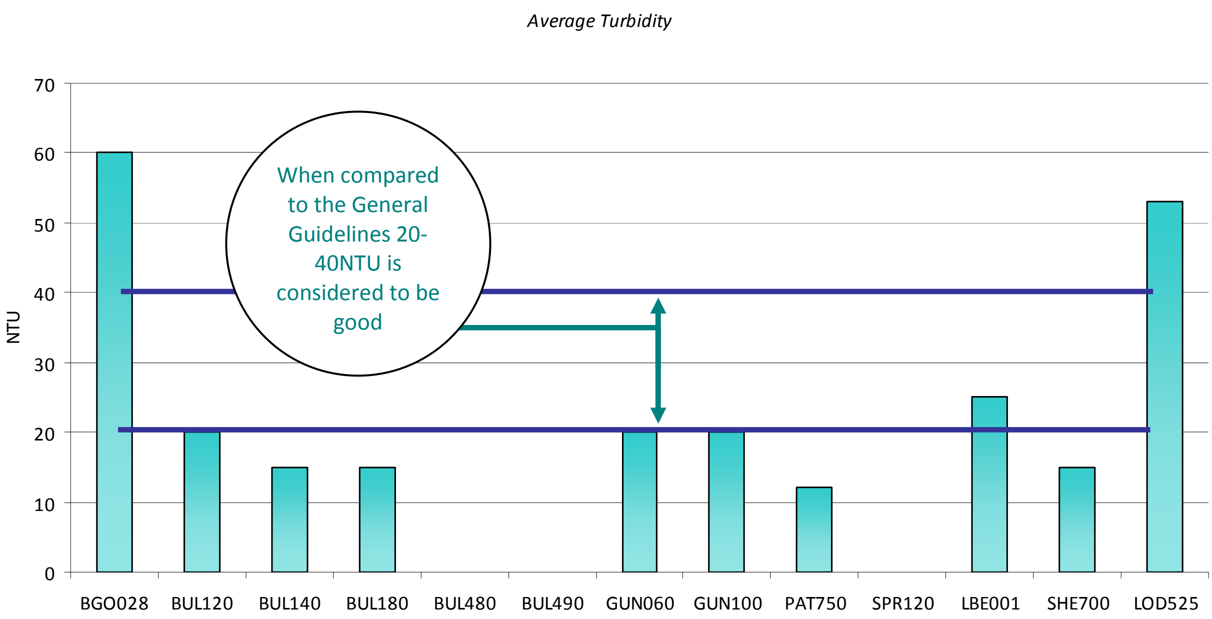
Turbidity

Turbidity in the Lower Loddon is consistent with the Guidelines. However, BGO028 experiences variance in data over April, August and September – when averaged this would indicate increased turbidity, rating the site as poor.

Table 17 Turbidity raw data

Site Code	January	February	March	April	may	June	July	August	September	October	November	December
BGO028			60	150	30	10	20	100	150		10	20
BUL120							30			10		
BUL140							20			10		
BUL180							20			10		
BUL480												
BUL490												
GUN060	20	17	22	15	15	13	15				35	32
GUN100	30	21	22	15	15	14	14	35			34	32
PAT750	10	18	10	10	10	12						
SPR120												
LBE001	20	30	20	20		25		50	15		50	
SHE700					10		20		15			
LOD525	<10	<15	<10	<10	<10	<10	12	<80	<40	30	150	20
		*			*				*			

Figure 17 Average Turbidity



Reactive Phosphorus

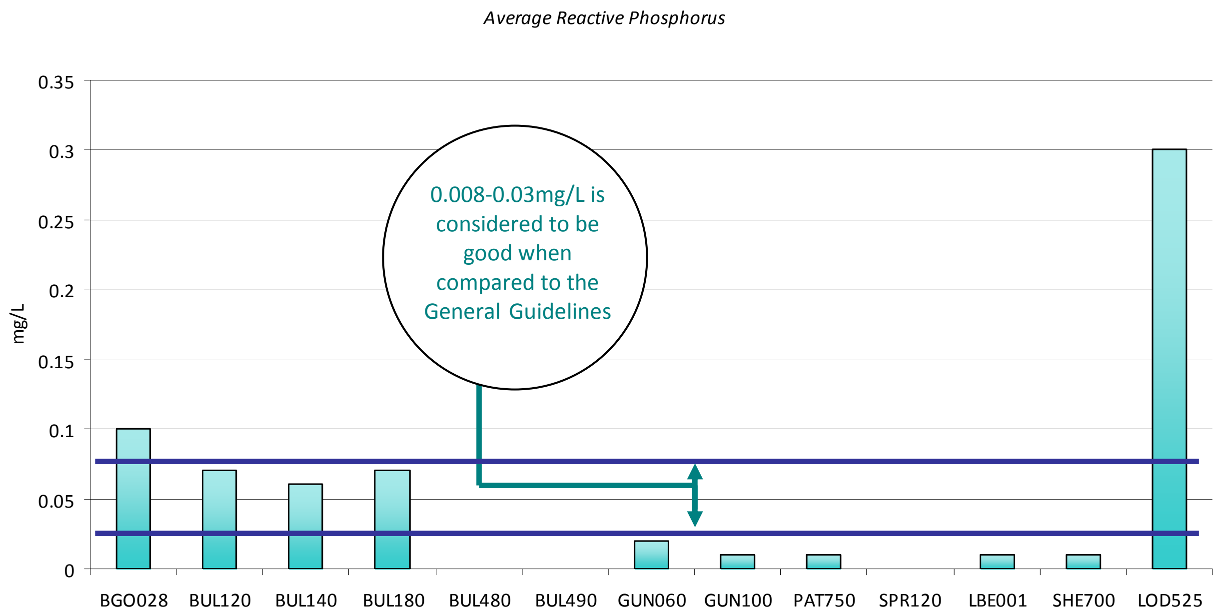
Reactive phosphorus on average at LOD5252 is slightly higher than all other sites, which fall well within the expected range for good quality.

Table 18 Reactive Phosphorus

Site Code	January	February	March	April	may	June	July	August	September	October	November	December
BGO028			0.2	0.02	0.1	0.15	0.01	0.15	0.25		0.03	0.03
BUL120							0.07			0.07		
BUL140							0.07			0.06		
BUL180							0.07			0.07		
BUL480												
BUL490												
GUN060	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.03			0.05	0.08
GUN100	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03			0.05	0.08
PAT750	0.01	0.01	0.01	0	0	0.01						
SPR120												
LBE001	0.1	0.02	0.01	0.05		0.02	0.05	0.07	0.07			
SHE700					0.01		0.01		0.03			
LOD525	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.03	0.02	0.1	0.1

* * *

Figure 18 Reactive Phosphorus



Avoca and Avon/Richardson Catchment

Catchment Description

The Avoca Catchment covers approximately 1.2 million hectares of the North Central CMA region. It extends about 340km from the Great Dividing Range near Amphitheatre northwards to the Avoca Marshes, and into the Murray River during associated flood events. Therefore, the Avoca River has some influence on the health of the Murray River, including salinity and flows. The average annual rainfall in the Avoca River catchment ranges from 650mm/year in the mountain regions in the south to 325mm/year on the northern plains.

The Avoca River in an anabranching river system and conveys the most variable flow of all Victorian rivers within the Murray-Darling Basin. The river ceases to flow for many months on end during dry years. Twelve weirs spaced along the length of the Avoca River influences its flow, but no major storages regulate flow in the system. Some of the smaller tributaries of the river have on-stream storages for towns – however, they are not considered significant.

The Avon-Richardson catchment is a land-locked river system that extends northwards from the Pyrenees foothills southwest of St. Arnaud to Lake Buloke on the margins of the Mallee, and covers approximately 330,000ha. The Avon-Richardson catchment lies to the east of the Wimmera Basin. The catchment has relatively little river regulation to modify or prevent flood flows and is connected to the Wimmera-Mallee channel system.

There are two main Waterways in the catchment - the Avon River and the Richardson River. The Avon River originates in the sedimentary hills south of Beazley Bridge; and the Richardson River flows mainly through the flat clay plains near Callawadda and Marnoo. The two rivers meet at Banyena, where the Richardson River continues flowing northward to the nationally significant Lake Buloke. The major tributaries flowing into the Avon River are Sandy, Paradise and Reedy creeks. Those flowing into the Richardson River include Walloo and Swedes creeks. There are over 100 lakes and wetlands within the Avon-Richardson catchment including Lake Batyo Catyo, Lake Cope Cope and the lakes at Avon Plains.

Community Monitoring Sites

During the sampling period, a total of 49 sites within the Avoca and Avon-Richardson catchment were monitored by seven local community volunteers who, on a monthly basis, went down to their sites to collect timely and critical water quality information. Site Codes and site locations are outlined in Table 19 below:

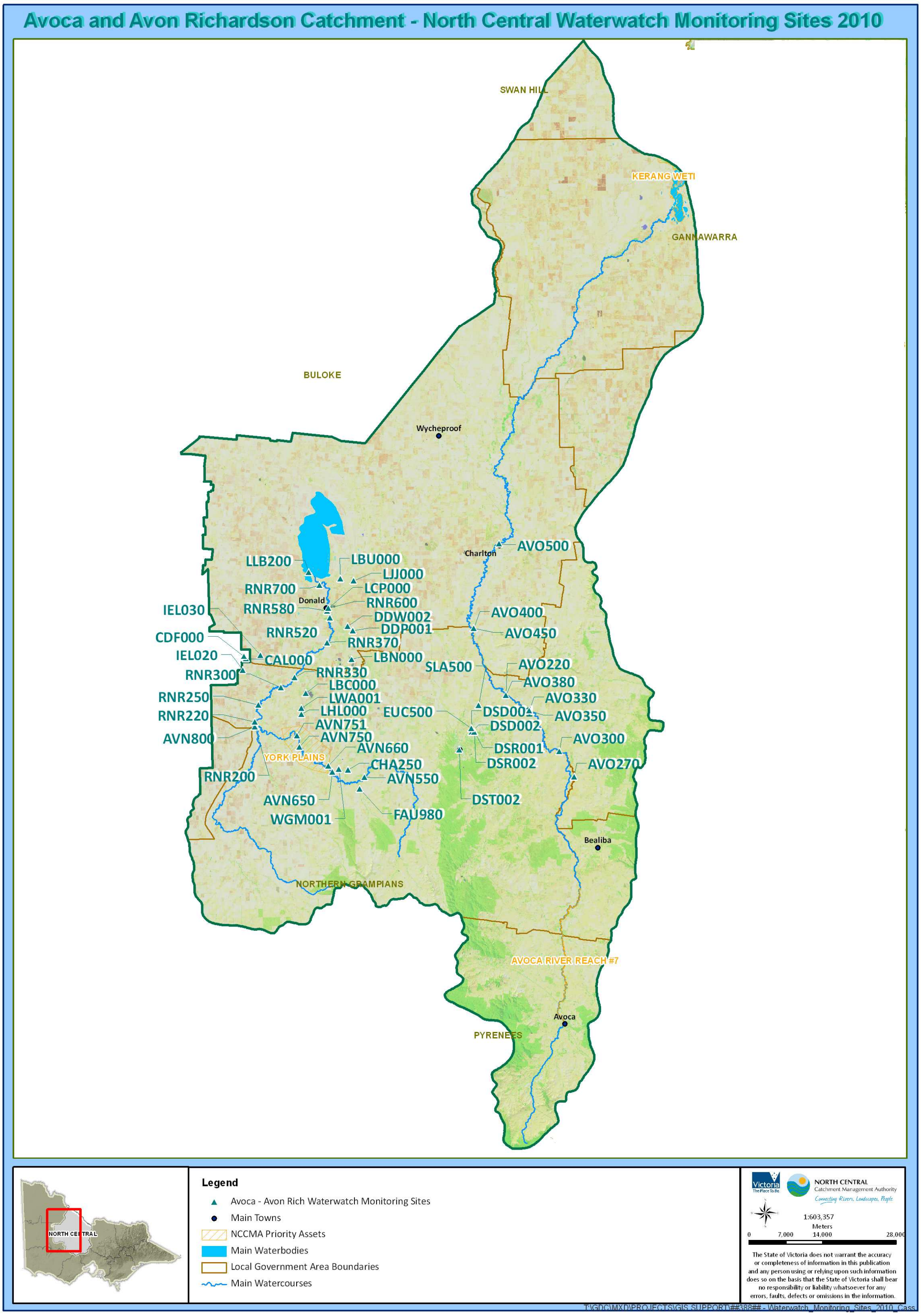
Table 19 Avoca and Avon-Richardson catchment Site Codes and Site Locations

Site Codes	Site Description
DST002	Botanic Park pond, St Arnaud
DSD001	Dam
DSD002	Dam behind house
DSR001	Small dam
DSR002	Large dam
EUC500	Eucy Creek, tributary of Slaty Creek
SLA500	Slaty Creek @ Charlton St Arnaud Road
FAU980	Faulkner Creek above bridge on Baldwins Plains Road
AVN550	Avon River @ Gre Gre Village
CHA250	Charlton channel @ Knights Rd, Gre Gre
WGM001	Swamp on McPherson Rd, Gre Gre
AVN660	Avon River, McPherson Rd @ monitoring station, Gre Gre
AVN650	Avon River @ crossing
DDW002	Dam on property
DDP001	Dam on property

Avoca and Avon/Richardson Catchment

AVO350	Avoca River, Gower East Bridge
AVO380	Avoca River, Yawong Rd Crossing
AVO400	Avoca river at Coonooer Bridge
AVO450	Avoca River, Yawong Weir
AVO500	Avoca River Charlton Weir
AVO220	Emu, Dunolly-St Arnaud Rd Bridge
AVO270	Avoca River, Scollary Rd Bridge
AVO300	Avoca River, Logan, Bendigo-St Arnaud Road
AVO330	Avoca River, Carapooee Bridge
AVN750	Avon River, Gray Bridge crossing, east of Banyena
AVN751	Avon River, York Plains Swamp, east side 100m from river
AVN800	Avon River, at Banyena,
CAL000	Catchment filled house dam
CDF000	catchment filled house dam
LCP000	Caravan Park Lake, Donald, east bank from jetty
LBC000	Lake Batyo Catyo, Avon Plains, from east end of jetty
LBN000	Brown's Lake, Cope Cope
LHL000	Holland's Lake
LJJ000	Lake Jil Jil, Jeffcott, Donald, middle of lake
LWA001	Walkers Lake
LLB200	Little Lake Buloke, eastern side near the Richardson inlet
LBU000	Lake Buloke at Pascal's Lane
RNR200	Richardson River, Banyena
RNR220	Banyena weir
RNR250	Richardson River, McCallisters Bridge
RNR300	Richardson River, near Donald/Stawell Rd, south bank
RNR330	Richardson River at Guthrie's Bridge
RNR370	Richardson River at Reseigh's ford, on Laen -Cope Cope Road
RNR520	Richardson River Wastewater Treatment Plant Road, Donald
RNR580	Richardson river, at Bullock's Head, Donald
RNR600	Richardson River, Apex Park, Donald
RNR700	Richardson River at Russell's wool shed north of Donald
IEL020	Channel crossing Rich Avon Road, Laen
IEL030	channel crossing Geddes Velodova Road

Figure 19 Avoca and Avon-Richardson Catchment - North Central Waterwatch Monitoring sites 2010/11



Avoca and Avon Richardson Catchment – Monitoring outcomes

pH

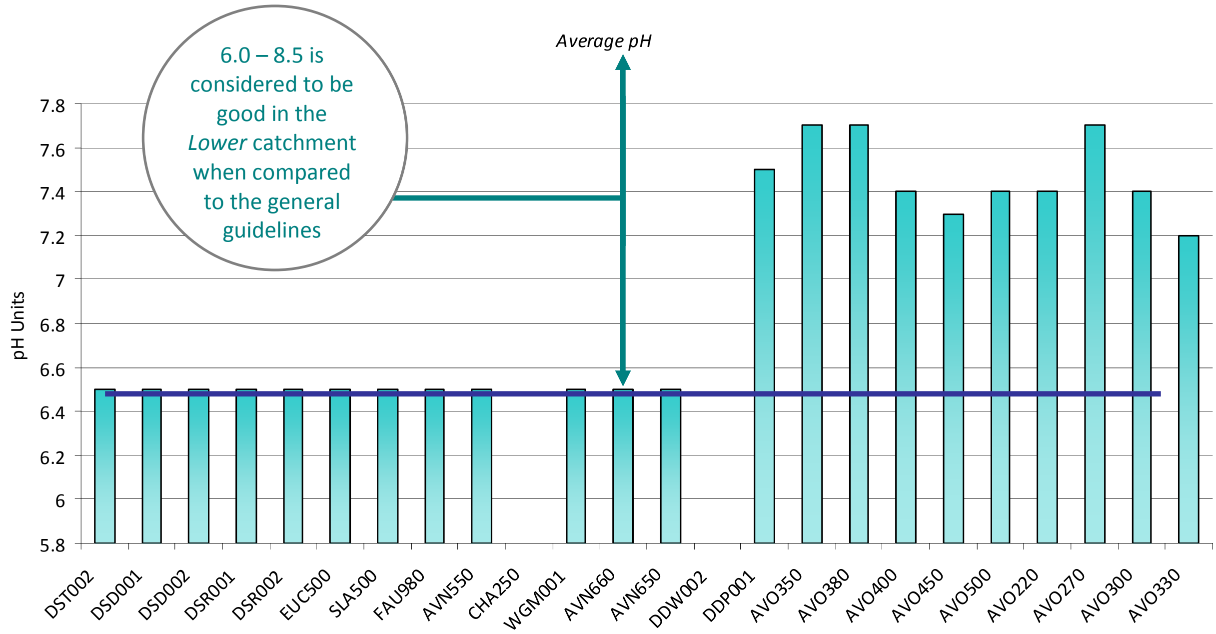
Sites monitored in the Avoca and Avon-Richardson for pH are consistent and range from good–excellent.

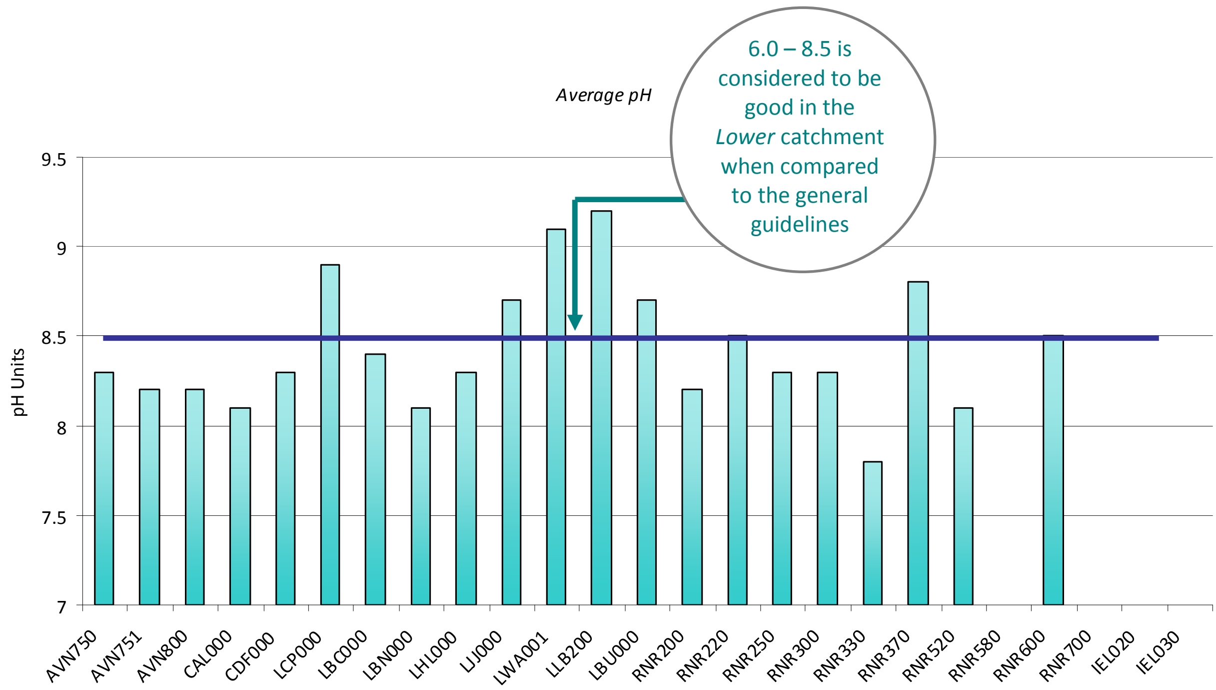
Table 20 pH raw data

Site Code	January	February	March	April	may	June	July	August	September	October	November	December
DST002	6.5	6.5			6.5	6.5						
DSD001		6.5			6.5	6.5						
DSD002	6.5	6.5			6.5	6.5						
DSR001	6.5	6.5			6.5	6.5						
DSR002	6.5	6.5			6.5	6.5						
EUC500					6.5							
SLA500								6.5	6			
FAU980								7	6.5			6.5
AVN550								6.5	7			6
CHA250												
WGM001								6.5	6			
AVN660								7.5	6.5			6
AVN650								7	6			6.5
DDW002												
DDP001								7.5				
AVO350	8	8	8	6.5	7.5	8.3						
AVO380	8.5	8	8	6.5	7	8.4		7.6				
AVO400	7.5	8	7.5	6.5	7	7.7		7.7				
AVO450	7.5	7.5	7.5	6.5	7	8		7.5				
AVO500	7.5	7.5	8	7.5	7	7.6		7.2				
AVO220	8	7.5	8	6.5	7.5	7.3						
AVO270	8			6.5	8.5	7.8						
AVO300	7.2	8	8	6.5	7	7.8						
AVO330	7.3			6.5	7	8.1						
AVN750								8.2		8.5		8.3
AVN751								8.2		8		8.2
AVN800									7.8	8.7		8.3
CAL000										8.1		8.5
CDF000										8.3		8.3
LCP000	9.3						9.1	9	8.7	8.7		8.6
LBC000						8.2				8.4		8.4
LBN000						8.1						
LHL000										9.3		9.4
LJJ000										8.7		
LWA001									8.5	9.6		9.4
LLB200										9.2		9.4
LBU000						8.7						
RNR200								8.4	7.8	8.3		8.3
RNR220	8.1	8.4	8.6		9.1					8.4		8.4
RNR250										8.5		8.3

RNR300	8.2	7.9	8.1		8.4	8.2	8.3		9.1	8.3		8.3
RNR330	7.2	7.7	7.6		7.3	7.4	7.5	7.7	8.9	8.7		8.4
RNR370									8.8	8.9	8.9	8.8
RNR520	8.6	8	7.9		7.6	7.7	8	7.6	8.4	8.3	8.3	8.7
RNR580												
RNR600	8.1	7.9	8.8		8.8	8.7	8.8	8.9	8.6	8.4	8.7	8.4
RNR700												
IEL020												
IEL030												
		*			*				*			

Figure 20 Average pH





Avoca and Avon/Richardson Catchment

Electrical Conductivity

Electrical conductivity in the Avoca and Avon-Richardson varies throughout the catchment, and is generally higher than recommended in the Guidelines.

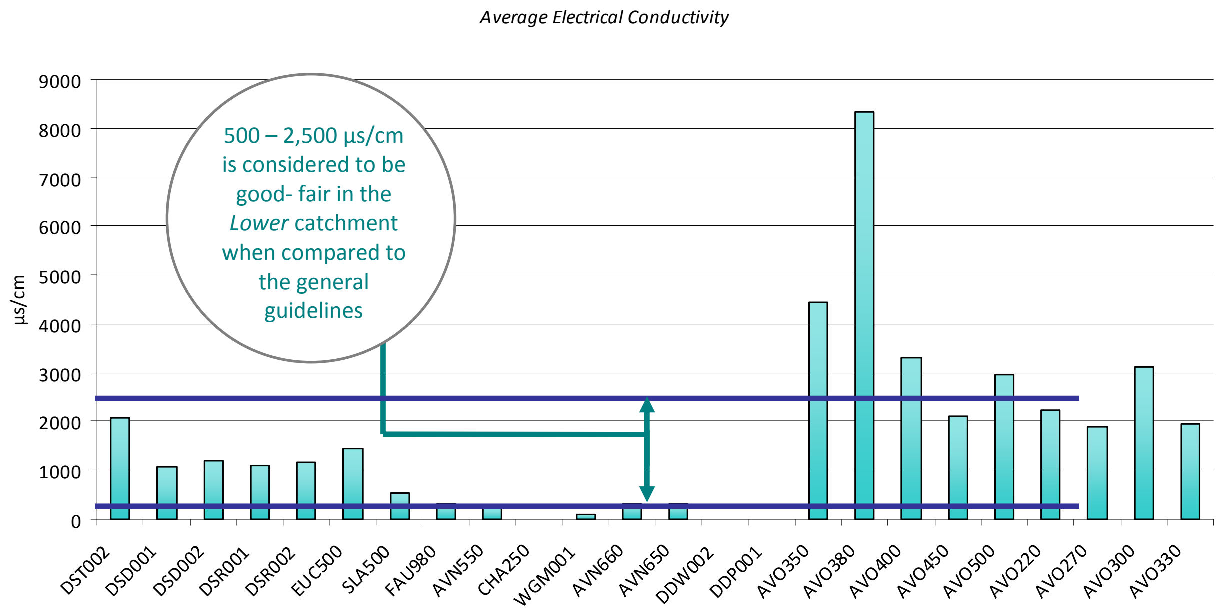
Table 21 Electrical Conductivity raw data

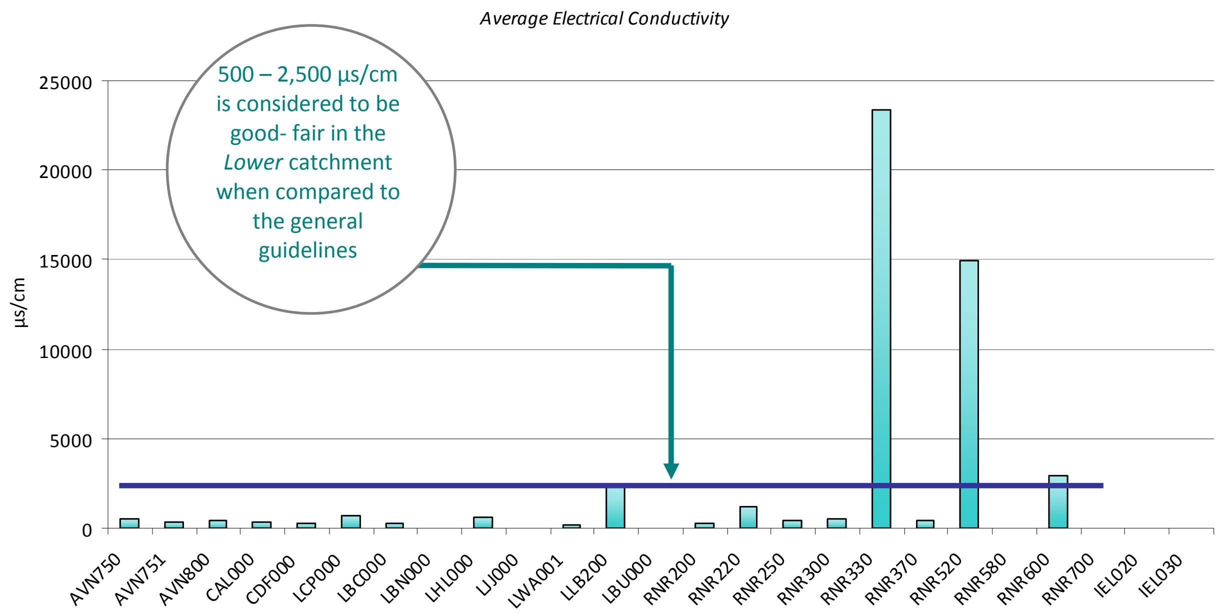
Site Code	January	February	March	April	may	June	July	August	September	October	November	December
DST002	1582	1671			2021	3061						
DSD001	131	1385			1413	1382						
DSD002	1747	169			1351	1457						
DSR001	1435	1447			1522	0						
DSR002	1157	1142			1207							
EUC500					1458							
SLA500								99	963			
FAU980								208	334			440
AVN550								221	159			257
CHA250												
WGM001								99	96.3			
AVN660								231	144			542
AVN650								224	180			533
DDW002												
DDP001								2740				
AVO350	5630	6820	7690	1097	1965	3410						
AVO380	1389	1725	1670	1423	2860	5830		322				
AVO400	4230	7540	4680	1522	2200	2580		378				
AVO450	2690	3250	3300	1479	1806	1955		320				
AVO500	2860	3490	3210	3100	3510	3700		763				
AVO220	4700	2580	2910	901	1200	1129						
AVO270	4590			887	985	1129						
AVO300	2280	5160	4660	728	2140	3730						
AVO330	2300			893	1887	2780						
AVN750								522		790		123
AVN751								500		311		285
AVN800									158	830		203
CAL000										322		300
CDF000										299		286
LCP000	1710						1317	725	101	211		221
LBC000						217				281		288
LBN000						304						
LHL000										480		670
LJJ000										542		
LWA001									90	209		221
LLB200										2180		2475
LBU000						690						
RNR200								147	100	758		141
RNR220	754	842	1109		3800					756		138
RNR250										798		138
RNR300	460	530	528		721	798	522		104	789		136

RNR330	3120	3410	3731		2740	3690	3370	3140	120	1800		141
RNR370									113	1020		153
RNR520	14,79 -	36,00 -	34,90 -		1790 -	1250 -	7100	3170 -	115	4340	4500	149
RNR580												
RNR600	3,100	7,150	2,249		3110	3500	2476	3100	119	6380	420	165
RNR700												
IEL020												
IEL030												

* * *

Figure 21 Average pH





Avoca and Avon/Richardson Catchment

Turbidity

Turbidity in the Avoca and Avon-Richardson varies throughout the catchment, and is generally higher than recommended in the Guidelines.

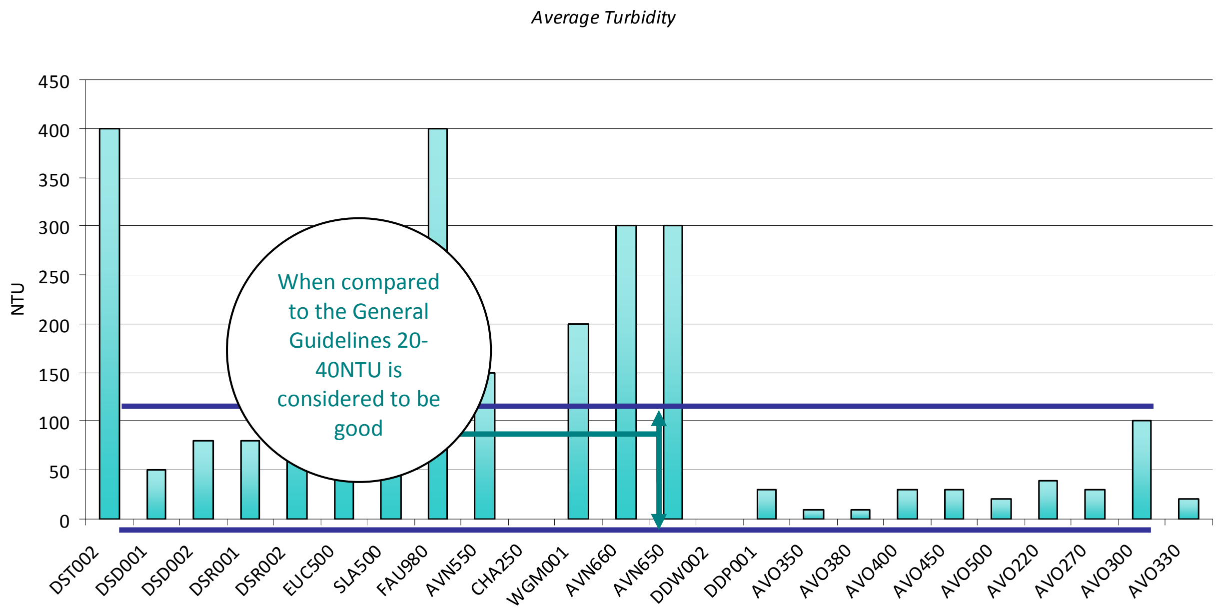
Figure 22 Turbidity Raw Data

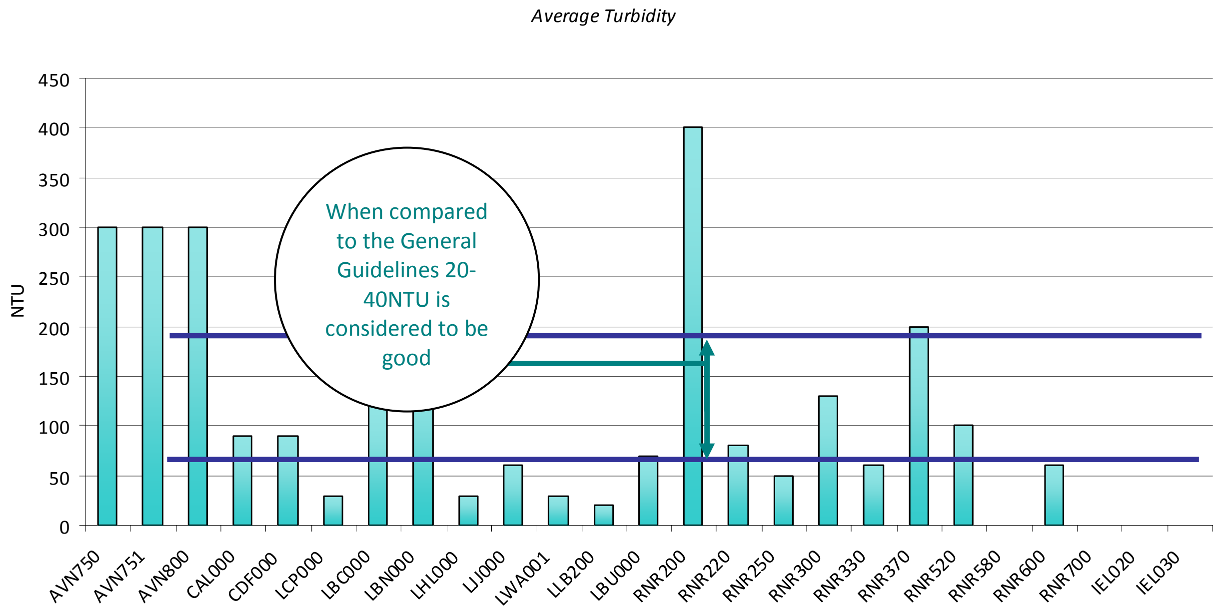
Site Code	January	February	March	April	may	June	July	August	September	October	November	December
DST002	400	400			400	300						
DSD001	55	50			12	100						
DSD002	80	80			150	100						
DSR001	60	60			110	120						
DSR002	200	200			200	100						
EUC500					300							
SLA500								200	<60			
FAU980								400	<300			>400
AVN550								300	<150			150
CHA250												
WGM001								200	<60			
AVN660								300	<200			300
AVN650								300	<150			400
DDW002												
DDP001								<30				
AVO350	<10	<10	<10	85	21	<10						
AVO380	<10	10	20	80	12	<10		150				
AVO400	100	45	<30	90	33	20		<200				
AVO450	27	30	35	85	33	<30		150				
AVO500	17	25	22	<10	38	<40		200				
AVO220	12	40	50	70	50	<40						
AVO270	25			65	32	<40						
AVO300	150	32	12	100	53	<15						
AVO330	22			110	30	<15						
AVN750								500		36		350
AVN751								500		62		303
AVN800									<400	39		358
CAL000										90		120
CDF000										80		90
LCP000	31						<80	<50	300	34		48
LBC000						400				131		148
LBN000						158						
LHL000										36		39
LJJ000										66		
LWA001									<400	25		29
LLB200										18		24
LBU000						78						
RNR200								400	400	94		320
RNR220	88	80	<60		39	<40				73		328
RNR250										51		310
RNR300	120	98	<100		90	101	<150		<500	41		330

RNR330	5	5	<10		5	5	<10	<10	<500	34		340
RNR370									400	45	68	342
RNR520	10	5	<10		5	8	<15	<400	400	42	74	320
RNR580												
RNR600	5	5	<10		5	13	<15	10	<500	34	80	325
RNR700												
IEL020												
IEL030												

* * *

Figure 23 Average Turbidity





Avoca and Avon/Richardson Catchment

Reactive Phosphorus

There was insufficient data collected for reactive phosphorus over the monitoring period in the Avoca and Avon-Richardson catchment. Therefore, no tables or graphs were able to be generated.

References

Department of Sustainability and environment (2005). Index of Stream Condition: The Second benchmark of Victorian River Condition, Melbourne, Victoria.

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