



Steph Carter, testing water quality



North Central Waterwatch  
River Health Snapshot Report

## **Bendigo Creek Citizen Science Project**

1 July 2018 to 30 Dec 2019





## Acknowledgement of Country

The North Central Catchment Management Authority (CMA) acknowledges Aboriginal Traditional Owners within the region, their rich culture and spiritual connection to Country. We also recognise and acknowledge the contribution and interest of Aboriginal people and organisations in land and natural resource management.

The *Dhelkunya Dja Country Plan* includes the goal of healthy waterways. Goal 5 Rivers and Waterways: Our Rivers and Waterways are healthy and meet the needs of our people and the land. Accordingly, Dja Dja Wurrung already play a leadership role in the protection and restoration of Bendigo Creek environment.

The Wanyarram Dhelk (Good Waterhole) project 2016, was a partnership project between Djandak (Dja Dja Wurrung Enterprise Pty Ltd) and the North Central CMA, with funding being made available through the Victorian Government's Aboriginal Water Unit, DELWP. North Central Waterwatch aims to continue monitoring the project area and report water quality health through this report to Dja Dja Wurrung Clan Aboriginal Corporation.



North Central Waterwatch and the City of Greater Bendigo support a team of citizen scientists to monitor the health of the Bendigo Creek.

Citizen scientists are playing an important role in monitoring the health of one of Bendigo's most valued waterways. Since October 2018 a dedicated team of volunteers have been gathering data that tells the story about the health of the creek. Understanding and reporting on the condition of our waterways is an important step for guiding waterway management decisions and demonstrating management outcomes.

The Reimagining Bendigo Creek project is identified as a flagship project in the Greater Bendigo Environment Strategy 2016-21. One of the actions identified in the plan is to 'establish a creek health monitoring and evaluation plan'. This is where citizen science fits in.

The Bendigo Creek Citizen Science program has been established to track and communicate the long-term ecological condition of the creek as it undergoes transformative changes over the coming years.

Read on to learn more about the current condition of the Bendigo Creek, our baseline for ongoing monitoring using citizen science data.





The Victorian Government is supporting community partnerships through Waterwatch and other citizen science initiatives to address local waterway priorities. These priorities are being addressed as part of the Victorian Government's \$222 million Water for Victoria investment to improve catchment and waterway health across regional Victoria.

## Bendigo Creek has a long, rich and varied history

The water quality monitoring results and the creek's current ecological health are a consequence of present day and past influences. Contributing factors include industry, current and past mining activities, storm water infiltration and the impact of urban development.

It's well known during the gold rush of the 1800s Bendigo Creek was fundamentally used as a drain to direct the vast amounts of sludge away from town. The values and function of the creek have vastly improved since this time and with careful future management it will continue to improve.

The City of Greater Bendigo's Reimagining Bendigo Creek plan aims to **"Change people's hearts and minds to take a journey of united action so that in a generation's time Bendigo Creek will be a healthy, connected and nurturing place"**<sup>2</sup> and is a good example of a proactive approach regarding the long-term health of the creek.

The results in this report contribute to a baseline regarding the creek's waterway health and will be replicated annually to build a picture over-time.

The North Central CMA is committed to supporting citizen science programs that enable communities to take action regarding the health of the region's waterways and to share knowledge. Citizen scientists are the custodians of the environment and make a real difference to decisions being made about natural resource management.



Bendigo Creek, Drummartin



Bendigo Creek, Knight Street

Site Code: BGO029 Monitor: Damien Harper

Beyond Lake Weeroona, the bed and bank of the creek become earth again with an abundance of instream vegetation that is the likely cause of a slight improvement in water quality at the site. The pH remains good, turbidity and phosphorous improve to moderate while electrical conductivity remains poor.

Adjacent to this site is a area referred to as the Knight Street frog ponds. The site was developed by Djandak, the commercial arm of Dja Dja Wurrung Clans Aboriginal Corporation. One of the aims of this site is remediation and water treatment works such as establishing reed beds. Tributaries here flow through a series of vegetated 'frog ponds' before entering the Bendigo Creek, a great showcase for water treatment in an urban environment.

Waterbug taxa richness, EPT and SIGNAL scores all rated poor at the site. This is not surprising as the water in the creek has travelled through the city with various industrial influences. The site is approximately 640 meters downstream from where the creek converts from concrete channel back to an earthen bed again. Vegetation plays a vital role in improving water quality and providing habitat which are compromised with a concrete base to the creek.

Phos (Mg/L)	pH	EC (Us/cm)	Turbity (NTU)	Waterbug Taxa Richness	ALT EPT	Signal Score
0.10	8.2	1512	17	5	0	2.4



Bendigo Creek, behind nursery near Bay Street

Site Code: BGO022 Monitor: Peter O'Toole

A slight improvement in reactive phosphorous result in a 'good' water quality rating at the site. Instream vegetation plays a vital role in reducing nutrients and this stretch of the creek has extensive reed beds.

Electrical conductivity at the site is poor. This site has a high groundwater table, is a known salinity discharge point and has the potential for groundwater intrusion into the creek. EC is likely to be influenced by saline groundwater along this reach.

Approximately 70 meters downstream, the creek is characterised by a concrete channel continuing for more than five kilometers through the central business district of Bendigo to just downstream of Lake Weeroona where it is an earth creek bed once again.

Waterbug taxa richness and EPT are rated poor at the site. Salinity and pollution are the most likely contributors as well as limited variety of habitats (common reed is dominant and dense). The SIGNAL score is close to meeting ALT objectives, with a variety of waterbugs of moderate pollution tolerance.

Phos (Mg/L)	pH	EC (Us/cm)	Turbity (NTU)	Waterbug Taxa Richness	ALT EPT	Signal Score
0.03	7.6	1736	19	12	1	3.8



Bendigo Creek, Elm Street

Site Code: BGO021 Monitor: Peter O'Toole

A sharp increase in EC occurs between this and the previous site, taking the score from 'good' to 'poor'. Phosphorous and turbidity levels are moderate, while pH remains stable.

Three tributaries enter between this and the Lockwood Road site (about 1.8 km upstream). Two flow in from the east - from an industrial precinct (around Grey Street Golden Square) and from an area of current mining activities in Golden Gully. A third flows in from the west. Inputs from these tributaries may be contributing to the contaminants found in Bendigo Creek.

No waterbug data was collected for the site during the reporting period.

Phos (Mg/L)	pH	EC (Us/cm)	Turbity (NTU)
0.05	7.6	1877	25



Frog Ponds, Number 7 Reservoir

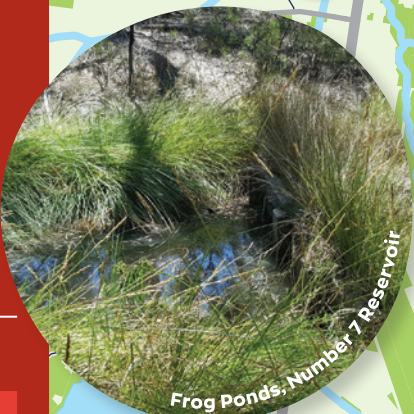
Site Code: FRO001 Monitor: Steph Carter

Although not on the Bendigo Creek itself, the Frog Ponds site at Number 7 Reservoir was chosen for monitoring as it represents what the creek may have once looked like. The site is within a forested catchment with an abundance of fringing and aquatic vegetation. Data collected at the site is a baseline for ecological function and it's not surprising that water quality at the site is the best of all sites monitored.

The ponds are regularly filled from the adjacent Number 7 Reservoir, so water quality is based on that of the Reservoir, combined with natural runoff following rain. Turbidity at this site is often high due to inflows from the Reservoir disturbing the sediment.

Interestingly, despite the good water quality score, waterbug taxa richness, EPT and SIGNAL scores rated low at the site and could be a result of poor turbidity.

Phos (Mg/L)	pH	EC (Us/cm)	Turbity (NTU)	Waterbug Taxa Richness	ALT EPT	Signal Score
0.02	6.9	636	200	12	0	2.3



Bendigo Creek, Scott Street

Site Code: BGO034 Monitor: Sallyanne Bartlett

A couple of years ago, the site was excavated to form a large refuge pond; a waterhole for wildlife refuge during drier times where water persists in the landscape for a longer period of time than the adjacent creek channel. Vegetation is establishing on the margins, but in time it will likely provide good habitat and improve water quality.

The pH is reading is good. There is a slight improvement in electrical conductivity but a poorer result for phosphorous. Water temperature at this site is very high, the highest of all sites. At an average of 27 degrees, the site would benefit from the establishment of overstory vegetation for shading.

Waterbug taxa richness, EPT and SIGNAL scores all rated poor at the site. In addition to the contributing factors outlined for site BGO029, the water temperature is warm due to limited shade. Warm water can contribute to decreased dissolved oxygen levels, increased waterbug sensitivity to pollution and disease and can also lead to increased algal blooms. Certain species will also only reproduce within certain temperature ranges.

Phos (Mg/L)	pH	EC (Us/cm)	Turbity (NTU)	Waterbug Taxa Richness	ALT EPT	Signal Score
0.15	7.8	1421	30	6	0	2.8



BGO060



Bendigo Creek, Millwood Road

Site Code: BGO060 Monitor: Nicole Howie

As the creek exits the town center, there is a gradual improvement in water quality. There are some extensive reed beds through Epsom and Huntly that help filter out nutrients and contaminants. The site is approximately five kilometers downstream from a water treatment facility, where high quality recycled water is released back to Bendigo Creek via a licensed discharge point.

Phosphorous levels return to a moderate level and turbidity begins to drop out. Good pH continues, while turbidity, phosphorous and electrical conductivity are rated as moderate.

Waterbug taxa richness and EPT scores remain poor, while the signal score is close to meeting ALT objectives. As the creek continues downstream in its more natural state it is expected that waterbug assemblages would continue to improve.

Of all the sites along the Bendigo Creek this area is the most natural looking and would no doubt be unrecognisable to many residents of Bendigo who only know the creek as it exists through the city center.

The Northern Bendigo Landcare Group takes great pride in this reach and actively delivers the Bendigo Creek Habitat Restoration project in the area. The project aims to protect and enhance habitat values, increase connectivity along the riparian corridor and raise awareness of the Bendigo Creek Streamside Reserve (its unique history, current assets and threats and future potential).

Phos (Mg/L)	pH	EC (Us/cm)	Turbity (NTU)	Waterbug Taxa Richness	ALT EPT	Signal Score
0.10	7.7	1081	16	11	0	3.9

Jackass Flat

BGO034



White Hills

BGO029



BGO027



Bendigo Creek, Bayne Street

Site Code: BGO027 Monitor: Derek Webb

This site is immediately downstream of the CBD and readings are the poorest of all sites monitored. The site is characterised by a concrete channel and bench and is heavily impacted by the vast stormwater inputs from the city and surrounding industries. Turbidity, phosphorous and electrical conductivity area all rated as poor.

Immediately downstream of the site, Back Creek joins the Bendigo Creek, behind the Bendigo Tennis Complex. Back Creek is a major tributary to the Bendigo Creek. Historical records indicate the site was "...the loveliest spot on Earth, with waterholes with water in them as clear as crystal, kingfisher birds flitting about in the silver wattle, whose lovely foliage almost hid the banks of the creek from view, with occasional splashings as the duck-billed platypus..."

No waterbug data was collected for this site during the reporting period.

Phos (Mg/L)	pH	EC (Us/cm)	Turbity (NTU)
0.25	8.2	2530	60

Bendigo Creek, Violet Street

Site Code: BGO025 Monitor: Derek Webb

Approximately 750 meters upstream of this site, the Golden Gully tributary enters Bendigo Creek and may be a contributor to the poor water quality as it originates from a mining area and travels through an industrial estate before entering Bendigo Creek.

Being within the city, there are a variety of contaminants likely to enter the creek. Urban stormwater is a complex issue. Litter, organic pollutants (leaves, grass clippings, animal faeces etc.) and chemical agents (such as petrochemicals, oils, fertilizers, industrial waste) can have a significant impact on the health of waterways. This is an issue along the length of the Bendigo Creek but more compounded through the CBD where there is no instream vegetation.

The creek is characterised by a concrete channel and bench (the flat area before the bank). There is no instream vegetation to assist with water purification. Turbidity is poor, while phosphorous and electrical conductivity are moderate.

No waterbug data was collected for the site during the reporting period.

Phos (Mg/L)	pH	EC (Us/cm)	Turbity (NTU)
0.07	8.4	1031	80



Bendigo Creek, Lockwood Road

Site Code: BGO011 Monitor: Steph Carter

As the most upstream site on Bendigo Creek, and with inflows from a small tributary about 300 meters upstream, it's not surprising the site has reasonably good water quality. EC and pH levels are relatively low and stable, moderate phosphorous levels are evident as could be expected in an urban environment.

The adjacent walking track sees regular passive use such as dog walking. Animal faeces entering the waterway could be a contributor to the moderate nutrient level score.

Urban development over time has seen vegetation clearing resulting in a very narrow vegetated buffer. This together with recent earthworks upstream may be contributing to a high turbidity score.

No waterbug data was collected for the site during the reporting period.

Phos (Mg/L)	pH	EC (Us/cm)	Turbity (NTU)
0.05	7.2	671	27



Water Quality Colour Coding

Sites have been colour coded and interpreted as follows:

- Good:** Water quality is acceptable and has minimal impacts on aquatic ecosystem health.
- Moderate:** Water quality and aquatic ecosystem health are moderately impacted.
- Poor:** Water quality and aquatic ecosystem health are largely impacted.



Water quality indicator levels

Water quality indicator levels for the Cleared Hills bioregions:

SEPP (WoV) segment	River health category	Reactive Phosphorus (mg/L)	pH (lower)	pH (lower)	Electrical conductivity (µS/cm)	Turbidity (NTU)
Cleared Hills	Good	≤0.03	≥6.3	≤8.5	≤700	≤15
	Moderate	>0.03 ≤0.1	<6.3 ≥5.5	>8.5 ≤9.0	>700 ≤1500	>15 ≤25
	Poor	>0.1	<5	>9.0	>1500	>25

Waterbugs Colour Coding

Sites have been colour coded and interpreted as follows:

- Meets or exceeds ALT objectives for a healthy ecosystem** (>30th percentile of index values for reference sites). Key processes and/or water quality may be slightly impacted however most habitats are intact.
- Close to meeting ALT objectives for a healthy ecosystem** (5th—30th percentile of index values for reference sites). Many key processes are not functional; water quality and/or habitat are moderately impacted.
- Does not meet ALT objectives for a healthy ecosystem** (<5th percentile of index values for reference sites). Most key processes are not functional and water quality and/or habitat is severely impacted.

**ALT Signal Index** (indicates the pollution tolerance of the waterbug community present)

**EPT Signal** (different types of stoneflies, mayflies and caddisflies)



Interpreting results

The results in this report are based on the analysis of macroinvertebrate monitoring data collected in spring 2019 and the analysis of water quality data collected monthly from June 2018 to December 2019. The report provides a baseline assessment of the current condition of Bendigo Creek using citizen science data.

The Victorian Government has a set of guidelines that provides limits to acceptable water quality levels and macroinvertebrate indices for healthy ecosystems. These levels are based on biological characteristics assigned to parts of the catchment which is determined by its position in the region.

In this program, the catchments lie within the Cleared Hills Bioregion.

Four water quality parameters were measured at each site during this time: pH, electrical conductivity, reactive phosphorous and turbidity. And three indices are calculated using macroinvertebrate data, assessed against Agreed Level Taxonomy (ALT) reference condition values.

Each site was assessed against these reference condition values and are calculated based on information known for the area, as if it was in the best available condition for that region.



## Acknowledgments

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We also acknowledge the tireless effort from our dedicated Citizen Scientists. If it weren't for their contribution and the huge amount of data required, this report would not be possible.

## References

1.The Bendigo Creek Story: The Map and Remembering, Part 2. 2013 (video transcript). Written and directed by Gerry Gill, produced by Daz Media.

2.Reimagining Bendigo Creek Draft Plan, 2020. City of Greater Bendigo. Online: <https://www.bendigo.vic.gov.au/About/Document-Library/reimagining-bendigo-creek-draft-plan-january-2020-0-pdf>



## How to get involved

Contact your local **Waterwatch Coordinator** at the **North Central Catchment Management Authority**

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