



# Bendigo Creek

Citizen Science Project

River Health Snapshot Report 2022



WaterWatch  
Victoria

North Central WaterWatch supports people to actively care for their environment by participating in Citizen Science programs that monitor and report on the health of the region's land, water, and biodiversity resources.



The Reimagining Bendigo Creek plan is continuing to be implemented by the City of Greater Bendigo (CoGB) and project partners including the North Central Catchment Management Authority (CMA). It aims to improve the health of Bendigo Creek, so that it will be a healthy, connected, and nurturing place for future generations. The Reimagining Bendigo Creek project spans the creek from its source in the Big Hill range, continuing for 21 kilometres downstream to the Bendigo-Tennyson Road in Huntly. This reach of the Bendigo Creek travels through predominantly urban landscapes.

Finally, the plan aspires to foster a community which cares for their creek, that enjoys spending time there, and improves the community's perception of the creek. Citizen Science programs reinforce the shared sense of responsibility in caring for the creek and provide hands-on participation opportunities for schools, community groups and volunteers.

North Central WaterWatch volunteers and Djandak are monitoring 17 sites as part of the Bendigo Creek Citizen Science Project, creating a long-spanning record of data, important for demonstrating the steady improvements made to Bendigo Creek over time.

The project is underpinned by three goals:

### 1. Catchment

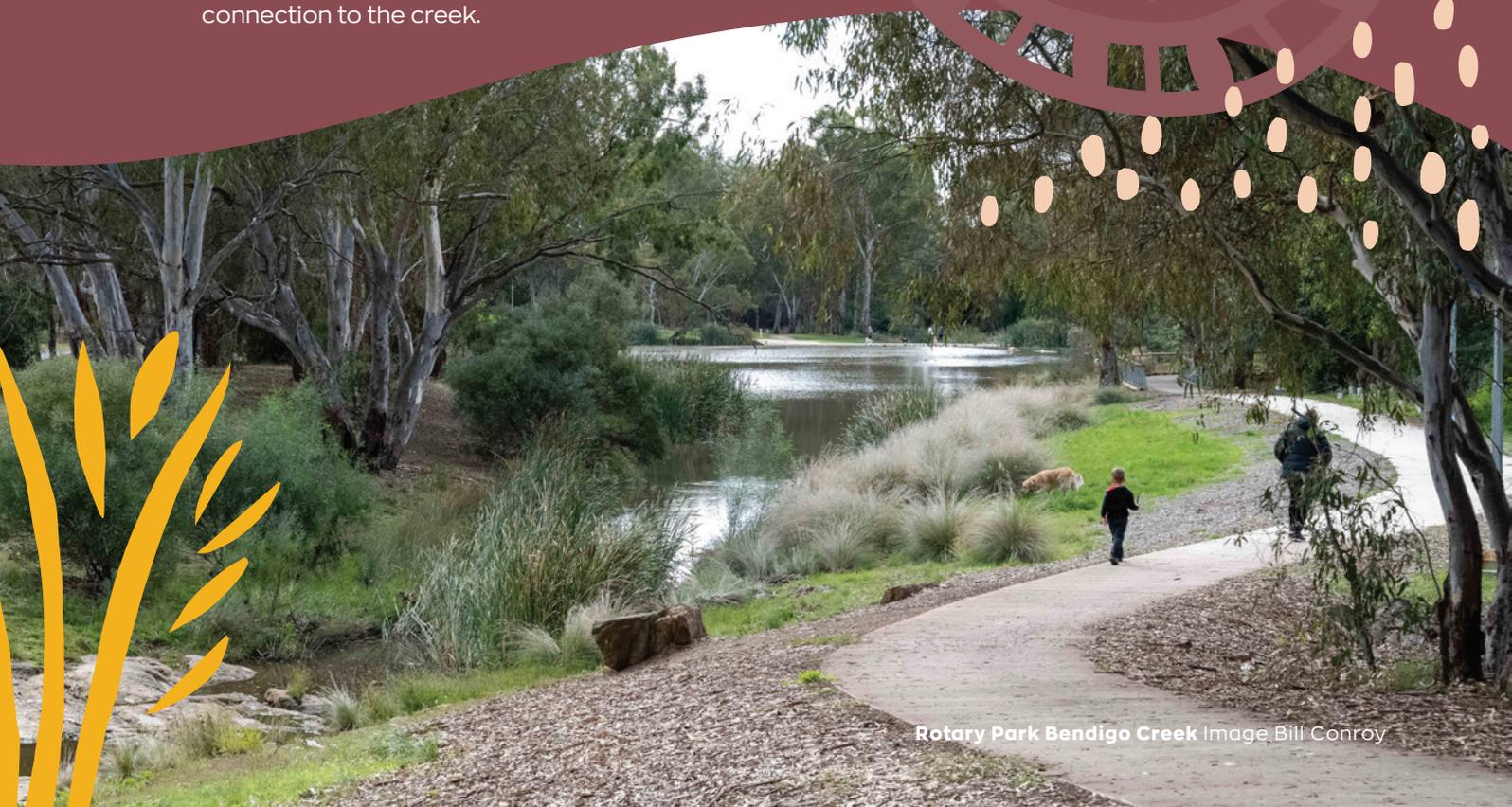
Improving the quality of the catchment, to create a healthier creek and a more resilient floodplain.

### 2. Connections

The creek will form a continuous, integrated public space, for the community to move through and enjoy.

### 3. Culture

Ensure the creek reflects Bendigo's rich and varied culture and becoming actively cared for by the community. The project seeks to empower the Traditional Owners, the Dja Dja Wurrung, to practice their cultural traditions and promote their spiritual and cultural connection to the creek.



Rotary Park Bendigo Creek Image Bill Conroy

## Summary of 2022 Results

### Water Quality Indicators

EC (µS/cm)	pH (lower)	pH (upper)	Turbidity (NTU)	PO4 (Mg/L)
1679	7	7.7	30	0.1
Moderate	Good	Good	Moderate	Poor

### Waterbug Indicators

Richness	EPT	Signal
10	1	3.0

Post-colonisation impacts, including extensive mining activity, continue to impact on Bendigo Creek catchment. During the gold rush of the 1800s, Bendigo Creek was mainly used to push mining sludge from away from the city centre. The heavily engineered drain that persists through central Bendigo today was created to straighten the creek and remove obstructions from a once-natural creek and deposit sediment across the landscape. Coupled with increasing urbanisation and the expansion of the drainage network, the Bendigo Creek catchment has been drastically altered resulting in poor water quality that persists today. Stormwater enters the creek with increasing volume and velocity leading to an increase of silting, littering and pollution of the waterway with no opportunities for natural filtration. Furthermore, contaminated groundwater from former mining activity continues to be discharged into the creek.

Results from 2022 citizen science data reflect these legacy impacts. Water quality of the creek through the channelised and urban sections of town is poor. Both upstream, and again further downstream of the city, water quality is better due to the improved instream habitat and catchment conditions. Heavy rainfall and localised flooding impacted the region in spring 2022. No-doubt these events have impacted on the waterbug surveys that were conducted during November as flooding can limit the macroinvertebrate population found in the months after major floods.

The COVID-19 pandemic continued to impact citizen science activities into 2022 with restrictions on public gatherings, remote learning and social isolation affecting participation in programs and events throughout the year. Nevertheless, volunteer visits to their adopted monitoring sites are up significantly from 2020 and 2021 and is trending towards pre-pandemic levels.

It is important to note that the Bendigo Creek is highly modified and despite efforts being made, improvements to the overall health of the creek are expected to take a long time. This is the beginning of a process of renewal, understanding and connection to Bendigo Creek spanning many generations.

## Pesticide Watch

North Central citizen science programs have been supporting a study into the presence of pesticides in Australian waterways led by Deakin University. A pilot study for Pesticide Watch was conducted at several locations along the Bendigo Creek during Spring 2022. Notably, pesticide residues were detected at each site of the five sites where the samples were taken. Pesticide Watch is being rolled-out across Australia throughout 2023 with all River Detectives schools in the Bendigo Creek footprint participating. Findings are due later in 2023.

## Bendigo Creek Citizen Science Project – 2022 Activities

- 17 Water Quality sites monitored by eight volunteers and Traditional Owners
- 50 site visits and data entries
- Six schools registered in the River Detectives education program delivering water science content to 638 students along Bendigo Creek
  - Kangaroo Flat Primary School
  - Golden Square Primary School
  - Camp Hill Primary School
  - Weeroona College
  - Epsom Primary School
  - Huntly Primary School
- One field day with 160 Year 7 students from Weeroona College at Wanyarram Dum supported by Parks Victoria and North Central CMA
- Three school incursions held with a total of 105 students.
- One Reimagining Bendigo Creek 'Project Prattle' at Wanyarram Dum yarning circle with City of Greater Bendigo and North Central CMA staff and teachers delivering River Detectives along Bendigo Creek
- Three Professional Development sessions for River Detectives teachers
- One field-day with macro-invertebrate expert John Gooderham attended by WaterWatch volunteers and TAFE students at Crusoe Reservoir
- Five sites surveyed for Deakin University's Pesticide Watch pilot study.
- Spring macroinvertebrate survey of six sites



## Bendigo Creek, Knight Street

Site Code: BGO029

This monitoring site is immediately downstream from where Bendigo Creek terminates as a concrete channel into a natural waterway. The site has a high amount of instream vegetation in the form of common reed (*Phragmites australis*), critical in the process of beginning to filter out contaminants gained through the city. *Phragmites* is a semi-aquatic plant that grows in poorly drained soils and tolerates moderately alkaline and saline soils, though can displace other plant species leading to a monoculture.

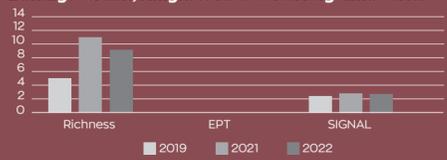
While there was insufficient water quality data collected during 2022, the poor waterbug scores are indicative of a polluted site and low-habitat diversity. All waterbug indicator targets for a healthy waterway have not been met, despite the slight improvement of instream habitat.

This site is directly adjacent to Wanyarram Dum, a series of frog ponds developed by Djandak, the corporate arm of Dja Dja Wurrung Clans Aboriginal Corporation who have begun to monitor this site.

This site tested positive for three insecticides, one of which is banned within Victoria; four herbicides, one of which is controlled; and one fungicide.

Waterbug Indicators		
Richness	EPT	Signal
9	0	2.7

### Bendigo Creek, Knight Street waterbug time series



## Bendigo Creek, Bay Street

Site Code: BGO022 Monitor: Peter O'Toole

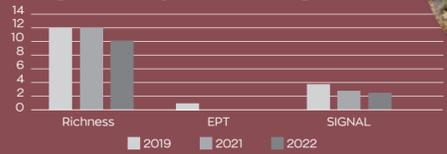
The Bendigo Creek is channelised at this point as it passes through the Bendigo suburb of Golden Square and water quality at this site is largely influenced by the surrounding land uses. While there is insufficient water quality data for 2022, the spring waterbug survey can assist in ascertaining the overall quality of the site.

Historically, this site has had moderate to poor water quality, with particularly high salinity due to the high groundwater table at this point. The invertebrate survey results are all far from meeting ALT objectives for a healthy ecosystem. This site is impacted by a lack of many habitats necessary for hosting invertebrates, such as stones, a soft waterbed, instream vegetation, in addition to prolonged periods of dryness.

This site has tested positive for three insecticides, three herbicides; two fungicides; and one miticide no longer registered with the APVMA.

Waterbug Indicators		
Richness	EPT	Signal
10	0	2.4

### Bendigo Creek, Bay Street waterbug time series



## Frog Ponds, Number 7 Reservoir

Site Code: FRO001 Monitor: Steph Carter

The Frog Ponds at Number 7 Reservoir are a series of ponds, kept full by regular top-ups from the adjacent reservoir, which heavily influences the water quality at this site. While this site is not directly connected to the Bendigo Creek, it is used as an informal standard for pre-industrialised Bendigo, as its healthy riparian zone and absence of urban run-off better illustrate the state of a natural waterway.

The site has moderate to good water quality, noting a fairly neutral pH and a low salinity. A lower pH of 6.9 is very close to what would be classed as a Good and nothing to be concerned with at this time. Given the high rainfall during the reporting period and the large amount of surrounding vegetation a slightly more acidic result for pH would be expected. As the site is influenced so heavily by the adjacent reservoir, the moderate turbidity may result from inflows disturbing sediments.

Water Quality Indicators				Waterbug Indicators		
EC	pH (lower)	pH (upper)	Turbidity	Richness	EPT	Signal
617	6.9	7.1	29	11	0	2.7

### Frog Ponds, Number 7 Reservoir waterbug time series



## Bendigo Creek, Scott Street

Site Code: BGO034 Monitor: Sallyanne Bartlett

Further downstream there is a slight improvement in waterbug indicators as the creek becomes more naturalised.

Although there is a lack of shade at this site, the healthy amount of instream vegetation has provided enough habitat for the observation of more sensitive waterbugs such as stick caddis, notable for their particularly low sensitivity to pollution. Although there was a low diversity (richness) of invertebrates species detected, the presence of more sensitive species at this site is positive. More fringing habitat, particularly trees, would assist in supporting greater numbers of more sensitive invertebrates at this location.

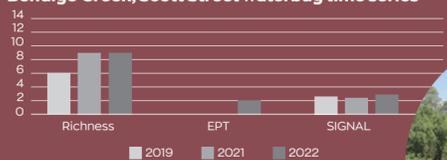
This site tested positive for two insecticides; five herbicides; one fungicide; and one miticide no longer registered with the APVMA.

Djandak has committed to monitoring this site in 2023.

### Waterbug Indicators

Richness	EPT	Signal
9	1	3.1

### Bendigo Creek, Scott Street waterbug time series



## Bendigo Creek, Bayne Street

Site Code: BGO027 Monitor: Derek Webb

This site, just downstream of central Bendigo, illustrates the debilitating impact urban stormwater has on Bendigo Creek. Salinity and reactive phosphorus levels have increased significantly from monitoring sites immediately upstream, showing how a lack of natural filtration heavily concentrates pollutants within a waterway.

### Water Quality Indicators

EC	pH (lower)	pH (upper)	Turbidity	PO4 (Mg/L)
1909	7.3	8	34	0.138

## Bendigo Creek, Millwood Road

Site Code: BGO060 Monitor: Nicole Howie

Further downstream is one of the most natural of the monitoring sites along the Bendigo Creek. Although this site recorded good salinity and pH results during 2022, it recorded poor turbidity and reactive phosphorus levels throughout the year. It is likely heavy spring rainfall and flooding lead to these poor results as the majority of poor turbidity and reactive phosphorus results were recorded after this time (mid-October). In addition, high amounts of water were released from the upstream wastewater treatment plant due to the risk of overflow during the floods.

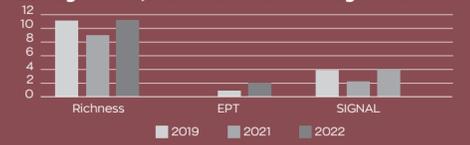
Invertebrate scores for this site are the highest seen of all of the Bendigo Creek sites, demonstrating natural filtration and a variety of habitats are pivotal in maintaining healthy ecosystem. The presence of both net spinning caddis and micro caddis larvae contributed to the moderate SIGNAL score for this site. Both are species of the Trichoptera order with SIGNAL scores of six and four respectively, and indicate a tolerance to mild pollution.

This site tested positive for two insecticides; six herbicides, one of which is controlled; four fungicides and one miticide, which is no longer registered with the APVMA.

### Water Quality Indicators

EC	pH (lower)	pH (upper)	Turbidity	PO4 (Mg/L)	Richness	EPT	Signal
956	7.1	7.5	32	0.168	11	2	4

### Bendigo Creek, Millwood Road waterbug time series



## Bendigo Creek, Violet Street

Site Code: BGO025 Monitor: Derek Webb

The water quality results at Violet Street are consistent with what would be expected of an inner-city creek. Although an initial glance at salinity results would appear good, further inspection reveals it is bordering on the moderate category. Turbidity and reactive phosphorus are similarly close to being very poor, and indicative of the proximity to the centre of town.

Runoff from the city's paved streetscapes is likely to be heavily contaminated from petrochemicals and litter as well as from organic debris such as fertilisers, leaf litter, grass clippings and animal droppings. As this section of the creek is entirely concrete, there is no opportunity for natural processes to alleviate the poor water quality.

### Water Quality Indicators

EC	pH (lower)	pH (upper)	Turbidity	PO4 (Mg/L)
1304	7.2	7.8	39	0.093

## Spring Creek at Ewing Park

Site Code: SPR450 Monitor: Tania MacLeod

Spring Creek is channelised at this point and receives a considerable amount of stormwater run-off from urban drains shortly after rain events. There is a marked increase in salinity between Spring Street and this site, likely due to the increased run-off of inorganic pollutants impacting the overall health of the site.

### Water Quality Indicators

EC	pH (lower)	pH (upper)	Turbidity	PO4 (Mg/L)
2640	7.7	7.7	17	0.05

## Spring Creek, Spring Street

Site Code: SPR300 Monitor: Tania MacLeod

Spring Creek is a tributary of Bendigo Creek, starting in Spring Gully and entering Bendigo Creek as a concrete channel just before Lake Weeroona. This site is just upstream of where the creek becomes channelised and receives stormwater from adjoining residential areas.

Throughout summer and autumn, the site is a series of disconnected pools, with occasional low flow. During winter and spring, the creek usually has a low or medium flow. In the dryer months, there is a higher rate of phosphorus content, possibly due to organic matter decaying within the stagnant pools.

Salinity and pH levels at this site were consistently good throughout 2022, at levels that support healthy ecosystem processes. Salinity and pH readings are both within a healthy range.

### Water Quality Indicators

EC	pH (lower)	pH (upper)	Turbidity	PO4 (Mg/L)
263	7.1	7.6	30	0.1

## Interpreting results

The results in this report are based on Citizen Science data collected for Bendigo Creek during 2022. Water Quality data was collected by WaterWatch monitors year-round and macroinvertebrate surveys were completed in late spring.

Water quality parameters in this report have been analysed using new indicator levels for the North Central CMA region developed in 2022 by Leon Metzeling and David Tiller. These indicators advance upon the State Environment Protection Policy (SEPP) guidelines, used in previous snapshot reports, to determine the ecological health of a waterway. This project lies within the Central Foothills - Campaspe, Loddon, and Avoca sub-segment of the surface water geographic region of the new Environmental Reference Standard (formerly Cleared Hills Bioregion).

Four water quality parameters were monitored by WaterWatch volunteers and Djandak staff: pH, electrical conductivity, reactive phosphorus, and turbidity. Site data was analysed for monitoring sites where there were five or more data entries and water quality results are the 75th percentile of all data entries at each site during 2022. For pH, the 25th percentile was also analysed to give an indication of the range of pH and diversion from neutral. The 25th percentile denotes the lower end of the range and the 75th percentile the upper end of the range of pH results during the 2022 calendar year.

Macroinvertebrate data was analysed at six sites in the project areas using Agreed Level Taxonomy (ALT) indexes for reference values of freshwater streams.

Samples were taken and analysed from five sites in the project area in November 2022 for the presence of pesticides as part of the pilot Pesticide Watch study. Results from the initial study are included in this report. Unless exempt from the registration requirement through the Australian Pesticides and Veterinary Medicines Authority (APVMA), unregistered chemical products are illegal and can be dangerous.

## 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.
- Very Poor:** Water Quality and aquatic ecosystems are severely impacted.

## Water quality indicator levels

Central Foothills - Campaspe, Loddon, and Avoca sub-segment

Indicator	Electrical conductivity (EC)	pH lower (25th percentile)	pH upper (75th percentile)	Turbidity	Reactive Phosphorus
Units	(µS/cm)	pH	pH	NTU	(mg/L)
Good	≤1,500	≥7.0	≤8.0	≤20	<0.025
Moderate	>1,500 ≤2,000	<7.0 ≥6.0	>8.0 ≤8.5	>20 ≤30	>0.025 ≤0.055
Poor	>2,000 ≤3,000	<6.0 ≥5.0	>8.5 ≤9.0	>30 ≤40	>0.055 ≤0.110
Very Poor	>3,000	<5.0	>9.0	>40	>0.110

## Waterbugs Colour Coding

Sites have been colour coded and interpreted as follows:

	Percentile of index values	ALT Richness	ALT EPT	ALT SIGNAL
<b>Meets or exceeds ALT objectives for a healthy ecosystem</b> Key processes and/or water quality may be slightly impacted, however, most habitats are intact.	30th	≥21	≥6	≥4.2
<b>Close to meeting ALT objectives for a healthy ecosystem</b> Many key processes are not functional; water quality and/or habitat are moderately impacted.	5th - 30th	>16 to <21	>3 to <6	>3.5 to <4.2
<b>Does not meet ALT objectives for a healthy ecosystem</b> Most key processes are not functional and water quality and/or habitat is severely impacted.	5th	≤16	≤3	≤3.5

## Glossary

**ALT** Agreed Level Taxonomy, is the current methodology implemented in Citizen Scientist macroinvertebrate surveying, to aid in the assessment of river and wetland health. The method involves identifying the features and movements of living organisms and means invertebrates can be returned to their waterway after data is collected.

**Richness** Refers to each unique genus identified using the ALT method. Generally, higher diversity of invertebrates reflects a healthier ecology.

**EPT** Ephemeroptera, Plecoptera and Trichoptera, refers to three orders of highly sensitive invertebrates, respectively; mayflies, stoneflies, and caddisflies (identified in their aquatic larval stages) found within Victorian waterways, with a particularly low sensitivity to pollution. Identification of a high count and richness of these invertebrates typically represents a healthy, unpolluted waterway.

**SIGNAL** Stream Invertebrate Grade Number - Average Level, is a simple index which determines each macroinvertebrate's tolerance of pollution. An abundance of macroinvertebrates with both high and low SIGNAL scores is indicative of a healthy waterway ecosystem.

## Want to get involved?

If you're passionate about your local environment, then we need your help!

We're calling on the local community to help keep a watchful eye on the health of our priority waterways.

If you'd like to get involved and become a volunteer citizen scientist, please register your interest with one of our Citizen Science project officers at:

Email: [citizenscienceteam@nccma.vic.gov.au](mailto:citizenscienceteam@nccma.vic.gov.au)

Ph.: (03) 5448 7124

Office: 628-634 Midland Hwy, Huntly Victoria 3551

## Acknowledgement of Country

The North Central Catchment Management Authority acknowledges Traditional Owners and Aboriginal and Torres Strait Islander peoples within the region, including their rich culture and enduring spiritual connection to Country. We also recognise and acknowledge the contributions and interests of Aboriginal peoples and organisations in land and natural resource management.

## Acknowledgments

North Central CMA would like to thank the City of Greater Bendigo for their ongoing commitment to Reimagining Bendigo Creek. We would also like to acknowledge the outstanding contributions made by WaterWatch volunteers, River Detectives schools, Djandak and Parks Victoria staff involved with the Bendigo Creek Citizen Science Program during 2022.



**Cove Image:** North Central CMA and Djandak Aboriginal staff, Ruby Norman and Annalise Varker testing water quality at Wanyarram Dum, July 2022

The Victorian Government is supporting community partnerships over the next four years 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 over the next four years to improve catchment and waterway health across regional Victoria.