ANNUAL DRINKING WATER QUALITY REPORT 2019-20

South Gippsland Region Water Corporation

South Gippsland Water

START SAFE
WORK SAFE
HOME SAFE

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Photos: Imagery of Leongatha water treatment plant

1. Introduction - from the Managing Director

I am pleased to present South Gippsland Water's annual drinking water quality report for the year ending 30 June 2020. In accordance with requirements of the Safe Drinking Water Act 2003 ("the Act"), this report summarises our performance against water quality standards, provides an overview of management practices, and describes how we respond to water quality challenges as they arise.

"Committed to providing safe, high-quality drinking water to all customers"

As part of South Gippsland Water's commitment to quality, we maintain a drinking water management system based on Hazard Analysis and Critical Control Point (HACCP) principles and the Australian Drinking Water Guidelines[1]. The system incorporates a catchment-to-tap monitoring program to ensure drinking water consistently meets legislative requirements of the Act and associated Safe Drinking Water Regulations 2015 ("the Regulations"). More information on water treatment, quality management systems and operational improvements can be found in part 2 of this report.

For the 2019/20 financial year, South Gippsland Water achieved 100 % compliance with the prescribed standards of the Regulations for *Escherichia coli*, turbidity, and trihalomethanes. A summary of results from our comprehensive monitoring program is provided in Part 4.

Customer satisfaction is very important to us at South Gippsland Water and we strive to meet expectations in in terms of supplying water that is both safe *and* pleasant to drink. In doing so we take pride in giving prompt and helpful service in response to water quality concerns. Details on the number of customer calls received in relation to drinking water quality in 2019/20, as well as information on how complaints are addressed, are provided in Part 5.

South Gippsland Water is committed to continual improvement and it is pleasing to note there has been a steady decline in customer complaints in recent years. This can be attributed to several factors, including the Lance Creek connection pipeline (refer to 2018/19 annual drinking water quality report on our website for details), water treatment plant improvements, and proactive distribution system cleaning programs.

We also began to reap the benefits of long-term catchment improvement projects in 2019/20. The risk rating for the Foster system catchment was lowered thanks to revegetation programs commenced in 2014. Catchment protection results in better-quality source water that requires less treatment to render it safe for drinking. This provides many advantages, including reduced operating costs.

The year has been challenging for everyone in terms of adapting to the Covid-19 pandemic. Like other businesses, we have had to changes our ways of working and postpone some non-critical activities. In view of this, we are proud of our successes in 2019/20, most notably delivering on our promise to provide clean, safe drinking water to the South Gippsland region.

1 National Health and Medical Research Council Australian Drinking Water Guidelines 2011

I trust you will find this report informative. For additional information on anything presented within, I invite you to contact us by phoning 1300 851 636 or emailing sgwater@sgwater.com.au

Philippe du Plessis
Managing Director

Characterisation of the System

Source water system

As part of the catchment-to-tap approach to providing safe drinking water, South Gippsland Water monitors for hazards in all water supply catchments. This approach is underpinned by the preventative and multiple barrier principles described in the *Australian Drinking Water Guidelines* 2011 (ADWG). The ADWG states that "prevention of contamination provides greater surety than removal of contaminants by treatments, so the most effective barrier is protection of source waters to the maximum degree practicable."

South Gippsland Water is reliant on "open" catchments for all source water. An open catchment is one in which part or all of the rainfall catchment area is in private ownership and land usage and public access is largely unrestricted. This presents a challenge in that complete protection of source water from farm and other run-off is not possible. Crucial to our role as a water supplier is improving our catchments as much as is achievable both within our own control and by engagement with other stakeholders.

Where hazards cannot be prevented, they are managed with robust and reliable barriers. Examples of these measures are documented in our Water Supply Catchment Monitoring Assessment and Improvement Program which is integrated into the Water Safety Plan and the Drinking Water Quality Management System. The program involves coordination of activities, including catchment surveillance, river health monitoring, land use planning assessment, and Source Water and Health-Based Target reporting. The Corporation also undertakes various catchment improvement works, including tree plantings and weed control, as well as promoting the importance of source water protection to the community via stakeholder engagement programs.

South Gippsland Water supply system

The service area of South Gippsland Water (SGW) covers approximately 4,000 square kilometres of the South Gippsland region, from Wonthaggi in the west to Yarram in the east; refer to Figure 1 – Map of South Gippsland Water water supply area and systems. The total water supply operation for 2019-20 comprised:

- 19 Water sampling localities
- 1,234 square kilometres of total catchment area
- 9 reservoirs and 4 raw water storage basins or tanks
- 8 water treatment plants and water supply systems
- 26 treated water distribution storages
- 18 water pumps
- 725 kilometres of water mains
- 21,928 connected properties supplying a population of approximately 37,000 permanent residents
- 4,689 megalitres (million litres) of metered water supplied to customers
- A connection pipeline from the Melbourne water grid to the Lance Creek water treatment plant

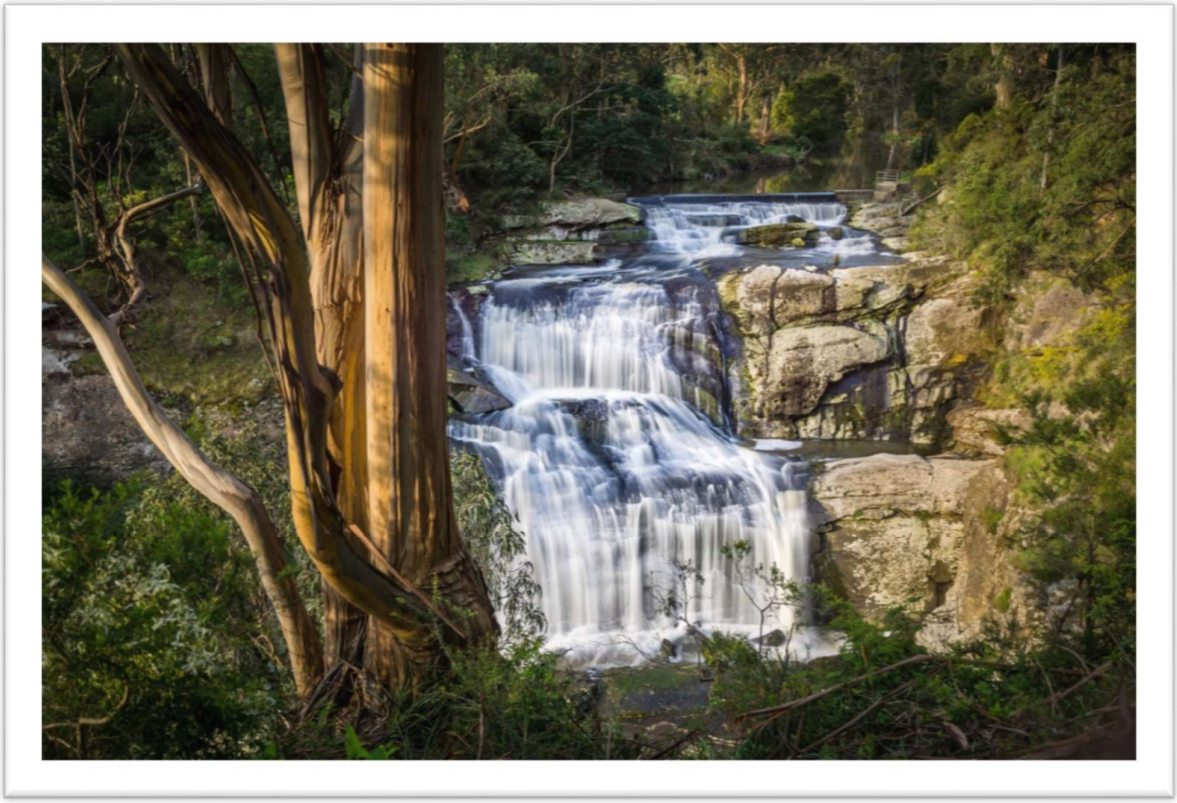


Photo: Agnes Falls (Image credit: David Barton)

Table 1: South Gippsland Water water sampling localities and supply sources

Localities supplied	Population serviced[2]	Principal raw water supply sources	Supplementary source water supply sources	Raw water storage	Water treatment plant
Alberton Yarram	560 2,480	Tarra River	Gippsland Basin groundwater aquifer (via bore, Devon North)	Devon North Raw Water Basin	Devon North
Dumbalk	410	Tarwin River (east branch)		Dumbalk Raw Water Tank	Dumbalk
Fish Creek	830	Battery Creek		Battery Creek Reservoir	Fish Creek
Foster	1,840	Deep Creek		Deep Creek Reservoir; Foster Dam; Foster Raw Water Basin	Foster
Cape PatersonCape Paterson Inverloch Lance Creek Wonthaggi Korumburra Loch Nyora Poowong	890 5,390 100 8,680 4,470 640 1,530 640	Lance Creek	Potable water also received from Cardinia Reservoir and Victorian Desalination Plant	Lance Creek Reservoir	Lance Creek
Koonwarra Leongatha	400 5,650	Ruby Creek		No. 1 Reservoir; No. 2 Reservoir; No. 3 Reservoir (Hyland); No. 4 Reservoir (Western)	Leongatha
Meeniyan	770	Tarwin River		Meeniyan Raw Water Basin	Meeniyan
Port Franklin Welshpool Toora	130 540 780	Agnes River		Cooks Dam	Toora

2 Population Served based on ABS 2017 Census data. The ABS method of calculation of population is based on State Suburbs (SSC) and may not always reflect the exact sewer/water district.

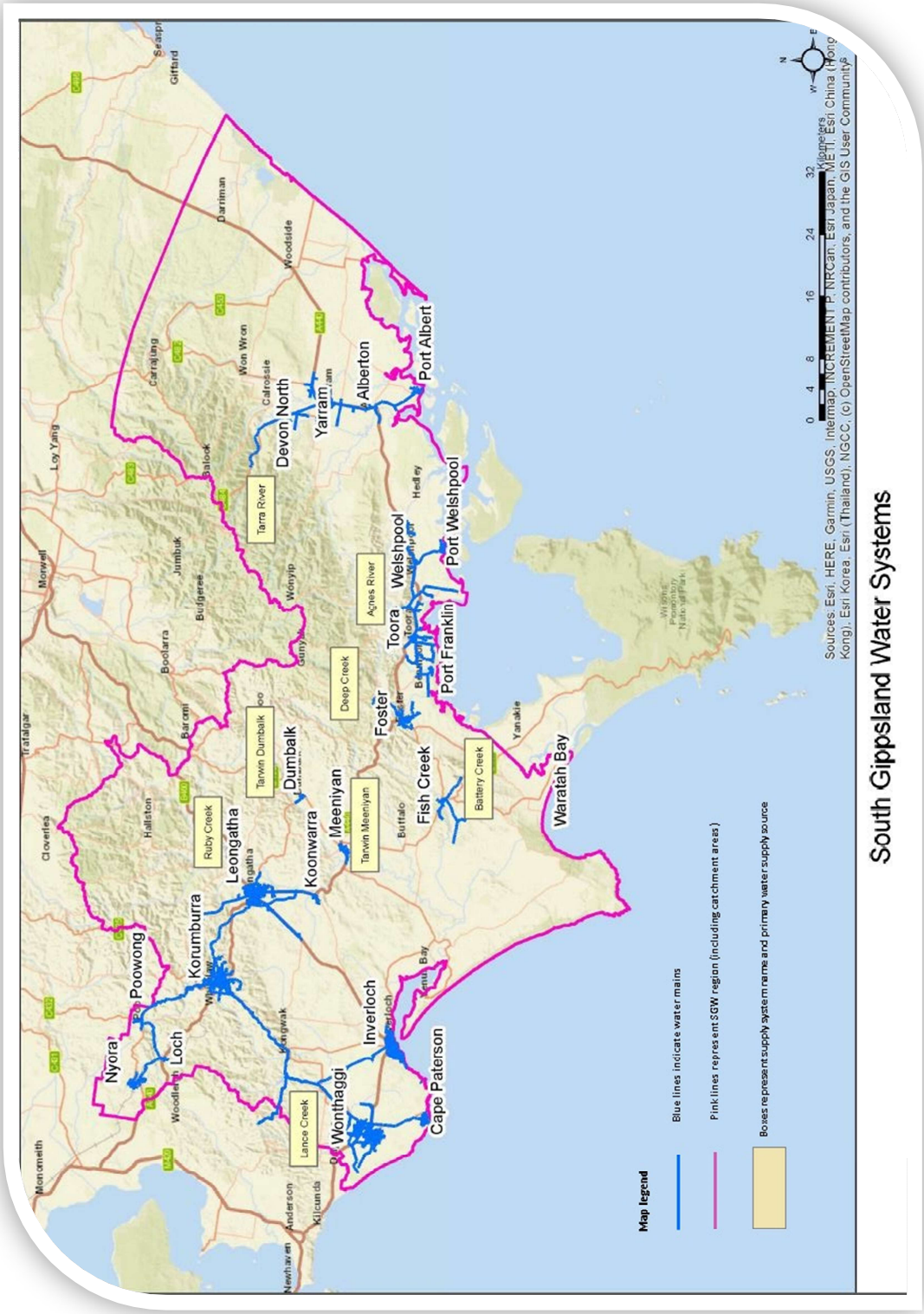


Figure 1: South Gippsland Water water supply area and systems

2. Water Treatment and Quality Management Systems

Water treatment overview

Conventional water treatment is a process whereby water is purified to a level suitable for human consumption. It generally begins with raw source water being allowed to settle in a reservoir so that natural sedimentation of large particulate matter can occur. The next step involves oxidation and precipitation of dissolved substances using aeration devices. Chemical agents are added as water flows through pipes from reservoir to the water treatment plant (WTP). The agents cause small particles to clump together into large insoluble masses known as floc in the processes of coagulation and flocculation. The floc formed is separated from water via gravitational settling or flotation. Filtration of the clarified water further reduces the load of small particles, microorganisms, and other contaminants. The final step in the process is disinfection. This commonly involves the addition of chlorine-based disinfectants, but other chemical agents or ultra-violet light may also be used to ensure water supplied to customers is free of harmful microorganisms.

A summary of the processes by which the drinking water supplied by South Gippsland Water (SGW) is treated and disinfected is provided in Table 2 and Table 3.

Changes in water treatment and supply conditions

There were no major changes to water treatment or supply conditions in 2019-20.

Photos: Imagery of Lance Creek reservoir, water treatment plant and clear water storage tank

Table 2: List of processes and chemicals used to treat and disinfect water supplied by SGW[3]

Water Treatment Plant (WTP)	Localities supplied	Treatment process	Treatment frequency	Added substances
Devon North	Alberton Yarram	Pre-treatment pH correction Manganese oxidation Coagulation and flocculation Dissolved air flotation clarification Filtration by granular medium Chloramine disinfection Dewatering of waste water	As required As required Regular Regular Regular Regular Regular	Sodium carbonate Potassium permanganate Aluminium sulphate / aluminium chlorohydrate - - Sodium hypochlorite and ammonia -
Dumbalk	Dumbalk	Pre-treatment pH correction Manganese oxidation Coagulation and flocculation Sedimentation clarification Filtration by granular medium Ultraviolet (UV) disinfection Primary chlorination disinfection Secondary chlorination disinfection Removal of volatile organics by aeration Dewatering of waste water	Regular As required Regular Regular Regular Regular Regular Regular Regular Regular	Sodium carbonate Potassium permanganate Aluminium chlorohydrate - - - Sodium hypochlorite Sodium hypochlorite - Anionic polyacrylamide
Fish Creek	Fish Creek	Pre-treatment pH correction Manganese oxidation Coagulation and flocculation Sedimentation clarification Filtration by granular medium Post-treatment pH correction Primary chlorination disinfection Removal of volatile organics by aeration Secondary chlorination disinfection Dewatering of waste water	Regular As required Regular Regular Regular Regular Regular Regular Regular Regular	Sodium carbonate Potassium permanganate Aluminium sulphate - Anionic polyacrylamide Sodium carbonate Sodium hypochlorite - Sodium hypochlorite -
Foster	Foster	Taste and odour control Pre-treatment pH correction Manganese oxidation Coagulation and flocculation Sedimentation clarification Filtration by granular medium Post-treatment pH correction Primary chlorination disinfection Secondary chlorination disinfection Dewatering of waste water	As required Regular As required Regular Regular Regular Regular Regular Regular Regular	Powdered activated carbon Sodium carbonate Potassium permanganate Aluminium sulphate / aluminium chlorohydrate - - Sodium carbonate Chlorine (gas) Sodium hypochlorite -
Lance Creek	Cape Paterson Inverloch Lance Creek Wonthaggi Korumburra Poowong Loch Nyora	Taste and odour control Pre-treatment pH correction Manganese oxidation Coagulation and flocculation Dissolved air flotation clarification Filtration by granular medium Post-treatment pH correction Fluoridation Primary chlorination disinfection* Secondary chloramination disinfection Dewatering of waste water	As required As required As required Regular Regular Regular Regular Regular Regular Regular Regular	Powdered activated carbon Sodium hydroxide / hydrochloric acid Potassium permanganate Aluminium sulphate / aluminium chlorohydrate - - Sodium hydroxide Hexafluorosilicic acid Chlorine (gas) Chlorine (gas) and ammonia Anionic polyacrylamide

[3] Refer to Glossary at end of report for further information

Table 2 (continued): List of processes and chemicals used to treat and disinfect water supplied by SGW

Water Treatment Plant (WTP)	Localities supplied	Treatment process	Treatment frequency	Added substances
Leongatha	**Koonwarra** **Leongatha**	**Taste and odour control** **Pre-treatment pH correction** **Manganese oxidation** **Coagulation and flocculation** **Sedimentation clarification** **Filtration by granular medium** **Post-treatment pH correction** **Primary chlorination disinfection** **Secondary chlorination disinfection** **Dewatering of waste water**	As required Regular As required Regular Regular Regular Regular Regular Regular Regular	**Powdered activated carbon** **Sodium hydroxide** **Potassium permanganate** **Aluminium sulphate** - - **Sodium hydroxide** **Chlorine (gas)** **Chlorine (gas)** -
Meeniyan	**Meeniyan**	**Manganese oxidation** **Coagulation and flocculation** **Sedimentation clarification** **Filtration by granular medium** **Chlorination disinfection** **Ultraviolet (UV) disinfection** **Removal of volatile organics by aeration** **Dewatering of waste water**	As required Regular Regular Regular Regular Regular Regular Regular	**Sodium hypochlorite** **Aluminium chlorohydrate** **Anionic polyacrylamide** - **Sodium hypochlorite** - - **Anionic polyacrylamide**
Toora	**Port Franklin** **Port Welshpool** **Toora**	**Taste and odour control** **Pre-treatment pH correction** **Manganese oxidation** **Coagulation and flocculation** **Sedimentation clarification** **Filtration by granular medium** **Post treatment pH correction** **Chlorination disinfection** **Dewatering of waste water**	As required As required As required Regular Regular Regular Regular Regular Regular	**Powdered activated carbon** **Sodium carbonate** **Potassium permanganate** **Aluminium sulphate** - - **Sodium hypochlorite** **Chlorine (gas)** -

Table 3: List of processes and chemicals used to treat and disinfect supplementary supply from Melbourne Water to Lance Creek clear water storage

Source water / Catchment	Storage / Transfer	Treatment process	Treatment frequency	Added substances
Transfer from Silvan Reservoir without being treated at Silvan WTP	Cardinia Reservoir	Disinfection Fluoridation pH Correction Secondary disinfection Secondary pH correction	Regular Regular Regular Regular Regular	Chlorine gas (Cl_2) Fluorosilicic acid (FSA) Lime (Calcium oxide) Sodium hypochlorite Carbon dioxide
Bass Strait sea water via Desalination Plant offtake	Direct to supply or Cardinia Reservoir	Coagulation Filtration Reverse osmosis Remineralisation Fluoridation Disinfection Sludge thickening Membrane preservations	Regular Regular Regular Regular Regular Regular Regular Regular	Ferric sulphate, Sulfuric acid, PolyDADMAC* -- Antiscalant, Sodium hydroxide Hydrated lime (Calcium dioxide), Carbon dioxide Fluorosilicic acid (FSA) Sodium hypochlorite Ferric sulphate. Polyacrylamide Sodium bisulphite
Melbourne Water Delivery point 5 (DP5) of desalination pipeline	Transfer pipeline from DP5 to Lance Creek clear water storage tank	pH Correction Disinfection	As required As required	Hydrochloric Acid, Sodium hydroxide Chlorine gas (Cl_2)

*Polydiallydimethylammonium chloride

Water Treatment Issues

Continual process monitoring and jar tests are used in water treatment plant laboratories to simulate plant conditions and ensure correct dosage of treatment chemicals. This enables optimisation of treatment processes in response to changes in raw water quality and other factors. Occasionally issues arise out of the application of water treatment processes and corrective actions must be taken.

Three fluoridation outages for periods greater than 72 hours at Lance Creek water treatment plant (WTP) are the only treatment issues noted for 2019-20. These were reported to the Department of Health and Human Services in accordance with the Code of practice for fluoridation of drinking water supplies. The outages related to intentional shut-downs of the fluorosilicic acid dosing system; refer to Table 4.

Table 4: Fluoridation outages

Issue	Location	Date	Summary
Fluoridation outage greater than 72 hours	Lance Creek WTP	30/8/2019 to 16/9/2019	Fluoride analyser replacement required
Fluoridation outage greater than 72 hours	Lance Creek WTP	8/11/2019 to 13/11/2019	Routine servicing of fluoridation system
Fluoridation outage greater than 72 hours	Lance Creek WTP	1/5/20 to 5/5/20	Electrical fault in WTP flow meter

Quality Management Systems and Continual Improvement

The risk management approach adopted by South Gippsland Water is based on the twelve elements of the Framework for Management of Drinking Water Quality as described in the *Australian Drinking Water Guidelines*. A number of on-going programs and practices form part of the risk management system. These are designed to ensure treatment plants and water supply distribution systems are operating optimally at all times; examples are as follows:

- Filter management program
- Backflow prevention program

- Regular site security checks of all water treatment facilities and distribution system water storages
- Procedures in relation to hygienic mains break repair and replacement
- Proactive mains flushing and air-scouring programs
- Hydrant replacement program

The risk management system also includes a commitment to continual improvement, with the aim of achieving best practice in the delivery of drinking water to customers. Training, attendance at seminars, and membership of peak industry bodies (including the Australian Water Association, the Water Industry Operators Association, and the Water Services Association of Australia) ensure all employees involved in water treatment and quality assurance are well-informed about drinking water-related research, and advances in technologies and practices.

There are several capital improvement projects currently planned or underway for water treatment plants (WTP); these include:

- Installation of an ultraviolet light (UV) disinfection system at Leongatha WTP (due 2022)
- Improvements to clear water storage configuration at Leongatha WTP which will enable greater control of disinfection contact times (due 2022)
- Individual filter turbidity monitoring and control at Meeniyan WTP (due 2020)
- Upgrading of the UV disinfection system at Toora WTP for improved reliability (due 2022-23)
- Replacement of powdered activated carbon (PAC) dosing systems at Lance Creek WTP and Foster WTP for improved taste and odour control (due 2022-23)

These projects will be discussed in more detail in future annual drinking water quality reports, once complete.

Photo: Water Treatment Plant Operator conducts a jar test

3. Emergency, Incident, and Event Management

Incidents reported under the Safe Drinking Water Act

Section 22 of the *Safe Drinking Water Act* 2003 (the Act) requires a water supplier to immediately notify the Department of Health and Human Services (the Department) of any circumstances where it is believed that drinking water supplied to the public may be the cause of an illness, pose a risk to human health or cause widespread public complaint. Section 18 of the Act requires a water supplier to notify the Department when it becomes aware that the drinking water it is supplying to another person does not comply, or is not likely to comply, with any relevant water quality standard. Based on this requirement, the incident described in this section has been reported to the Department in the 2019-20 reporting period. Table 5 provides a summary of the event reported under section 22. There were no events reported under section 18 in 2019-20.

Table 5: Summary of event reported to the Department of Health and Human Services under section 22 Safe Drinking Water Act 2003

Water sampling locality affected	Type of notification	Date of incident	Location of Incident	Nature of incident	Investigation result
Meeniyan	Section 22	14/01/2020 to 15/01/2020	Meeniyan clear water storage outlet	*Escherichia coli* (*E. coli*) detection for a routinely-collected sample	Was not representative of the water being supplied and was concluded a false positive result

Escherichia coli detection – Meeniyan clear water storage outlet

Escherichia coli (*E. coli*) was detected in a sample taken from the outlet of the Meeniyan clear water storage tank on the 14th January 2020. In accordance with SGW's drinking water risk management plan, the Meeniyan locality was resampled and an investigation of possible sources of contamination was carried out. There were no *E. coli* detections for any of the investigative samples collected on the 15th January 2020, nor were there indications of a failure in water treatment processes. Inspection of the clear water storage tank found it to be secure with no points of potential ingress.

The Department of Health and Human Services was notified of the E. coli and sent a detailed investigation report in accordance with section 22 of the Safe Drinking Water Act. The department accepted the conclusion of the report, which stated that the low-level detection was not representative of the water being supplied to Meeniyan. Thus, the Meeniyan water sampling locality remained compliant with the Safe Drinking Water Regulations 2015 in the 2019-20 period.

4. Drinking Water Quality Standards

During the 2019-20 reporting period, South Gippsland Water implemented water quality monitoring programs consistent with requirements of the *Safe Drinking Water Act 2003* (the Act) and associated Safe Drinking Water Regulations 2015 (the Regulations).

Schedule 2 of the Regulations lists three water quality parameters —*Escherichia coli*, trihalomethanes (total), and turbidity —and stipulates both the sampling frequency required for each parameter and the acceptable standard with which collected and tested samples must comply. As specified in the Regulations, mandatory samples must be collected from the drinking water supply at relevant frequencies and analysed for performance against water quality standards as shown in Table 6 below.

Table 6: Drinking water quality standards and required sampling frequencies as defined in Schedule 2 of the Safe Drinking Water Regulations 2015

Parameter	Relevant sampling frequency for each water sampling locality	Quality standard for each water sampling locality
Escherichia coli	One sample per week	All samples of drinking water collected are found to contain no Escherichia coli per 100 millilitres of drinking water, with the exception of any false positive sample. For the purposes of this quality standard, ***a false positive sample*** means a sample that is found, after an analysis conducted in accordance with regulation 14, to contain *Escherichia coli* per 100 millilitres of drinking water, if--- **a)** following the analysis, the water supplier has conducted an investigation, which has been conducted in accordance with any guidelines issued by the Secretary in relation to such investigations, including any timeframes for commencement and completion of the investigations, to ascertain whether the results for the analysis are representative of water in the relevant sampling locality; and **b)** the water supplier has reported the results of the investigation to the Secretary in relation to such reports, including any timeframes for provision of the report; and **c)** the investigation has concluded that the results of the analysis conducted in accordance with regulation 14 were not representative of the water in the relevant water sampling locality because the investigation established that— (i) all other factors that would indicate the presence of *Escherichia coli* are not present in that water in the water sampling locality at the time of the investigation; and (ii) the drinking water treatment process applied, or other specified actions taken by the water supplier, are such as would be reasonably expected to have eliminated the presence of Escherichia coli in the water sampling locality at the relevant time; and (iii) all plant and infrastructure associated with the water treatment process were operating to specification at all relevant times; and (iv) there were no issues arising from degradation of plant or infrastructure in or around the relevant water sampling locality that could reasonably be suspected to have contributed to the presence of *Escherichia coli* in the drinking water in that water sampling locality. A sample analysed in accordance with regulation 14 that is found, on that analysis, to contain *Escherichia coli* per 100 millilitres of drinking water is not a false positive sample unless all of the circumstances in paragraphs (a), (b) and (c) apply.
Trihalomethanes (total)	One sample per month	Less than or equal to 0.25 milligrams per litre of drinking water
Turbidity	One sample per week	The 95 percentile of results for samples in any 12-month period must be less than or equal to 5.0 Nephelometric Turbidity Units

Analysis Results – Schedule 2 parameters

The results of analysis for Schedule 2 parameters for 2019-20 are summarised in Tables 7 to 9.

Section 23 of the Act requires that a water supplier make available for inspection by the public the results of any water quality monitoring program that is conducted on any drinking water it supplies. Customers and members of the public may access drinking water quality data by telephoning South Gippsland Water Customer Service on 1300 851 636, or by emailing **sgwater@sgwater.com.au**

Escherichia coli

Escherichia coli (E. coli) is used as a specific indicator of faecal contamination to determine the safety of water for drinking. For the quality standard for each water sampling locality to be met with respect to *E. coli*, then all samples of drinking water collected must have been found to contain no *E. coli* per 100 millilitres of drinking water, with the exception of any false positive sample (refer to Table 6 above for definition of "*false positive sample*").

Results: *Escherichia coli*

Monitoring for *E. coli* for the 2019-20 reporting period was conducted in accordance with requirements of the Regulations and South Gippsland Water's risk-based monitoring program. The program specifies which sites are to be sampled and at what frequencies. Samples for *E. coli* analysis are collected weekly from a range of different sampling sites and locations including dedicated customer tap sites, clear water storages (CWS), and process water from water treatment plants. Other sites in distribution systems, such as upstream and downstream of secondary disinfection dosing units, and at the inlets and outlets of CWS tanks and basins are also sampled on a weekly or less-frequent basis.

Compliance with the water quality standard for *E. coli* is based on monitoring of drinking water as it is supplied to customers. For some localities, this includes the results of distribution clear water storage sample analysis (where there is not a more representative site downstream of the storage) in addition to those from customer tap sample analysis. All but one sample of drinking water collected were found to contain no *Escherichia coli* per 100 millilitres of drinking water. Results of *E. coli* compliance monitoring are presented in Table 7. Refer to part 3 for details on the detection of *E. coli* in the water sampling locality of Meeniyan in January 2020.

Table 7: Escherichia coli results for 2019-20

*

Water Sampling Locality	Minimum Customer tap sampling frequency (samples per time period)	Minimum Clear water storage outlet sampling frequency (samples per time period)	Total number of samples collected in compliance period	Maximum result (Orgs/100mL)	Number of investigations	Number of samples where standard was not met
Alberton	one/week	-	53	0	0	0
Cape Paterson	one/week	one/week	106	0	0	0
Dumbalk	one/week	one/week	106	0	0	0
Fish Creek	one/week	one/week	106	0	0	0
Foster	one/week	one/week	106	0	0	0
Inverloch	two/week	one/week	159	0	0	0
Koonwarra	one/week	-	53	0	0	0
Korumburra	one/week	two/week	159	0	0	0
Lance Creek	one/week	one/week	106	0	0	0
Leongatha	two/week	one/week	159	0	0	0
Loch	one/week	one/week	106	0	0	0
Meeniyan	one/week	one/week	106	2	1	0*
Nyora	one/week	-	53	0	0	0
Poowong	one/week	two/week	159	0	0	0
Port Franklin	one/week	-	53	0	0	0
Port Welshpool	one/week	-	53	0	0	0
Toora	one/week	two/week	159	0	0	0
Wonthaggi	two/week	one/week	159	0	0	0
Yarram	one/week	one/week	106	0	0	0

Investigation found that the sample was a "false positive" and therefore standard was met; refer to Section 3 for information

Trihalomethanes

Trihalomethanes (THMs) are organic chemical compounds in which three of the four hydrogen atoms of methane (CH_4) are replaced by halogen atoms. The compounds may be present in drinking water principally as a result of chlorination or, to a much lesser extent, chloramination. Chlorine forms hypochlorous acid when added to water, and can react with naturally-occurring organic material to produce the trihalomethane species trichloromethane (chloroform), bromodichloromethane, dibromochloromethane, and tribromomethane (bromoform)

The ADWG states that, "Based on health considerations, the concentration of trihalomethanes, either individually or in total, in drinking water should not exceed 0.25 mg/L. Trihalomethane concentrations fluctuating occasionally (for a day or two annually) up to 1 mg/L are unlikely to pose a significant health risk. Action to reduce trihalomethanes is encouraged, but must not compromise disinfection, as non-disinfected water poses significantly greater risk than Trihalomethanes."

Total trihalomethanes results for 2019-20

For the year ending 30th June 2020, testing for trihalomethanes was conducted in accordance with the Regulations and South Gippsland Water's risk-based monitoring program. There were no exceedances of the regulatory limit of 0.25 mg/L; results are presented in Table 8.

Table 8: Trihalomethanes (total) results for 2019-20

Water Sampling Locality	Customer tap sampling frequency (samples per time period)	Number of Clear water storage Outlet samples taken	Total number of samples collected in compliance period	Average result (mg/L)	Maximum result (mg/L)	Number of samples where standard was not met
Alberton	one/month	0	12	0.051	0.088	0
Cape Paterson	one/month	0	12	0.046	0.090	0
Dumbalk	one/month	0	12	0.065	0.086	0
Fish Creek	one/month	12	24	0.136	0.200	0
Foster	one/month	0	12	0.094	0.120	0
Inverloch	one/month	0	12	0.045	0.081	0
Koonwarra	one/month	0	12	0.101	0.130	0
Korumburra	one/month	0	12	0.045	0.076	0
Lance Creek	one/month	0	12	0.048	0.073	0
Leongatha	one/month	0	12	0.086	0.140	0
Loch	one/month	0	12	0.032	0.064	0
Meeniyan	one/month	0	12	0.085	0.110	0
Nyora	one/month	0	12	0.045	0.088	0
Poowong	one/month	0	12	0.043	0.085	0
Port Franklin	one/month	0	12	0.104	0.160	0
Port Welshpool	one/month	0	12	0.080	0.150	0
Toora	one/month	0	12	0.078	0.120	0
Wonthaggi	one/month	0	12	0.046	0.086	0
Yarram	one/month	0	12	0.047	0.078	0

Turbidity

Turbidity is the measurement of the light-scattering property of water which is dependent on the amount, size, and composition of fine suspended matter. The Safe Drinking Water Regulations 2015 specify that the 95th percentile of results for samples in any 12-month period must be less than or equal to 5.0 Nephelometric Turbidity Units (NTU).

Results: Turbidity

Monitoring for compliance with the water quality standard for turbidity was conducted in accordance with the Regulations and South Gippsland Water's risk-based monitoring program. Turbidity results are presented in Table 9.

Table 9: Turbidity Results 2019-20

Water Sampling Locality	Customer tap sampling frequency (samples per time period)	Total number of samples collected in compliance period	Maximum turbidity in a sample (NTU)	Maximum 95th percentile of turbidity results in any 12 months	Number of 95th percentile of results in any 12 months above standard
Alberton	one/week	53	0.3	0.2	0
Cape Paterson	one/week	53	0.2	0.1	0
Dumbalk	one/week	53	<0.1	0.2	0
Fish Creek	one/week	53	3.0	0.3	0
Foster	one/week	53	0.2	0.2	0
Inverloch	two/week	106	0.2	0.1	0
Koonwarra	one/week	53	<0.1	0.1	0
Korumburra	one/week	53	0.2	0.2	0
Lance Creek	one/week	53	0.4	0.2	0
Leongatha	two/week	106	0.5	0.2	0
Loch	one/week	53	0.2	0.1	0
Meeniyan	one/week	53	<0.1	0.2	0
Nyora	one/week	53	0.2	0.1	0
Poowong	one/week	53	0.3	0.1	0
Port Franklin	one/week	53	0.4	0.2	0
Pt Welshpool	one/week	53	0.3	0.2	0
Toora	one/week	53	0.7	0.3	0
Wonthaggi	two/week	106	0.3	0.2	0
Yarram	one/week	53	0.5	0.2	0

Analysis Results - Other water quality standards (algal toxin, pathogen, chemical or substance that may pose a risk to human health)

As part of South Gippsland Water's drinking water quality management system, water quality parameters with potential to affect human health are monitored. These parameters are measured against standard values defined in the *Australian Drinking Water Guidelines 2011* (ADWG).
As many of these parameters do not change significantly over time or through water supply systems, frequent monitoring is not required. Results are summarised in Tables 10 to 26.

Section 23 of the Act requires that a water supplier make available for inspection by the public the results of any water quality monitoring program that is conducted on any drinking water it supplies. Customers and members of the public may access drinking water quality data by telephoning South Gippsland Water Customer Service on 1300 851 636, or by emailing **sgwater@sgwater.com.au**

Photos: Water Quality Officers carry out routine weekly water supply monitoring in Loch

Aluminium (total)

Aluminium may be present in drinking water where aluminium salts are used as coagulants in water treatment processes to destabilise particles in water. Water quality performance with respect to aluminium was measured against the ADWG aesthetic guideline value of 0.2 mg/L. As stated in the ADWG, "no health-based guideline is set for aluminium at this time but this issue will be kept under review." A summary of aluminium (total) results is presented in Table 10.

Table 10: Aluminium (Total) results 2019-20

Water Sampling Locality	Minimum frequency of sampling (samples per time period)	Customer Tap samples collected	Aesthetic drinking water quality guideline (mg/L)	Average result (mg/L)	Maximum Result (mg/L)	Number of samples where guideline was not met
Alberton	**one/month**	**12**	**0.2**	**0.04**	**0.11**	**0**
Cape Paterson	**one/month**	**12**	**0.2**	**0.02**	**0.04**	**0**
Dumbalk	**one/month**	**12**	**0.2**	**<0.01**	**0.01**	**0**
Fish Creek	**one/month**	**12**	**0.2**	**0.05**	**0.19**	**0**
Foster	**one/month**	**12**	**0.2**	**<0.01**	**0.01**	**0**
Inverloch	**one/month**	**12**	**0.2**	**0.02**	**0.03**	**0**
Koonwarra	**one/month**	**12**	**0.2**	**0.02**	**0.01**	**0**
Korumburra	**one/month**	**12**	**0.2**	**0.03**	**0.04**	**0**
Lance Creek	**one/month**	**12**	**0.2**	**0.02**	**0.05**	**0**
Leongatha	**one/month**	**12**	**0.2**	**0.02**	**0.03**	**0**
Loch	**one/month**	**12**	**0.2**	**0.03**	**0.06**	**0**
Meeniyan	**two/month**	**12**	**0.2**	**0.07**	**0.14**	**0**
Nyora	**one/month**	**12**	**0.2**	**0.02**	**0.04**	**0**
Poowong	**one/month**	**12**	**0.2**	**0.02**	**0.03**	**0**
Port Franklin	**one/month**	**12**	**0.2**	**0.02**	**0.02**	**0**
Port Welshpool	**one/month**	**12**	**0.2**	**0.02**	**0.02**	**0**
Toora	**one/month**	**12**	**0.2**	**0.02**	**0.03**	**0**
Wonthaggi	**one/month**	**12**	**0.2**	**0.02**	**0.03**	**0**
Yarram	**one/month**	**12**	**0.2**	**0.04**	**0.15**	**0**

Arsenic

Arsenic is a naturally-occurring element which can be introduced to water through dissolution of minerals and ores, or from industrial effluent, atmospheric deposition, drainage from old gold mines or the use of some types of sheep dip. The ADWG specify that, from a health perspective, the concentration of arsenic should not exceed 0.01 mg/L. Water supplied by South Gippsland water complied with the ADWG guideline value for arsenic, with all results indicating levels were below detection limits; refer to Table 11.

Table 11: Arsenic results for 2019-20

Water treatment plant / system	Locality supplied	Sampling frequency (samples per time period)	Total number of samples	Drinking water quality guideline (mg/L)	Result (mg/L)	Number of samples where guideline was not met
Devon North	Alberton Yarram	one/year	1	0.01	<0.001	0
Dumbalk	Dumbalk	one/year	1	0.01	<0.001	0
Fish Creek	Fish Creek	one/year	1	0.01	<0.001	0
Foster	Foster	one/year	1	0.01	<0.001	0
Korumburra	Korumburra	one/year	1	0.01	<0.001	0
Lance Creek	Cape Paterson Inverloch Lance Creek Wonthaggi	one/year	1	0.01	<0.001	0
Leongatha	Leongatha Koonwarra	one/year	1	0.01	<0.001	0
Meeniyan	Meeniyan	one/year	1	0.01	<0.001	0
Poowong	Loch Nyora Poowong	one/year	1	0.01	<0.001	0
Toora	Port Franklin Port Welshpool Toora	one/year	1	0.01	<0.001	0

Copper

Copper is naturally distributed in rocks and soils. It may also be present in drinking water where aggressive waters of low pH and hardness induce corrosion of copper pipes. The ADWG specify that the concentration of copper should not exceed 1 mg/L based on aesthetic considerations, and 2 mg/L based on health considerations. Water supplied by South Gippsland Water complied with both the aesthetic-based and health-based guideline values for copper; refer to Table 12.

Table 12: Copper results for 2019-20

Water Sampling Locality	Frequency of sampling (samples per time period)	Customer Tap samples collected	Drinking water quality health guideline (mg/L)	Average result (mg/L)	Maximum result (mg/L)	Number of samples where guideline was not met
Alberton	**one/quarter**	**4**	**2**	**0.001**	**0.001**	**0**
Cape Paterson	**one/quarter**	**4**	**2**	**0.006**	**0.009**	**0**
Dumbalk	**one/quarter**	**4**	**2**	**0.004**	**0.005**	**0**
Fish Creek	**one/quarter**	**4**	**2**	**0.005**	**0.008**	**0**
Foster	**one/quarter**	**4**	**2**	**0.005**	**0.007**	**0**
Inverloch	**one/quarter**	**4**	**2**	**0.009**	**0.016**	**0**
Koonwarra	**one/quarter**	**4**	**2**	**0.009**	**0.013**	**0**
Korumburra	**one/quarter**	**4**	**2**	**0.005**	**0.008**	**0**
Lance Creek	**one/quarter**	**4**	**2**	**0.016**	**0.025**	**0**
Leongatha	**one/quarter**	**4**	**2**	**0.009**	**0.019**	**0**
Loch	**one/quarter**	**4**	**2**	**0.026**	**0.093**	**0**
Meeniyan	**one/quarter**	**4**	**2**	**0.006**	**0.009**	**0**
Nyora	**one/quarter**	**4**	**2**	**0.005**	**0.008**	**0**
Poowong	**one/quarter**	**4**	**2**	**0.007**	**0.009**	**0**
Port Franklin	**one/quarter**	**4**	**2**	**0.002**	**0.002**	**0**
Port Welshpool	**one/quarter**	**4**	**2**	**0.009**	**0.023**	**0**
Toora	**one/quarter**	**4**	**2**	**0.010**	**0.017**	**0**
Wonthaggi	**one/quarter**	**4**	**2**	**0.009**	**0.019**	**0**
Yarram	**one/quarter**	**4**	**2**	**0.001**	**0.001**	**0**

Note: Samples are taken for analysis from the reticulation system. Copper levels may be higher at the customers' internal taps if copper plumbing is used in the domestic system. Customers experiencing blue copper staining of fixtures or discolouration of water are advised to call South Gippsland Water Customer Service on 1300 851 636.

Cyanogen chloride

Cyanogen chloride is a byproduct of chloramination that can be formed through the reaction between organic precursors with hypochlorous acid in the presence of the ammonium ion. Based on health considerations, the ADWG specify that the concentration of total cyanogenic compounds in drinking water should not exceed 0.08 mg/L.

Monitoring of chloraminated water systems confirmed that water supplied by South Gippsland Water complied with the guideline value for cyanogen chloride, with all results indicating levels were below the detection limit; refer to Table 13.

Table 13: Cyanogen chloride for 2019-20: chloraminated systems only

Water Treatment plant / system	Locality supplied	Frequency of sampling (samples per time period)	Number of samples collected	Drinking water quality guideline (mg/L)	Average Result (mg/L)	Number of samples where guideline was not met
Devon North	**Alberton Yarram**	**one/year**	**1**	**0.01**	**<0.05**	**0**
Lance Creek	**Cape Paterson Inverloch Korumburra Lance Creek Loch Nyora Poowong Wonthaggi**	**three/year**	**3**	**0.01**	**<0.05**	**0**

Chlorine disinfection residual (Free or Total Chlorine)

Disinfection is a critical part of water treatment. Not all microorganisms can be removed during clarification and filtration processes so an additional "kill-step" is required to ensure drinking water safety. Chlorine and chloramine (compounds formed from chlorine and ammonia) are the most commonly used agents. These are applied in carefully controlled dosages at treatment plants in the process known as primary disinfection.

The actual amount of disinfection agent dosed is very small (to visualise, think of about a cup's worth in a swimming pool). It is just adequate to both inactivate microorganisms that have made it through the purification process, and to confer a disinfection residual on the water. The residual helps to protect water as it passes through the pipes and storages of the distribution system. Chlorine and, to a lesser extent, chloramine tend to dissipate with time and distance through a water supply network so secondary dosing units may be used to ensure water remains protected to the ends of the system.

Disinfection agent dosing is automatically controlled by on-line monitoring systems which shut-down treatment plant operation in the event of levels being either too low or too high. This prevents out-of-specification water from being produced while the problem is addressed. With these controls in place, water supplied to customers is unlikely to ever exceed the ADWG guideline. The main purpose of disinfection residual monitoring is to ensure that it remains at an adequate level throughout the distribution system. There is no guideline for minimum disinfection residual and what is considered acceptable is particular to an individual water supply system based on its size and components, as well as the results of microbiological monitoring results.

South Gippsland Water uses both chlorine and chloramine disinfection. Chlorine dissociates in water to form free chlorine, which consists of aqueous molecular chlorine, hypochlorous acid and hypochlorite ion. Free chlorine is monitored in the reticulation systems of chlorinated supplies on a (minimum) weekly basis during routine sampling. For the chloraminated supplies, total chlorine is monitored. Total chlorine is the sum of chlorine in combined form (with ammonia and other nitrogenous or organic compounds) and free chlorine.

Based on health considerations, the ADWG guideline value for total chlorine in drinking water is 5 mg/L. There is no specific guideline for free chlorine; however, in chlorinated systems free chlorine generally approximates total chlorine. As both total and free chlorine levels are well below 5 mg/L, all localities can be assumed to be compliant with the water quality guideline for total chlorine; refer to tables 14 and 15.

Table 14: Free Residual Chlorine for 2019-20 (chlorinated localities)

Water sampling locality	Minimum sampling frequency (samples per time period)	Total number of samples	Minimum result * (mg/L)	Average result (mg/L)	Maximum result (mg/L)	Number of samples where guideline was not met
Dumbalk	one/week	53	0.09	0.46	0.91	0
Fish Creek	one/week	53	0.00	0.37	1.30	0
Foster	one/week	53	0.02	0.46	1.00	0
Koonwarra	one/week	53	0.00	0.03	0.20	0
Leongatha	two/week	106	0.01	0.64	1.36	0
Meeniyan	one/week	53	0.04	0.47	0.83	0
Port Franklin	one/week	53	0.03	0.56	0.98	0
Port Welshpool	one to two/week	100	0.16	0.96	1.57	0
Toora	one/week	53	0.54	1.01	1.48	0

Table 15: Total Chlorine for 2019-20 (chloraminated localities)

Water sampling locality	Minimum sampling frequency (samples per time period)	Total number of samples	Minimum result * (mg/L)	Average result (mg/L)	Maximum result (mg/L)	Number of samples where standard was not met
Alberton	one/week	64	1.49	2.30	3.5	0
Cape Paterson	one/week	53	0.18	1.54	2.4	0
Inverloch	two/week	117	0.74	1.88	2.9	0
Korumburra	two/week	106	0.79	2.06	3.0	0
Lance Creek	one/week	53	1.64	2.49	4.0	0
Loch	one/week	63	0.28	1.35	2.3	0
Nyora	one/week	64	0.74	1.68	2.8	0
Poowong	one/week	53	0.05	1.21	2.6	0
Wonthaggi	two/week	106	0.91	1.87	2.7	0
Yarram	one/week	64	1.36	2.42	3.6	0

*Low minimum results are generally recorded at dead-end main or other low water usage sites (e.g. that supply farms) and are addressed with mains flushing to freshen up supply. Corresponding microbiological results indicated no decline in drinking water safety because of low disinfection residual results recorded.

Fluoride

Naturally-occurring fluoride concentrations in drinking water are largely dependent on the type soil and rock through which source water drains. Fluoride may also be added to drinking water supplies as a public health measure for the prevention of dental decay. The Australian Drinking Water Guidelines 2011 (ADWG) specify that the maximum concentration of fluoride in drinking water should not exceed 1.5 mg/L. Under the *Health (fluoridation) Act,* fluoride added to drinking water must not result in an average optimum concentration in excess of one part per million parts of water.

The Code of practice for fluoridation of drinking water supplies (2018) made under the *Health (Fluoridation) Act 1973* states that a water agency must not add fluoride to an extent that results in an average optimum concentration in excess of one part fluoride per million parts of water (1.0 mg/L) over any 12-month period in any water sampling locality.

Results: Fluoride in non-fluoridated supplies

Monitoring of non-fluoridated drinking water is conducted annually to verify continued low levels of naturally-occurring fluoride, as have been recorded historically. Results of fluoride monitoring for non-fluoridated supplies are provided in Table 16.

Table 16: Fluoride results for non-fluoridated supplies for 2019-20

Water treatment plant / system	Locality supplied	Sampling frequency (samples per time period)	Total number of samples	Drinking water quality guideline (mg/L)	Result (mg/L)	Number of samples where guideline was not met
Devon North	Alberton Yarram	one/year	1	1.5	<0.05	0
Dumbalk	Dumbalk	one/year	1	1.5	0.05	0
Fish Creek	Fish Creek	one/year	1	1.5	<0.05	0
Foster	Foster	one/year	1	1.5	<0.05	0
Leongatha	Leongatha Koonwarra	one/year	1	1.5	<0.05	0
Meeniyan	Meeniyan	one/year	1	1.5	0.06	0
Toora	Port Franklin Port Welshpool Toora	one/year	1	1.5	<0.05	0

Results: Fluoride in fluoridated supplies

For the fluoridated supply system of Lance Creek, monitoring is conducted in accordance with the Code of practice for fluoridation of drinking water supplies (2018) under the *Health (fluoridation) Act 1973*. Refer to Table 17 for results.

Table 17: Results: Fluoride in fluoridated supply for 2019-20

Water sampling locality	Frequency of sampling (samples per time period)	Total Number of samples	Operating target range mg/L	Min. result mg/L	Max. result mg/L	Average result mg/L	Number of samples where standard was not met
Cape Paterson	**one/week**	**53**	**0.9±0.1**	**0.31**	**0.97**	**0.76**	**0**
Inverloch	**one/week**	**53**	**0.9±0.1**	**0.40**	**0.96**	**0.77**	**0**
Korumburra	**one/week**	**53**	**0.9±0.1**	**0.33**	**0.99**	**0.79**	**0**
Lance Creek	**one/week**	**53**	**0.9±0.1**	**0.18**	**0.99**	**0.75**	**0**
Loch	**one/week**	**53**	**0.9±0.1**	**0.34**	**0.91**	**0.75**	**0**
Nyora	**one/week**	**53**	**0.9±0.1**	**0.30**	**0.95**	**0.76**	**0**
Poowong	**one/week**	**53**	**0.9±0.1**	**0.14**	**0.91**	**0.76**	**0**
Wonthaggi	**one/week**	**53**	**0.9±0.1**	**0.32**	**0.93**	**0.78**	**0**

Lead

Lead may be detected in drinking water as a result of dissolution from natural sources or from household plumbing systems containing lead. The ADWG specify that, from a health perspective, the concentration of lead should not exceed 0.01 mg/L. Water supplied by South Gippsland Water complied with the ADWG guideline value; refer to Table 18.

Table 18: Lead results for 2019-20

Water sampling locality	Frequency of sampling (samples per time period)	Total number of samples	Drinking water quality guideline (mg/L)	Minimum result (mg/L	Maximum result (mg/L)	Number of samples where standard was not met
Alberton	one/quarter	4	0.01	<0.001	<0.001	0
Cape Paterson	one/quarter	4	0.01	<0.001	<0.001	0
Dumbalk	one/quarter	4	0.01	<0.001	<0.001	0
Fish Creek	one/quarter	4	0.01	<0.001	<0.001	0
Foster	one/quarter	4	0.01	<0.001	<0.001	0
Inverloch	one/quarter	4	0.01	<0.001	<0.001	0
Koonwarra	one/quarter	4	0.01	<0.001	<0.001	0
Korumburra	one/quarter	4	0.01	<0.001	<0.001	0
Lance Creek	one/quarter	4	0.01	<0.001	<0.001	0
Leongatha	one/quarter	4	0.01	<0.001	<0.001	0
Loch	one/quarter	4	0.01	<0.001	<0.001	0
Meeniyan	one/quarter	4	0.01	<0.001	0.001	0
Nyora	one/quarter	4	0.01	<0.001	<0.001	0
Poowong	one/quarter	4	0.01	<0.001	<0.001	0
Port Franklin	one/quarter	4	0.01	<0.001	<0.001	0
Port Welshpool	one/quarter	4	0.01	<0.001	<0.001	0
Toora	one/quarter	4	0.01	<0.001	<0.001	0
Wonthaggi	one/quarter	4	0.01	<0.001	<0.001	0
Yarram	one/quarter	4	0.01	<0.001	<0.001	0

Manganese

Manganese may be present in source waters as a result of dissolution form natural sources. Concentrations may be reduced in drinking water by converting soluble forms of the element to insoluble precipitates followed by physical removal using filtration. The ADWG specify that the concentration of manganese should not exceed 0.1 mg/L based on aesthetic considerations, and 0.5 mg/L based on health considerations. Drinking water supplied by South Gippsland Water complied with the health guideline for manganese. Based on average results all localities complied with the aesthetic guideline. One sample collected from Fish Creek recorded a result greater than the aesthetic guideline; this occurred following a water main break in the town that caused temporary resuspension of settled manganese sediments in the supply system; refer to Table 19.

Table 19: Manganese for 2019-20

Water sampling locality	Minimum Frequency of sampling (samples per time period)	Total number of samples collected*	Drinking water quality health guideline (mg/L)	Minimum result (mg/L)	Average result (mg/L)	Maximum result (mg/L)	Number of samples where guideline was not met
Alberton	one/month	12	0.5	<0.001	<0.001	0.003	0
Cape Paterson	one/month	12	0.5	<0.001	<0.002	0.007	0
Dumbalk	one/month	12	0.5	<0.001	<0.001	<0.001	0
Fish Creek	one/month	12	0.5	0.002	0.044	0.480	0
Foster	one/month	12	0.5	<0.001	<0.001	0.002	0
Inverloch	one/month	12	0.5	0.001	0.002	0.006	0
Koonwarra	one/month	12	0.5	0.001	0.003	0.005	0
Korumburra	one/month	12	0.5	0.001	0.003	0.009	0
Lance Creek	one/month	12	0.5	0.001	0.003	0.011	0
Leongatha	one/month	12	0.5	0.002	0.005	0.011	0
Loch	one/month	12	0.5	<0.001	<0.002	0.009	0
Meeniyan	one/month	12	0.5	0.001	0.001	0.002	0
Nyora	one/month	12	0.5	0.001	0.003	0.010	0
Poowong	one/month	12	0.5	0.001	<0.003	0.007	0
Port Franklin	one/month	12	0.5	0.001	0.005	0.011	0
Port Welshpool	one/month	12	0.5	0.001	0.004	0.015	0
Toora	one/month	12	0.5	0.002	0.006	0.016	0
Wonthaggi	one/month	12	0.5	0.001	0.003	0.008	0
Yarram	one/month	12	0.5	<0.001	<0.003	0.022	0

Nitrate and Nitrite

Nitrates and nitrites are naturally-occurring oxides of nitrogen. Nitrite is rapidly oxidised to nitrate and is seldom present in well-oxygenated or chlorinated supplies. Chloramination disinfection can lead to nitrate and nitrite formation in the distribution system due to the action of nitrifying bacteria. The ADWG specify that, from a health perspective, the concentrations of nitrate and nitrite should not exceed 50 mg/L and 3 mg/L respectively. Monitoring for oxidised nitrogen (nitrate plus nitrite) was conducted in all chlorinated South Gippsland Water systems in 2019-20. The standard of 50 mg/L for nitrate was used to measure water quality performance for oxidised nitrogen given nitrite's rapid conversion to nitrate. Specific analysis for both nitrate and nitrite was conducted in the chloraminated localities. All the chloraminated localities complied with the specific guideline values for nitrate and nitrite; refer to Tables 20, 21 and 22.

Table 20: Oxidised nitrogen (nitrate + nitrite) for 2019-20 (chlorinated supplies only)

Water treatment plant / system	Localities supplied	Sampling frequency	Total number of samples	Minimum Result (mg/L)	Maximum Result mg/L	Number of samples where standard was not met
Dumbalk	**Dumbalk**	**one/quarter**	**4**	**0.05**	**1.40**	**0**
Fish Creek	**Fish Creek**	**one/quarter**	**4**	**0.23**	**0.58**	**0**
Foster	**Foster**	**one/quarter**	**4**	**0.13**	**0.25**	**0**
Leongatha	**Leongatha Koonwarra**	**one/quarter**	**4**	**0.49**	**1.50**	**0**
Meeniyan	**Meeniyan**	**one/quarter**	**4**	**0.17**	**1.20**	**0**
Toora	**Port Franklin Post Welshpool Toora**	**one/quarter**	**4**	**0.53**	**1.20**	**0**

Table 21: Nitrate for 2019-20 (chloraminated localities only)

Water sampling locality	Minimum sampling frequency	Total number of samples	Minimum result (mg/L)	Maximum result (mg/L)	Number of samples where guideline was not met
Alberton	one per month	12	0.320	1.30	0
Cape Paterson	one per month	12	0.025	1.10	0
Inverloch	one per month	12	0.028	0.88	0
Korumburra	two per month	24	0.004	1.10	0
Lance Creek	one per month	12	0.003	1.20	0
Loch	one per month	12	0.030	1.30	0
Nyora	one per month	12	0.018	1.20	0
Poowong	one per month	12	0.070	0.92	0
Wonthaggi	one per month	14	0.011	0.91	0
Yarram	one per month	12	0.320	1.30	0

Table 22: Nitrite for 2019-20 (Chloraminated localities only)

Water sampling locality	Minimum sampling frequency	Total number of samples	Minimum result (mg/L)	Maximum result (mg/L)	Number of samples where guideline was not met
Alberton	one per month	12	0.002	0.019	0
Cape Paterson	one per month	12	0.002	0.007	0
Inverloch	one per month	12	0.002	0.005	0
Korumburra	two per month	24	<0.002	0.003	0
Lance Creek	one per month	12	<0.002	0.003	0
Loch	one per month	12	0.003	0.450	0
Nyora	one per month	12	0.002	0.004	0
Poowong	one per month	12	<0.002	<0.002	0
Wonthaggi	one per month	12	0.002	0.010	0
Yarram	one per month	12	<0.002	0.004	0

Nitrosodimethylamine (NDMA)

N-Nitrosodimethylamine (NDMA) is produced as a byproduct of chloramination of drinking water due to the oxidation of natural organic matter by chlorine in the presence of ammonia. The ADWG specify that, based on health considerations, the concentration of NDMA in drinking water should not exceed 0.0001 mg/L (100 ng/L).

Monitoring of chloraminated systems for NDMA was conducted quarterly, with results indicating water supplied by South Gippsland Water complied with the guideline value for NDMA; refer to Table 23.

Table 23: NDMA in chloraminated supplies for 2019-20

Water treatment plant /system	Localities supplied	Sampling frequency (samples per time period)	Total number of samples	Average Result (mg/L)	Number of samples where standard was not met
Devon North	**Alberton Yarram**	**one/year**	**1**	**<0.000003**	**0**
Lance Creek	**Cape Paterson Inverloch Korumburra Lance Creek Loch Nyora Poowong Wonthaggi**	**three/year**	**3**	**<0.000003**	**0**

Other inorganic chemicals

Inorganic chemicals may be present in water as a result of the natural dissolution of rocks, soils and some plants, or through contamination from industrial and agricultural sources. Materials used to coat pipes and plumbing fittings may also be sources of inorganic chemicals in drinking water. Monitoring of all water supply systems was conducted to verify compliance with ADWG health-related guidelines for chemical concentrations as specified in Table 24.

Table 24: Other inorganic chemicals for 2019-20

Parameter	Sampling frequency	Number of samples per water supply/locality*	Total Number of samples taken in 2019-20	ADWG guideline value (mg/L)	Maximum results (mg/L)	Number of samples where standard was not met
Antimony	Annually	one per locality	19	0.003	<0.001	0
Barium	Annually	one per system	8	2	0.020	0
Beryllium	Annually	one per system	8	0.06	<0.001	0
Boron	Annually	one per system	8	4	0.36	0
Cadmium	Annually	one per locality	19	0.002	<0.0002	0
Chromium	Annually	one per locality	19	0.05	<0.001	0
Cyanide	Annually	one per system	8	0.08	<0.005	0
Mercury	Annually	one per system	8	0.001	<0.001	0
Molybdenum	Annually	one per system	8	0.05	<0.001	0
Nickel	Annually	one per locality	19	0.02	<0.001	0
Selenium	Annually	one per system	8	0.01	<0.001	0
Silver	Annually	one per system	8	0.1	<0.001	0
Sulphate	Quarterly	one per system	32	500	54	0
Zinc	Annually	one per locality	19	3	0.016	0

*Monitoring is conducted at the entry point to distribution systems or at customer tap sites in each locality dependent on likelihood of change in level of chemical as it passes through the water supply system.

Other organic chemicals

Potential sources of contamination of the drinking water supply with organic chemicals are industrial effluent, run-off from agricultural land, and the use of pesticides and herbicides. Organic disinfection byproducts, such as the chloroacetic acids, can also form as result of disinfection processes. Consistent with historical data, monitoring of raw water intakes, distribution entry point water or customer tap sites found that levels of organic chemicals were compliant with the ADWG health-related guidelines for the 2019-20 period; refer to Table 25

Table 25: Organic chemical monitoring results for 2019-20

Parameter	Sampling frequency	Number of samples per water supply system/locality*	Total Number of samples taken in 2019-20	Maximum results mg/L	ADWG Guideline value mg/L	Number of samples where guideline was not met
1,1-dichloroethane	Annually	One per system	8	<0.001	a	-
1,2-dichloroethane	Annually	One per system	8	<0.001	0.003	0
2,4,5-T	Annually	One per system	8	<0.00001	0.1	0
2,4,5-TP	Annually	One per system	8	<0.00001	b	-
2,4,6-T	Annually	One per system	8	<0.0001	b	-
2,4,6-trichlorphenol	Annually	One per system	8	<0.001	0.02	0
2,4-D	Annually	One per system	8	0.0002	0.03	0
2,4-DB	Annually	One per system	8	<0.00001	b	-
2,4-DP	Annually	One per system	8	<0.00001	b	-
2,6-D	Annually	One per system	8	<0.0001	b	-
4-Chlorophenoxyacetic Acid	Annually	One per system	8	<0.00001	b	-
Atrazine	Annually	One per system	8	<0.002	0.02	0
Benzene	Annually	One per system	8	<0.001	0.001	0
Benzo(a)pyrene	Annually	One per system**	4	<0.000002	0.00001	0
Carbon tetrachloride	Annually	One per system	8	<0.001	0.003	0
Chloroacetic acid	Annually	One per locality	19	<0.005	0.15	0
Clopyralid	Annually	One per system	8	<0.00005	2	0
Dicamba	Annually	One per system	8	<0.00001	0.1	0
Dichloroacetic acid	Annually	One per locality	19	0.024	0.1	0
Fluoroxypyr	Annually	One per system	8	<0.00005	b	-
Glyphosate	Annually	One per system	8	<0.03	1	0
MCPA	Annually	One per system	8	<0.00001	0.04	0
MCPB	Annually	One per system	8	<0.00001	b	-
Mecoprop	Annually	One per system	8	<0.00001	b	-
Metsulfuron methyl	Annually	One per system	8	<0.0001	0.04	0
Pentachlorphenol	Annually	One per system	8	<0.001	0.01	0
Picloram	Annually	One per system	8	0.00005	0.3	0
Prometryn	Annually	One per system	8	<0.002	b	-
Simazine	Annually	One per system	8	<0.002	0.02	0
Tetrachloroethene	Annually	One per system	8	<0.001	0.05	0
Trichloroacetic acid	Annually	One per locality	19	0.033	0.1	0
Trichloroethylene	Annually	One per system	8	<0.001	a	-
Triclopyr	Annually	One per system	8	0.00010	0.02	0

Table notes:

a Insufficient data to set an ADWG guideline value based on health considerations

b No ADWG information available

***** Monitoring is conducted at raw water inlets to treatment plants or at clear water storage outlets to distribution systems

****** Monitoring conducted at Devon North, Lance Creek and Leongatha water treatment plants only

Raw water monitoring

For the purposes of risk management, the parameters listed in Table 26 were monitored in raw water at the specified (minimum) frequencies by external laboratory analysis in raw water at all South Gippsland Water treatment plants for the 2019-20 reporting period.

Table 26: Raw water monitoring frequencies

Parameter	Sampling frequency
Escherichia coli	Weekly
Total Coliforms	Weekly
Cryptosporidium	Event-based
Giardia	Event-based
Cyanobacteria (Blue-green algae)	Weekly (external/internal)
Algae byproducts (MIB/Geosmin/Saxitoxin)	Event-based
Alkalinity	Monthly
Aluminium	Quarterly
Calcium	Quarterly
Copper	Quarterly
Dissolved Organic Carbon	Quarterly
Manganese	Quarterly
Nitrogen	Quarterly
Orthophosphorous	Quarterly
Total Organic Carbon	Quarterly
Turbidity	Weekly
Pesticides	Annually/Biannually/Event-based
Radionuclides	Every 7 years: Sampling conducted in 2016

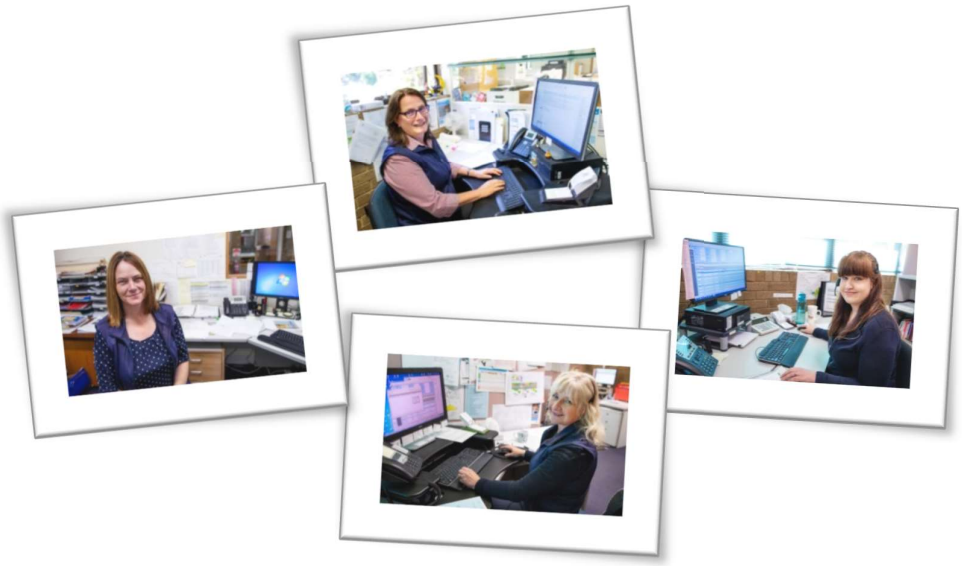
Data obtained from all water quality monitoring programs conducted by South Gippsland Water is available on request by telephoning Customer Service on 1300 5682 0444 or emailing **sgwater@sgwater.com.au**

Aesthetics

South Gippsland Water strives to provide drinking water that is consistently clear and pleasant to drink for all customers. Actions taken to manage aesthetic characteristics include:

- Optimisation of treatment processes to minimise levels of iron, manganese, and organic compounds in supplied water
- pH adjustment of treated water
- Regular flushing and air-scouring to remove sediment accumulation in mains
- Frequent sampling and analysis for aesthetic parameters
- Monitoring and management of algal blooms in raw water reservoirs
- Monitoring when required for compounds that may impart unpleasant tastes and odours to drinking water

Results of monitoring for aesthetic characteristics are provided in Tables 27 to 32 on the following pages.



Photos: Members of our friendly customer service team

Colour

Water may appear coloured due to the presence of natural organic substances including humic and fulvic acids, and dissolved inorganics, such as iron and manganese. Based on aesthetic considerations, the ADWG specifies that colour should not exceed 15 Hazen Units (HU). Water supplied by South Gippsland Water complied with the guideline value for colour; refer to Table 27.

Table 27: True Colour Results for 2019-20

Water treatment plant / system	Localities supplied	Minimum sampling frequency (samples per time period)	Total number of samples	Average result (HU)	Maximum result (HU)	Number of samples where guideline was not met
Devon North	Alberton Yarram	one/quarter	4	<2	<2	0
Dumbalk	Dumbalk	one/quarter	4	<2	<2	0
Fish Creek	Fish Creek	one/quarter	4	<2	2	0
Foster	Foster	one/quarter	4	<2	<2	0
Lance Creek	Cape Paterson Inverloch Korumburra Lance Creek Loch Nyora Poowong Wonthaggi	one/quarter	4	<2	<2	0
Leongatha	Leongatha Koonwarra	one/quarter	4	<2	<2	0
Meeniyan	Meeniyan	one/quarter	4	<2	<2	0
Toora	Port Franklin Port Welshpool Toora	one/quarter	4	<2	<2	0

Iron

Iron is present in source waters due to dissolution of soil and rock. High iron concentrations in drinking water can occur through rusting of iron pipes and fittings. Based on aesthetic considerations, the ADWG specify that the concentration of iron should not exceed 0.3 mg/L. Water supplied by South Gippsland Water complied with the guideline value for iron; refer to Table 28.

Table 28: Iron results for 2019-20

Water sampling locality	Frequency of sampling (samples per time period)	Total number of samples	Minimum result mg/L	Maximum result mg/L	Number of samples where guideline was not met
Alberton	one/quarter	4	<0.01	0.02	0
Cape Paterson	one/quarter	4	<0.01	0.02	0
Dumbalk	one/quarter	4	<0.01	<0.02	0
Fish Creek	one/quarter	4	<0.01	0.05	0
Foster	one/quarter	4	<0.01	<0.01	0
Inverloch	one/quarter	4	<0.01	<0.01	0
Koonwarra	one/quarter	4	<0.01	<0.01	0
Korumburra	one/quarter	4	<0.01	0.02	0
Lance Creek	one/quarter	4	<0.01	<0.01	0
Leongatha	one/quarter	4	<0.01	<0.01	0
Loch	one/quarter	4	<0.01	0.02	0
Meeniyan	one/quarter	4	<0.01	<0.01	0
Nyora	one/quarter	4	<0.01	<0.01	0
Poowong	one/quarter	4	<0.01	0.02	0
Port Franklin	one/quarter	4	<0.01	0.01	0
Port Welshpool	one/quarter	4	<0.01	<0.01	0
Toora	one/quarter	4	<0.01	<0.01	0
Wonthaggi	one/quarter	4	<0.01	<0.01	0
Yarram	one/quarter	4	<0.01	<0.01	0

Alkalinity

Alkalinity is defined as the quantitative capacity of an aqueous solution to neutralise an acid. In simpler terms, it is a measure of how easily the pH of water can be changed. Alkalinity is mainly determined by the levels of carbonate, bicarbonate and hydroxyl anions (negatively-charged ions) present. The property of alkalinity has a strong influence on what is referred to as water stability, which is the tendency of water to be corrosive, stable, or scale-forming on contact with surfaces.

Water stability is complex and influenced by a number of factors, but in general soft water of low pH and low alkalinity will tend to corrode surfaces. Highly corrosive (aggressive) water is not desirable in that it can lead to the leaching of copper and other metals from pipes and plumbing fittings.

In contrast, hard water of high pH and high alkalinity will generally tend to deposit calcium carbonate (form scale) on pipes, plumbing fittings and hot water systems. While encrustation of pipes and fittings is not desirable for obvious reasons, a thin layer of calcium carbonate can be beneficial in that it provides protection against corrosion in conditions of changing water stability.

There are no specific standards for alkalinity in drinking water but as this property provides resistance against changes in pH that can lead to either corrosion or excessive encrustation, a reasonable level should be maintained in drinking water supplies. What is reasonable for a particular type of water will depend mainly upon its other characteristics of pH and hardness, but a value in the range of 50 to 200 mg/L $CaCO_3$ is generally considered to be optimal.

Results of alkalinity monitoring are provided in Table 29.

**Explanatory note on units used to express both alkalinity and hardness properties*

Calcium carbonate equivalent (mg/L CaCO3) is the value obtained when taking into account the different characteristics in relation to reactivity (ability to combine) of various salts, such that the overall effect is the same as that produced by the expressed concentration of calcium carbonate. This allows for a convenient method of comparison in chemistry. As both alkalinity and hardness are aggregate properties created by the combined effects of different salts, the calcium carbonate equivalent unit is used in each case. This does not mean, however, that alkalinity and hardness are the same property. Alkalinity is chemically defined as the sum of all titratable bases in a solution, whereas hardness is the sum of all polyvalent cation (ions having more than one positive charge) concentrations in a solution. With respect to a solution made purely from the compound calcium carbonate, therefore, the property of alkalinity is due to the component carbonate anion (a base), while the property of hardness is due to the component calcium cation.

Table 29: Alkalinity Results for 2019-20

Water treatment plant / system	Localities supplied	Minimum sampling frequency (samples per time period)	Total number of samples	Minimum result (mg/L as $CaCO_3$)*	Average result (mg/L as $CaCO_3$)*	Maximum result (mg/L as CaCO3)*
Devon North	Alberton Yarram	one/quarter	4	20	22	27
Dumbalk	Dumbalk	one/quarter	4	35	50	79
Fish Creek	Fish Creek	one/quarter	4	28	32	35
Foster	Foster	one/quarter	4	37	39	43
Lance Creek	Cape Paterson Inverloch Korumburra Lance Creek Loch Nyora Poowong Wonthaggi	one/quarter	4	28	46	58
Leongatha	Leongatha Koonwarra	one/quarter	4	29	36	41
Meeniyan	Meeniyan	one/quarter	4	35	45	58
Toora	Port Franklin Post Welshpool Toora	one/quarter	4	39	44	53

**refer to explanatory note in text above*

Hardness

Hardness is a measure of the concentration of calcium and magnesium ions in water. To minimise undesirable build-up of scale in hot water systems, the ADWG specifies that total hardness (as calcium carbonate) in drinking water should not exceed 200 mg/L. Water supplied by South Gippsland Water complied with the guideline value for hardness; refer to Table 30.

Table 30: Total Hardness in calcium carbonate ($CaCO_3$) equivalents* for 2019-20

Water treatment plant / system	Localities supplied	Sampling frequency (samples per time period)	Total number of samples	Minimum result (mg/L as CaCO3)*	Average result (mg/L as $CaCO_3$)*	Maximum result (mg/L as $CaCO_3$)*	Number of samples where guideline was not met
Devon North	Alberton Yarram	one/quarter	4	17	21	25	0
Dumbalk	Dumbalk	one/quarter	4	52	78	120	0
Fish Creek	Fish Creek	one/quarter	4	23	29	34	0
Foster	Foster	one/quarter	4	17	27	33	0
Lance Creek	Cape Paterson Inverloch Korumburra Lance Creek Loch Poowong Wonthaggi	one/quarter	4	23	45	73	0
Leongatha	Leongatha Koonwarra	one/quarter	4	37	50	58	0
Meeniyan	Meeniyan	one/quarter	4	49	66	77	0
Toora	Port Franklin Port Welshpool Toora	one/quarter	4	16	25	31	0

**refer to explanatory note on units in alkalinity section on previous pages.*

pH

The property of pH relates to the hydrogen ion concentration of water. pH is measured on a logarithmic scale from 0 to 14. A pH of 7 is neutral, a pH greater than 7 is alkaline, and a pH less than 7 is acidic.

To reduce corrosion and encrustation in pipes and fittings, the ADWG specifies that the pH of drinking water should be between 6.5 and 8.5. The ADWG also states that new concrete tanks and cement-mortar lined pipes can significantly increase pH and a value up to 9.2 may be tolerated, provided monitoring indicates no deterioration in microbiological quality.

The reference to microbiological quality is made in the ADWG since the disinfecting power of chlorine in chlorinated systems is greatest at lower pH and gradually declines as pH increases. Significant impairment of chlorine disinfection occurs above pH 8.0. The results for pH in chlorinated systems are provided in Table 31. Based on mean pH values, all localities complied with the aesthetic guideline. One sample taken from the locality of Port Franklin recorded a pH above ADWG guidelines. This is most likely due to aging of water within the main due to low demand. Mains flushing was implemented to remove aged water from the system.

The chemistry (and the effect of pH) for chloramination disinfection differs from that of chlorination. A higher pH is beneficial in a chloraminated system as it slows the natural decay of monochloramine and prevents the formation of dichloramine and trichloramine, which can cause unpleasant tastes and odours. A consequence of maintaining a higher pH is that occasional exceedance of the ADWG guideline can occur, particularly where there are cement-lined pipes. Based on mean pH results as provided in Table 32, all chloraminated localities complied with the aesthetic guideline of 6.5 to 9.2. As shown in Table 32 there were six results for Alberton and two for Yarram which did not meet the aesthetic guideline in 2019-20. The Covid-19 pandemic "lockdowns" and consequent low water usage at the affected sites in Alberton are likely to have contributed to these results. Similarly, the affected site in Yarram is located within an industrial area where low water usage has resulted in localised pockets of aged water. Water mains flushing was implemented to remove aged water from the system and improve pH at all affected sites.

Table 31: pH results for chlorinated system in 2019-20

Water sampling locality	Minimum frequency of sampling (samples per time period)	Total number of samples	Minimum result pH	Mean result pH	Maximum result pH	Number of samples not compliant with aesthetic guideline
Dumbalk	**one/week**	**53**	**7.8**	**8.0**	**8.2**	**0**
Fish Creek	**one/week**	**53**	**7.6**	**7.9**	**8.3**	**0**
Foster	**one/week**	**53**	**7.5**	**7.7**	**7.8**	**0**
Koonwarra	**one/week**	**53**	**7.5**	**7.7**	**7.9**	**0**
Korumburra	**two/week**	**64**	**7.6**	**8.0**	**8.7**	**0**
Leongatha	**two/week**	**106**	**7.3**	**7.5**	**7.9**	**0**
Meeniyan	**one/week**	**60**	**7.3**	**7.9**	**7.9**	**0**
Port Franklin	**one/week**	**53**	**7.7**	**8.2**	**9.2**	**1**
Port Welshpool	**one/week**	**53**	**7.1**	**7.6**	**7.9**	**0**
Toora	**one/week**	**53**	**7.2**	**7.5**	**7.8**	**0**

Table 32: pH results for chloraminated localities in 2019-20

Water sampling locality	Minimum frequency of sampling (samples per time period)*	Total number of samples*	Minimum result pH	Mean result pH	Maximum result pH	Number of samples not compliant with aesthetic guideline
Alberton	one per week	64	8.0	8.7	9.5	6
Cape Paterson	one per week	53	7.9	8.1	8.6	0
Inverloch	two per week	117	7.8	8.0	8.4	0
Korumburra	two per week	117	7.6	8.0	8.5	0
Lance Creek	one per week	53	7.6	7.9	8.4	0
Loch	one per week	63	8.0	8.3	9.1	0
Nyora	one per week	64	7.8	8.1	9.0	0
Poowong	one per week	53	7.6	8.1	8.8	0
Wonthaggi	two per week	106	7.8	8.1	8.7	0
Yarram	one per week	64	7.7	8.4	9.4	2

* Monitoring frequency changes seasonally for some localities

Analysis of results

Comparison of results for Schedule 2 parameters over three years

A comparison of compliance with water quality standards specified in Schedule 2 of the Safe Drinking Water Regulations 2015 in the 2019-20 period with that of the previous two financial years is presented in Figure 2. Consistent compliance across all South Gippsland Water water sampling localities is illustrated and in measure with the water quality standards listed in Schedule 2 of the Regulations for *Escherichia coli*, Trihalomethanes and Turbidity.

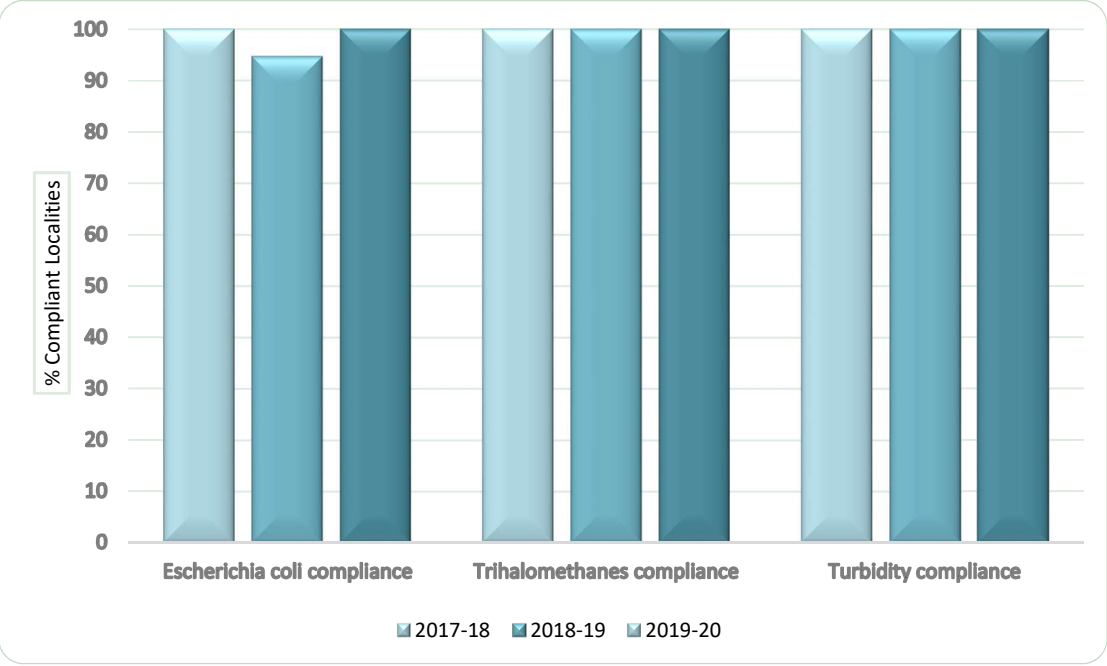


Figure 2: Percentage of localities where the drinking water complied with the water quality standards for Escherichia coli, trihalomethanes and turbidity

Comparison of results of other water quality parameters over three years

A comparison of results for the 2019-20 reporting period and the previous two financial years for water quality parameters other than those listed in Schedule 2 of the Safe Drinking Water Regulations 2015 is presented in Table 33. The comparison is based on percentage compliance with the guideline values of the *Australian Drinking Water Guidelines 2011.*

Table 33: Percentage of samples compliant with health-related guidelines from the ADWG

Water Quality Parameter	Percentage of samples compliant with health-related guidelines from the *Australian Drinking Water Guidelines 2011*		
	2017-18	2018-19	2019-20
Arsenic	100 %	100 %	100 %
Aluminum	100 %	100 %	100 %
Chlorine	100 %	100 %	100 %
Copper	100 %	100 %	100 %
Cyanogen chloride	100 %	100 %	100 %
Iron	100 %	100 %	100 %
Lead	100 %	100 %	100 %
Manganese	100 %	100 %	100 %
Nitrate	100 %	100 %	100 %
Nitrite	100 %	100 %	100 %
NDMA	100 %	100 %	100 %
Antimony	100 %	100 %	100 %
Barium	100 %	100 %	100 %
Beryllium	100 %	100 %	100 %
Boron	100 %	100 %	100 %
Cadmium	100 %	100 %	100 %
Chloroacetic acid	100 %	100 %	100 %
Chromium	100 %	100 %	100 %
Cyanide	100 %	100 %	100 %
Dichloroacetic acid	100 %	100 %	100 %
Mercury	100 %	100 %	100 %
Molybdenum	100 %	100 %	100 %
Nickel	100 %	100 %	100 %
Selenium	100 %	100 %	100 %
Silver	100 %	100 %	100 %
Sulphate	100 %	100 %	100 %
Trichloroacetic acid	100 %	100 %	100 %
Zinc	100 %	100 %	100 %
1,2-dichloroethane	100 %	100 %	100 %
2,4,5-T	100 %	100 %	100 %
2,4,6-trichlorphenol	100 %	100 %	100 %
2,4-D	100 %	100 %	100 %
Atrazine	100 %	100 %	100 %
Benzene	100 %	100 %	100 %
Benzo(a)pyrene	100 %	100 %	100 %
Carbon tetrachloride	100 %	100 %	100 %
Clopyralid	100 %	100 %	100 %
Dicamba	100 %	100 %	100 %
Glyphosate	100 %	100 %	100 %
MCPA	100 %	100 %	100 %
Metsulfuron methyl	100 %	100 %	100 %
Pentachlorphenol	100 %	100 %	100 %
Picloram	100 %	100 %	100 %
Simazine	100 %	100 %	100 %
Tetrachloroethene	100 %	100 %	100 %
Triclopyr	100 %	100 %	100 %
Gross Alpha *	100 %	Not monitored	Not monitored
Gross Beta *	100 %	Not monitored	Not monitored

*Radiological parameters monitored once every seven years as per risk-based monitoring program. No monitoring occurred in the 2019-20 reporting period.

5. Complaints relating to water quality for 2019-20

South Gippsland Water records and attends to all complaints relating to drinking water quality to ensure the highest level of customer satisfaction. Table 34 below illustrates the four complaint types and the number of complaints received for each type over the 2019-20 year. Determination of the number of complaints per 100 customers supplied is based on the number of complaints compared with the total number of connected properties. A comparison of the number complaints with that of the previous two reporting periods is provided in Table 35. Complaints for 2019-20 are broken down into complaint type per locality and supply system in Table 36.

Table 34: Customer complaints for 2019-20

Type of complaint	Number of complaints	Number of complaints per 100 customers (connected properties) supplied
Dirty/discoloured water	**27**	**0.12**
Taste and/or odour	**20**	**0.09**
Air in water	**14**	**0.06**
Alleged/suspected illness	**1**	**0.00**
Other	**8**	**0.04**
Total complaints	**70**	**0.31**

Table 35: Complaints comparison of 2019-20 with the previous two reporting periods

Type of complaint	Number of Complaints			Comparison with previous reporting period	Comments
	2017-18 reporting period	2018-19 reporting period	**2019-20 reporting period**		
Dirty/discoloured Water	142	**41**	**27**	Moderately significant decrease	Lance Creek connection to Korumburra (and decommissioning of problematic Korumburra water treatment plant) in late 2018 is a significant contributor to decline in complaints for 2019-20. Other contributors include proactive cleaning programs for clear water storages and water mains, and improved treatment of manganese for some systems.
Taste or odour	62	**32**	**20**	Moderately significant decrease	Supplemental supply from Melbourne water grid and water treatment plant improvements have allowed for better management of algae-related taste and odour issues in 2019-20.
Air in Water	13	**9**	**14**	Slight increase	Complaints have mainly followed water mains break repair or other works. Some can be attributed to issues with domestic supplies (e.g. service pipe damage)
Alleged illness	6	**2**	**1**	No significant change	Category includes general queries re water quality and health concerns. No evidence provided or found that supplied drinking water was cause.
Other	4	**3**	**8**	Slight increase	Complaints include problems with aquatic animal pets, corrosion of internal household plumbing or appliances, etc.

Table 36: Customer complaints per complaint type and locality for 2019-20

Water treatment plant / supply system	Water sampling locality	Complaint category					Total complaints per locality	Total complaints per supply system
		Dirty / discoloured water	Taste and/or odour	Air in water	Alleged illness	Other		
Devon North	Alberton	0	0	6	0	0	6	11
	Yarram	1	0	3	0	1	5	
Dumbalk	Dumbalk	0	0	0	0	0	0	0
Fish Creek	Fish Creek	0	0	0	0	0	0	0
Foster	Foster	0	1	2	0	0	3	3
Lance Creek (southern towns)	Cape Paterson	0	0	0	0	0	0	24
	Inverloch	1	2	0	0	0	3	
	Lance Creek	0	0	0	0	0	0	
	Wonthaggi	2	1	1	1	2	7	
Lance Creek (northern towns)	Korumburra	7	4	1	0	2	14	
	Loch	0	0	0	0	0	0	
	Nyora	0	0	0	0	0	0	
	Poowong	0	0	0	0	0	0	
Leongatha	Koonwarra	2	0	0	0	0	2	25
	Leongatha	12	9	1	0	1	23	
Meeniyan	Meeniyan	0	1	0	0	0	1	1
Toora	Port Franklin	1	0	0	0	0	1	6
	Port Welshpool	1	1	0	0	0	2	
	Toora	0	1	0	0	2	3	
Total complaints per category		27	20	14	1	8	70	70

Photos: Air-scour cleaning, SGW staff, mains break trailer

Management of complaints

Dirty/discoloured water

Dirty/discoloured water complaints relate to problems with the clarity of water. Tap water that contains sediments or particles and is coloured yellow, brown or blackish hues is often reported as "dirty water" by the customer. The particles and colour are produced by manganese and other mineral oxides rather than what might commonly be referred to as "dirt" (i.e. soil, mud, sewerage), but the overall effect is that water appears dirty and is unacceptable to the customer. Complaints in this category include reports of stained laundry items which may result from oxidation of minerals in contact with laundry detergents in a washing machine.

Dirty/discoloured water complaints primarily result from:

- High manganese levels in source waters. The soil in the South Gippsland region is naturally high in manganese, and run-off into reservoirs and rivers is unavoidable. Not all manganese can be removed during the water treatment process so accumulation in the distribution system can occur;
- Accumulation of sediment within clear water storages and water mains over time; and/or
- Unintended scouring of water mains following high flows or recharging of the system.

Corrective actions to address dirty/discoloured water include:

- Use of aeration and potassium permanganate dosing systems at water treatment plants to oxidise manganese and maximise physical removal through filtration;
- Cleaning of clear water storage tanks and basins
- Implementation of scheduled air-scouring and flushing programs within all water sampling localities to remove manganese and other accumulated sediments;
- Additional flushing when required in response to individual complaints, and increased frequency of flushing regimes for problem areas.
- Provision of a commercial cleaning product which removes discolouration marks from laundry items in response to individual customer complaints.

There were 27 complaints received in relation to dirty/discoloured water in the 2019-20 reporting period. The significant decline in complaints in this category over the past three years (refer to Table 35) can be at least partially attributed to the Lance Creek connection to Korumburra in late 2018. This has allowed the Coalition Creek reservoir storage system and (relatively old) Korumburra water treatment plant to be taken offline; thus eliminating associated frequent manganese issues for that system. Proactive mains flushing and scouring programs have also contributed to the decline in dirty/discoloured water complaints. The township of Cape Paterson was air-scoured in November 2019.

Taste and odour

What is considered acceptable in terms of the flavour and smell of water has some level of individual subjectivity. For instance, some customers object to the taste and odour of chlorine, while others receiving water with the same chlorine concentration do not. This may be because the objecting

customers sense the chlorine taste and odour more acutely than others, or because they perceive chlorine as something they don't want to drink. While tastes and odours in drinking water do not generally denote that the water is unsafe, South Gippsland Water endeavours to minimise unpleasant flavours. This is important not only for the customer's satisfaction and enjoyment but also so that they will choose supplied tap water over other potentially less-safe options (e.g. from a poorly-managed tank water system) or options having adverse environmental impacts (i.e., purchased bottled water).

Taste and odour complaints result primarily from:

- Cyanobacterial (blue-green algal) compounds in the water;
- Manganese and/or iron sediment in the water;
- Changes in pH, dissolved oxygen, and other factors in relation to ageing of water within a water main due to low flows.
- Chlorine in water.

Corrective actions to prevent or address taste and odour issues include:

- Routine monitoring of supplied water for taste and odour, manganese, iron, turbidity, pH and chlorine;
- Analysis for taste and odour related parameters (as above) when required in response to individual complaints;
- Use of powdered activated carbon (PAC) at treatment plants to remove algae-related and other taste and odour compounds from water;
- Use of aeration and potassium permanganate dosing systems at water treatment plants to oxidise manganese and maximise removal from source waters.
- Water main flushing and air-scouring programs

There were 20 complaints relating to taste and odour issues received from customers in 2019-20, From an historical perspective, this can be considered a good outcome. The observed steady decline in taste and odour complaints in the past three years (refer to Table 35) can be largely attributed to the connection of the Lance Creek system to the Melbourne water supply grid. The ability to supply the system with 100% Melbourne water has allowed the Lance Creek Reservoir to be taken completely offline when affected by cyanobacterial blooms. The capacity to blend Melbourne and Lance Creek waters has also enabled dilution of cyanobacterial taste and odour compounds in the reservoir to levels acceptable to customers.

Air in water

Air in water complaints are generally received following mains breaks or the implementation of air-scour mains cleaning programs. While notification is given to residents prior to air-scouring, customers may become concerned at the 'milky' appearance of water. Customers are advised that the white colour of the water is due to the presence of tiny air-bubbles and that flushing through a tap for a few minutes should correct the problem. If the problem cannot be resolved by the customer, mains flushing is carried out.

There were 14 complaints involving air in water from South Gippsland Water customers in the 2019-20 reporting period.

Alleged illness

Customers may make an alleged illness complaint if they suspect supplied tap water is the cause of illness or other conditions, such as skin or eye irritation. Generally, a customer will call to seek reassurance with regards to water quality rather than alleging that the water is the cause of their health problem. Customers with health concerns are encouraged to consult a medical professional for diagnosis and treatment. Depending on the nature of the complaint, additional monitoring to verify quality of drinking water supplied to the customer's residence and through the domestic plumbing system may be carried out. Details of the complaint and results of both monitoring and diagnostic testing (if provided) are recorded via an Illness Complaint Record Form. In the unlikely event of supplied drinking water being found to be a causative factor of illness, the Department of Health and Human Services would be immediately notified. Further actions, which might include issuing of a boil water advisory, would be implemented as a matter of the highest priority.

There was one call received in relation to health concerns for 2019-20. Investigation found no evidence that the drinking water supply was the cause of the issue.

Other complaints

Other complaints generally relate to concerns that are beyond the control and responsibility of South Gippsland Water, such as problems with aquarium fish or garden plants, and issues with domestic plumbing or appliances. In response to such complaints, results of monitoring programs that may be relevant are reviewed, and additional investigation and sampling is carried out where appropriate. Customers are informed of the likelihood of supplied water being the cause of the problem and given advice on where to seek additional assistance if required.

There were eight calls in this category for 2019-20.

6. Findings of the most recent risk management plan audit

Under section 7 of the Safe Drinking Water Act 2003 (the Act), a water supplier is required to prepare, implement, and review a risk management plan for the supply of drinking water to the public. The plan must be audited by an approved external auditor periodically as directed by the Department of Health and Human Services. An audit was scheduled to take place in April 2020; however, due to the Covid-19 pandemic, this was postponed until August 2020. Audit outcomes will be discussed in South Gippsland Water's 2020-21 Annual Drinking Water Quality Report.

The most recent risk management plan audit was carried out in April 2018. South Gippsland Water was found to be compliant in all auditable elements for the period 8th June 2016 to 27th April 2018. While no non-compliances were recorded, the auditor made several observations and identified some opportunities for improvement (OFIs); these can be found in Appendix 3 of the 2017-18 Annual Drinking Water Quality Report. South Gippsland Water has actioned or prioritised OFIs for future review, as deemed appropriate.

Many of the OFIs are covered in capital improvements projects currently underway or programmed for the 2020-21 year, as outlined in section 3. As noted in the discussion in section 5, the Lance Creek connection project and supplemental supply from Melbourne water grid, in addition to proactive flushing and scouring programs, has resulted in a significant decline in customer complaints – addressing relevant OFI as noted by the auditor. A study of options in relation to catchment improvements for the Lance Creek system is currently in progress. Additionally, the "Health-based target" risk profile for the Foster Dam was downgraded in 2019-20 as a result of catchment improvements (tree-planting, fencing, cattle exclusion). Both these actions go towards addressing an OFI in relation to long-term catchment management strategies.

7. Regulated water

Regulation 16 of the Safe Drinking Water Regulations 2015 requires details of regulated water supplied be included in this annual report. Regulated water is defined as "water that is not intended for drinking but could reasonably be mistaken as drinking water". South Gippsland Water did not supply any regulated water in the 2019-20 period.

Appendices

Appendix 1: South Gippsland Water's Drinking Water Quality Policy

Drinking Water Quality Policy

South Gippsland Water

"Committed to high-quality drinking water"

South Gippsland Water is committed to providing safe, high-quality drinking water that consistently meets accepted standards, guidelines, regulatory requirements, and customer expectations. To achieve this, in partnerships with stakeholders and relevant agencies, the Corporation will:

- Manage water quality at all points along the delivery chain from source water to consumer;
- Use a risk-based approach to identify and manage potential threats to water quality;
- Continually assess the quality of drinking water through appropriate monitoring programs and effective reporting systems;
- Develop appropriate contingency planning and incident response capability;
- Integrate into our planning the needs and expectations of customers, stakeholders, regulators, and employees;
- Continually improve our management systems by assessing performance against industry best practice, corporate commitments, and stakeholder expectations;
- Participate in appropriate research and development activities to ensure continued understanding of drinking water quality issues and performance;
- Contribute to the debate on setting industry regulations and guidelines, and other standards relevant to public health and the water cycle.

The Corporation will implement and maintain a drinking water quality management system consistent with the NHMRC, NRMMC *Australian Drinking Water Guidelines* to* effectively manage risks to drinking water quality.

All managers and employees involved in the supply of drinking water are responsible for understanding, implementing, maintaining, and continuously improving the drinking water quality management system.

This Drinking Water Quality Policy is proudly displayed at South Gippsland Water facilities and is communicated to all persons working for or on the Corporation's behalf during induction or contract proceedings. The Policy is available to the public upon request or via the South Gippsland Water website. Contact details are: –

South Gippsland Water
14-18 Pioneer Street
PO Box 102 or: sgwater@sgwater.com.au
Foster, Victoria 3960
(03) 5682 0444

Glossary of acronyms and terms used in report

ADWG	*Australian Drinking Water Guidelines* 2011; published by the National Health and Medical Research Council
Coliforms	A general term for certain types of rod-shaped bacteria that share identifying characteristics.
Cyanobacteria	Photosynthetic aquatic bacteria commonly referred to as 'blue-green algae' (though not actually algae).
DWMS	Drinking Water Management System
'the Department'	Department of Health and Human Services (State Government of Victoria)
E. coli	*Escherichia coli*: thermotolerant bacteria used as an indicator of faecal contamination
HACCP	Hazard Analysis and Critical Control Point
<	'Less than' (mathematical term)
>	'Greater than' (mathematical term)
L	Litre: a unit of volume (equal to 1000 cubic centimetres)
mg/L	Milligrams per litre: a unit of concentration (one milligram is equal to 0.001 grams)
ML	Megalitres: a unit of volume (one megalitre is equal to one million litres)
NATA	National Association of Testing Authorities
ng/L	Nanograms per Litre: a unit of concentration (one ng is equal to 0.000000001 grams)
NHMRC	National Health and Medical Research Council
OFI	Acronym for "opportunity for improvement" as noted in audit reports
Orgs/100 mL	Organisms/per 100 millilitre of water: a unit of measurement used in microbiology
Pathogen	Disease-causing microorganism
PAC	Powdered activated carbon
PLC	Programmable logic controller: a digital computer used for automation of electromechanical processes
Quarter	Time period referring to one quarter of a year, *i.e.* three months.
RMP	Risk Management Plan
'the Act'	*Safe Drinking Water Act 2003*
'the Regulations'	Safe Drinking Water Regulations 2015
SGW	South Gippsland Water (South Gippsland Region Water Corporation, 'the Corporation')

Glossary of water treatment agents and processes

Aluminium chlorohydrate	Aluminium salt used as a coagulant in water treatment
Aluminium sulphate	Aluminium salt used as a coagulant in water treatment
Chloramine	A compound of chlorine and ammonia used for disinfection
Chlorine	An element used as a disinfectant in water treatment. May be applied in gaseous, elemental form, or via aqueous solution of sodium hypochlorite.
Coagulation	A chemical water treatment process that involves neutralisation of charge on particles (impurities) in water. This destabilisation of charge allows for particles to clump together rather than repel each other electrostatically.
Dewatering of waste water	Method of post water treatment water conservation. Removes excess water from sludge so it can be returned to a reservoir and reused.
Disinfection	Use of chemical, other agent (e.g. ultraviolet light) or process to kill or inactivate microorganisms which may be harmful to human health.
Dissolved air floatation (DAF) clarification	Water treatment process involving use of pressurised air for clarification. Microscopic air bubbles attach to floc and cause floc to float and make a sludge layer. This allows for separation of impurities (as floc) from water.
Filtration	Final water treatment process prior to disinfection; clarified water passes through large filters where impurities are entrapped.
Flocculation	A physical water treatment process that causes clumps formed through coagulation processes to come together into larger masses known as floc. Formation of floc allows for purification of water via sedimentation and filtration processes.
Fluoridation	Addition of fluoride to water for public dental health purposes.
Granular medium	Layers of sand, gravel and crushed anthracite that make up a water treatment plant filter.
Hydrochloric acid	An acid used to lower the pH of water which enables optimisation of coagulation processes
Manganese oxidation	Water treatment process important for minimising dirty/discoloured water complaints. Oxidation of dissolved manganese in raw (source) water causes it to precipitate out of solution as a solid. This is in turn allows for the solid oxidised manganese particles to be removed via coagulation, flocculation and filtration processes.
Manganese sequestration	Process that may be used to mitigate post treatment manganese oxidation and resulting discolouration of water. Manganese that has not been removed in treatment may oxidise on contact with chlorine disinfectants or air. Sequestration (or chelation) causes manganese to form soluble complexes that do not cause discolouration of water.
pH correction (pre/post treatment)	Raw water pH can vary due to environmental factors. Pre pH correction is needed to optimise treatment processes. Post pH treatment may be required to ensure pH is suitable for disinfection, and for distribution to customers in terms of aesthetics and water stability.
Polyacrylamide	Chemical polymer which may be used to facilitate flocculation or dewatering processes. Acts by binding particles/floc together.
Potassium permanganate	Compound used to oxidise manganese
Powdered activated carbon (PAC)	Primarily used to adsorb taste and odour compounds produced by algae from raw water
Sedimentation clarification	A physical water treatment process using gravity to remove suspended solids from water
Sodium hydroxide	Base used to raise the pH of water and optimise coagulation pH levels.
Ultraviolet disinfection	Use of ultraviolet light to kill/inactivate water-borne microorganisms that may be harmful to human health.