2016 – 2017

ANNUAL DRINKING WATER QUALITY REPORT

South Gippsland Water

Glossary of treatment processes and chemicals

Aluminum sulphate	An acidic chemical used in water purification. Causes unwanted impurities to coagulate into larger particles so they can be trapped more effectively in filter media.
Anionic polyacrylamide	A synthetic flocculant used for water clarification.
Chloramine	A compound of chlorine and ammonia commonly used for disinfection in water treatment
Chlorination disinfection	
Chlorine	An element commonly used as a disinfectant in water treatment.
Coagulation	Water treatment process where particles in water are destabilized (have charges neutralized).
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.
Dissolved air floatation clarification	Water treatment process used for clarification. Microscopic air bubbles attach to floc and cause floc to float and make a sludge layer,
Filtration	Water treatment process that collects the suspended impurities in water and enhances the effectiveness of disinfection.
Flocculation	Water treatment process where "floc" is formed. Term used to describe the action of polymeric materials which form bridges between individual particles.
Granular medium	Found in Filtration Systems made up of layers of sand, gravel and crushed anthracite
Hydrochloric acid	Used to lower the pH of water and optimise coagulation pH levels.
Manganese oxidation	A water treatment process used to prevent dirty water issues.
pH correction (pre/post treatment	Raw water pH can vary due to environmental factors such as increased turbidity and algal blooms. pH correction is needed to optimise treatment processes.
Potassium permanganate	Used to oxidise manganese
Powder activated carbon	Used to adsorb natural organic compounds, taste and odour compounds produced by some algae species.
Sedimentation clarification	
Sodium hydroxide	Used to raise the pH of water and optimize coagulation pH levels.
Ultraviolet disinfection	A very effective disinfectant used to inactivate water borne microorganisms that may be harmful to human health.

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From our Managing Director

Welcome to South Gippsland Water's 2016/17 Annual Drinking Water Quality Report.

This report is produced each year to provide our customers and the community with information about the quality of drinking water supplied by South Gippsland Water across its service area.

South Gippsland Water operates ten individual water supply systems within open catchment areas that total approximately 1,234 square kilometres. Through South Gippsland Water's water quality program, I am pleased to advise the Corporation continues to deliver safe, reliable water services.

The 2016/17 financial year was a challenging year for water quality due to extreme weather events experienced across the South Gippsland region. Natural climatic events saw the extremes of torrential downpours creating challenges in raw water turbidity, and dry spells resulting in low inflows and required the implementation of staged water restrictions for the Coalition Creek system (Korumburra).

I would like to thank all South Gippsland Water staff for their continued dedication and professionalism through the challenges of these times. I would also like to note the success of the Corporation trainee program with Will Egan achieving the Young Operator of the Year Award at the 79th Annual Victorian Water Industry Operations Conference and Exhibition in September 2016. This award recognises excellent performance, initiative and all round attention to detail and is the second time a South Gippsland Water employee has achieved state-wide success via the Corporation's trainee program.

Despite the climatic challenges of the 2016/17 financial year, we are pleased to advise that the drinking water supplied by South Gippsland Water's 19 localities achieved 100% compliance with the prescribed standards of the Safe Drinking Water Regulations 2015 for *Escherichia coli*, turbidity and trihalomethanes.

Philippe du Plessis
Managing Director

1. Introduction

At South Gippsland Water we are committed to the management of our water supply systems for the provision of safe, high-quality drinking water to all customers.

Welcome to South Gippsland Water's annual water quality report for the period 1st July 2016 to 30th June 2017. 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 our management practices, and describes how we respond to water quality challenges as they arise.

South Gippsland Water adheres to a Drinking Water Quality Policy which requires all managers and employees involved in the supply of drinking water to be responsible for understanding, implementing, maintaining and continually improving the Corporation's Drinking Water Quality Management System. A copy of the policy is provided in Appendix 1.

The Drinking Water Quality Management System is 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 (the Regulations). Additional information on water treatment and quality management systems for 2016-17 can be found in part 2 of this report.

For the 2016-17 financial year, we are pleased to advise that drinking water supplied in South Gippsland Water's 19 localities complied with the prescribed standards of the Regulations for *Escherichia coli* (*E. coli*), trihalomethanes and turbidity. Parts 4 and 5 of this report provide a summary of results from our comprehensive monitoring program, while part 3 outlines corrective actions taken to resolve water quality issues.

Customer satisfaction is very important to us at South Gippsland Water and we strive to meet expectations in terms of supplying water that is not only safe to drink but also aesthetically-pleasing. We also aim to provide a prompt and helpful service in response to water quality concerns. For details on the number of customer calls received in relation to water quality in 2016-17, as well as general information on how complaints are addressed, please refer to part 8.

In relation to overall efficiency optimisation, 2016–17 saw development and improvement in the area of chemical application and usage in several areas of water treatment. Efficiency trials with aluminium chloride were conducted at several water treatment facilities with the aim of optimising flocculation processes. The physical application method used to apply copper sulphate to algal blooms in reservoirs was also reassessed, with a move away from bulk dosing in preference to targeted spot spraying being implemented. Reductions in both chemical concentration and dose rate have been observed.

We hope that you find this report informative and invite you to contact our customer service department by telephoning 03 5662 0444 or emailing sgwater@sgwater.com.au if you require additional information on anything presented within.

[1] National Health and Medical Research Council and National Resource Management Ministerial Council *Australian Drinking Water Guidelines 2011*

1.1 Characterisation of the System

1.1.1 Source water system

As part of the catchment-to-tap approach to providing safe drinking water, South Gippsland Water monitors for hazards that may pose a risk to human health in all water supply catchments. This approach is underpinned by the preventative and multiple barrier principles described in the Australian Drinking Water Guidelines (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 catchment area is in private ownership and access and usage is largely unrestricted (as opposed to a "closed" catchment where the whole of the catchment area is publicly owned and controlled). While this means that complete protection of source waters is not achievable, improving the resilience of water supply catchments and minimising water quality deterioration is a crucial part of our role in providing safe drinking water.

Where hazards cannot be prevented, they are managed with robust and reliable barriers. Examples of these measures are illustrated 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.

1.1.2 South Gippsland Water 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. Drinking water is supplied to 22 rural centres via ten separate supply systems; refer to Figure 1 (map).

The total water supply operation for 2016-17 comprised:

- 1,234 square kilometres of total catchment area
- 13 reservoirs and 4 raw water storage basins or tanks
- 18 service storages
- 10 water treatment plants
- 25 treated water distribution storages
- 15 water pump stations
- 703 kilometres of water mains
- 4,950 megalitres (million litres) of metered water supplied to customers

Information on localities and water supply systems is provided in Table 1. There have been no major changes in arrangements with respect to water supply since the previous reporting period.

Table 1: SGW water sampling localities and supply sources

Water treatment plant	Localities supplied	Population serviced[2]	Principal raw water supply sources	Supplementary raw water supply sources	Raw water storage
Devon North	Alberton Yarram	520 2,280	Tarra River	Gippsland Basin groundwater aquifer (via bore, Devon North)	Devon North Raw Water Basin
Dumbalk	Dumbalk	430	Tarwin River (east branch)		Dumbalk Raw Water Tank
Fish Creek	Fish Creek	830	Battery Creek		Battery Creek Reservoir
Foster	Foster	1,140	Deep Creek		Deep Creek Reservoir; Foster Dam; Foster Raw Water Basin.
Korumburra	Korumburra	3,510	Coalition Creek; Bellview Creek; Ness Creek.	Tarwin River (West Branch)	Coalition Creek Reservoir; Bellview Reservoir; Ness Gully Reservoir.
Lance Creek	Cape Paterson Inverloch Lance Creek Wonthaggi	700 4,620 120 7,560	Lance Creek		Lance Creek Reservoir
Leongatha	Koonwarra Leongatha	400 5,070	Ruby Creek		No. 1 Reservoir; No. 2 Reservoir; Hyland Reservoir (No. 3); Western Reservoir (No. 4).
Meeniyan	Meeniyan	470	Tarwin River		Meeniyan Raw Water Basin
Poowong	Loch Nyora Poowong	280 730 330	Little Bass River		Little Bass Reservoir
Toora	Port Franklin Port Welshpool Toora	130 630 460	Agnes River		Cooks Dam

[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.

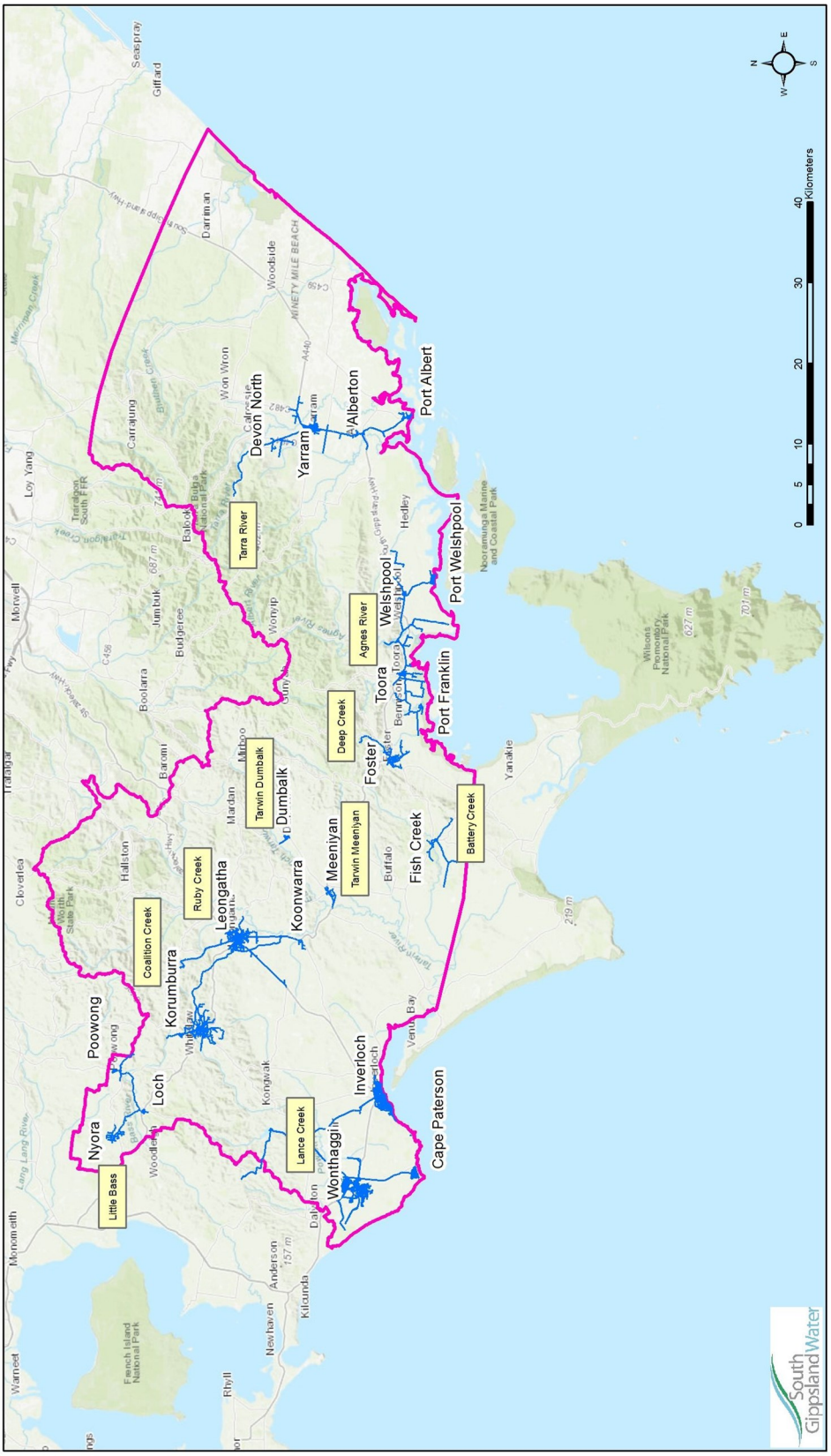


Figure 1: South Gippsland Water supply area and systems

2. Water Treatment and Quality Management Systems

2.1 Water Treatment

Conventional water treatment is a process whereby water is purified to a level suitable for human consumption prior to being disinfected. In general, raw water is either collected in a reservoir or pumped from a river to a settling basin, where natural sedimentation of large particulate matter occurs. As smaller particles and dissolved substances will not settle out of the water within a practical timeframe, chemical agents must be added to precipitate and coagulate them into larger insoluble masses known as floc. The water can then be clarified by gravity settling or flotation of the floc, followed by filtration through a granular medium. Chemical disinfectants are added to the treated water product to destroy any microorganisms that may remain.

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 of this report. The role of listed treatment processes and chemical additives are described further in the Glossary of Terms. There have been no major changes in water treatment processes since the 2015 - 2016 reporting period.

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

Water treatment plant	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 - - 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 As required Regular Regular Regular Regular Regular Regular Regular	Sodium carbonate Potassium permanganate Polyaluminium chloride - - - 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 -

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

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 - - Sodium carbonate Chlorine (gas) Sodium hypochlorite -
Korumburra	Korumburra	• Taste and odour control • Pre-treatment pH correction • Manganese oxidation • Coagulation and flocculation • Sedimentation clarification • Filtration by granular medium • Manganese sequestration • Primary chlorination disinfection • Secondary chlorination disinfection • Dewatering of waste water	As required Regular As required Regular Regular Regular As required Regular Regular Regular	Powdered activated carbon Sodium carbonate Potassium permanganate Aluminium chlorohydrate Cationic polyacrylamide* - Sodium hexametaphosphate Chlorine (gas) Chlorine (gas) -
Lance Creek	Cape Paterson Inverloch Lance Creek Wonthaggi	• 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 • Chloramination disinfection • Fluoridation • Dewatering of waste water	As required As required As required Regular Regular Regular Regular Regular Regular Regular	Powdered activated carbon Sodium hydroxide / hydrochloric acid Potassium permanganate Aluminium sulphate - - Sodium hydroxide Chlorine (gas) and ammonia Hexafluorosilicic acid Anionic polyacrylamide
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) Anionic polyacrylamide
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
Poowong	Loch Nyora Poowong	• Taste and odour control • Pre-treatment pH correction • Manganese oxidation • Coagulation and flocculation • Sedimentation clarification • Filtration by granular medium • Post treatment pH correction • Chloramination 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 Anionic polyacrylamide* - Sodium hypochlorite Sodium hypochlorite and ammonia -

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

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) -

***Polyacrylamide used as a floc aid, filter aid or sludge-thickening agent when required.

2.2 Water Treatment Issues

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

An exceedance of chlorine greater than the ADWG guideline of 5 mg/L occurred for the locality of Fish Creek in September 2016. A notification under section 22 of the Safe Drinking Water Act was submitted to the Department of Health and Human Services. The increase in chlorine level was caused by an inactive isolation value not supplying flow to a chlorine analyser. Refer to Section 3.3 of this report for further information.

In February 2017, high raw water turbidity results were recorded at the Leongatha Water Treatment Plant. A heavy rainfall event caused soil from a recently ploughed paddock to run into a source water supply reservoir resulting in a sudden spike in raw water turbidity at the plant. A Section 22 report was submitted to the Department of Health and Human Services. Please refer to Section 3.5 of this report for further information.

2.3 Quality Management Systems and Continual Improvement

The risk management approach adopted by South Gippsland Water for the provision of safe drinking water is based on the twelve elements of the 'Framework for Management of Drinking Water Quality', as described in the *Australian Drinking Water Guidelines 2011.* Incorporated into the risk management system are a number of on-going programs and practices designed to ensure treatment plants are operating optimally at all times, and treated water within distribution systems is both protected from external contamination and remains aesthetically pleasing to customers; 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.

Suggestions for improvement are documented in the Drinking Water Management System (DWMS) improvement plan register. The register is reviewed regularly with items being prioritised, actioned, and included in capital works plans where appropriate.

3. Emergency incident management

3.1 Incidents reported under section 22 of the Act

Section 22 of the *Safe Drinking Water Act 2003* (the Act) requires water suppliers 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. Based on this requirement, the incidents described in this section have been reported to the Department in the 2016-17 reporting period. Table 3 provides a summary of events reported under section 22 of the Act.

Table 3: Summary of events reported to the Department under Section 22 of the Act in 2016-17

Water sampling locality affected	Date of Incident	Location of Incident	Nature of Incident	Nature of known or suspected contamination/cause of incident	Report Section Ref.
Fish Creek	06/09/16 to 06/09/16	Fish Creek Basin outlet post-secondary disinfection site	Chlorine above ADWG guideline value (5 mg/L) in reticulation system	*Fish Creek Basin – outlet free chlorine recorded at 8.0 mg/L. Chlorine monitor isolation valve turned off.*	3.3
Leongatha	06/02/2017 to 09/02/17	Leongatha raw water feed to water treatment plant	Severe weather conditions and heavy rainfall contributing to very high raw water turbidity in supply reservoir.	*A breach of critical control limits for raw water turbidity was detected.*	3.4

3.2 *Escherichia coli* detections

Escherichia coli (*E. coli)* is a species of bacteria that inhabits the intestinal tracts of humans, other mammals and some birds. *E. coli can* also be carried by reptiles and amphibians. While most strains of *E. coli* are not harmful, their presence in water indicates possible contamination with faecal material; hence *E. coli* are used as an indicator in quality monitoring for other potentially pathogenic (and more difficult to detect) microorganisms that may be associated with faeces. Other types of bacteria with similar characteristics as *E. coli (*collectively known as 'coliforms') but not necessarily associated with faecal contamination are also routinely monitored to provide a general gauge on the cleanliness of the water supply system.

Routine weekly microbiological monitoring is performed at water sampling locations as per requirements of the Safe Drinking Water Regulations 2015. There were no *E. coli* detections in the 2016-17 reporting period.

3.3 Chlorine above ADWG guidelines at Fish Creek Basin

A notification in accordance with section 22 of the Safe Drinking Water Act was forwarded to the Department of Health and Human Services following the detection of free chlorine residual levels above the ADWG guideline value of 5 mg/L on Tuesday September 6th, 2016.

During routine water quality sampling, a free chlorine residual of 8.0 mg/L was recorded at 9:30 am for the Fish Creek basin outlet post-secondary disinfection site. Chlorine mapping in the township of Fish Creek was immediately carried out to determine the spread and direction of travel of water with elevated chlorine residual in the reticulation system. Readings of between 0.7 to 8 mg/L were recorded at sites across town, including a tap at the Fish Creek primary school.

All chlorine analysers at the Fish Creek basin were checked and it was quickly identified that one was offline. As a result there was no sample water flowing through the analyser and the chlorine residual registering was that for the stationary water remaining in the sample line, this being 0.4 mg/L. As the chlorine dosing pump operates on a feedback loop from the analyser to maintain a target chlorine level of 0.8 mg/L in the water flowing out of the basin, it continued to run in response to the unrepresentative reading of 0.4 mg/L rather than switching itself off in response to the true level in the water flow.

While it is not known with certainly what time the analyser went offline, it was found to be working normally during routine checks on the previous morning (September 5th). It can be assumed, therefore, that over-dosing of chlorine into the water supply occurred for a period no greater than 24 hours.

Following restoration of flow through the chlorine analyser and normal supply conditions at the basin, mains flushing based on chlorine mapping results was carried out to remove the slug of chlorine over-dosed water from the reticulation system. Chlorine residual readings following mains flushing of between 0.4 and 0.7 mg/L at various sites across town confirmed resolution of the issue by about 12:00 pm on the 6th September.

In line with all SGW WTP facilities, alarm sensors have been installed on all Fish Creek basin chlorine analysers following this incident. Alarm sensors enable the analyser to detect if it is turned off or when air bubbles are in the sample line. Testing of alarm sensors has also been included in maintenance schedules providing a further cross check to ensure analysers are operating effectively.

Given that the ADWG states that "very few toxic effects have been associated with drinking water containing high chlorine", and the guideline of 5 mg/L is based on possible effects of long-term ingestion, communication regarding this incident with the wider public was not deemed necessary at the time of the incident. As a precaution with respect to possible chlorine-related gastric upset in children, the Fish Creek primary school was contacted. School administration sent an advisory note to parents/carers and purchased bottled water for students and staff. While only two related customer enquiry calls were received, SGW communication procedures were reviewed following the incident. With respect to the potential for such events to cause concerns for members of the public, social media and website platforms will now be utilised to a greater extent to ensure the community are kept informed appropriately.

3.4 High Source Water Turbidity at Leongatha WTP

A notification in accordance with section 22 of the Safe Drinking Water Act was forwarded to the Department following the detection of very high raw water feed turbidity at the Leongatha water treatment plant from February 6th to 9th 2017.

This increase in raw water turbidity occurred due to extreme rainfall causing the scouring of an adjacent farm track and recently ploughed paddock into an ephemeral stream that feeds the Leongatha Reservoir number 1. Clay sediments were washed into the reservoir by the heavy rain with a distinct change in the hue of the water being visible in both the feeder stream and the reservoir.

Immediate corrective actions were implemented in response to the subsequent water treatment plant alarm and shut down. To continue meeting water supply demand, backwash and alarm set-points were adjusted slightly to allow the plant to continue operation outside control limits documented in SGW's Drinking Water Risk Management Plan (DWRMP). To mitigate any potential increase in disinfectant demand, chlorine dosage was increased.

Water quality monitoring for cryptosporidium and giardia of the treated storage water was also conducted. These protozoan parasites have been identified as risks in SGW's DWRMP. Analysis results indicated no cryptosporidium or giardia were present in collected distribution system entry point samples.

While the individual filtered water turbidity did exceed the ADWG guideline of 0.5 NTU for addressing cryptosporidium and giardia risk, the threat to public health was considered minimal given the following:

- The high turbidity was due to inert clay sediments from the localised scouring event of track and paddock rather than organic material/manures from drainage more widely across the farm catchment,
- There were no cryptosporidium or giardia detected in samples taken on February 6th.

To reduce the likelihood of a similar event occurring in the future, SGW has engaged with the property owner to negotiate on farm improvements including planting out the riparian zone of the ephemeral creek feeding Reservoir Number 1 and installing fences. A bypass system is also being installed so that in the event of high turbidity in Reservoir Number 1, raw water can be supplied to the treatment plant directly from Reservoir Number 2. Following completion and testing, the bypass system will be commissioned for use by early 2018.

To further minimise the risks to drinking water safety posed by high turbidity events, disinfection upgrade works for the Leongatha water treatment plant are due to commence in the 2017-18 financial year. Included in the project are installation of an ultra-violet light (UV) disinfection system, and modifications to clear water storage set-up to improve chlorination control and contact times.

3.6 Other reported events: Section 18 events and Blue-green algae blooms reported to DELWP

Section 18 of the *Safe Drinking Water Act 2003* (the Act) requires a water supplier to notify the Department of Health and Human Services where it becomes aware that supplied drinking water does not comply, or is not likely to comply, with any relevant water quality standard. The purpose of section 18 is to ensure the Department is alerted to potential water quality issues that may require further investigation or actions.

For the 2016-17 reporting period there were no Section 18 submissions by South Gippsland Water to the Department.

3.6.1 Blue-green algae (cyanobacteria) blooms reported to DELWP

Notification of an algal bloom to the Department of Health and Human Services is only required if drinking water supplied from the water source affected by the bloom has the potential to pose a threat to human health or may result in widespread public complaint, as stipulated in section 22 of the Safe Drinking Water Act. For the purposes of regional monitoring and management, however, the Department of Environment, Land, Water and Planning (DELWP) is advised when local algal blooms occur and cell volumes exceed specified limits.

Algal blooms are managed according to the potential toxicity of the identified species, cell numbers and densities, and efficacy of existing treatment processes in removing algae and algae-related compounds from raw water. As part of South Gippsland Water's incident response procedures, which are documented in its drinking water management system, the following actions may be implemented in response to algal detections:

- Increased monitoring for algae and algae-related toxins (when potentially toxic species are identified) and other compounds that may cause taste and odour issues;
- Initiation of powdered activated carbon (PAC) dosing to remove algae-related toxins and other compounds;
- Isolation and containment of the affected reservoir where applicable;
- Selective use of offtakes (where available) at reservoirs to minimise volume of algae cells entering the treatment plant;
- Destratification of reservoir;
- Application of algicide to raw water storages where appropriate; and,
- Notification to major customers advising of potential for taste and odour issues.

With respect to the algae events reported in Table 4, implementation of appropriate incident response procedures resulted in controlled events that had no real potential to affect public health.

Table 4: Blue-green algae (cyanobacteria) blooms reported to DELWP in 2016-17

Location	Date of bloom	Nature of bloom
Poowong Raw Water Reservoir	20-03-17 to 01-05-17	Total cyanobacterial biovolume >0.2 mm^3/L
Lance Creek Reservoir	09-01-17 to 24-04-17	Total cyanobacterial biovolume >0.2 mm^3/L
Korumburra Reservoir number 1	23-01-17 to 24-04-17	Total cyanobacterial biovolume >0.2 mm^3/L
Foster Dam	28-12-16 to 31-01-17	Total cyanobacterial biovolume >0.2 mm^3/L
Foster Raw Water 24ML Basin	31-10-16 to 17-01-17	Total cyanobacterial biovolume >0.2 mm^3/L
Devon North 30 ML Raw Water Basin	06-12-16 to 01-01-17	Total cyanobacterial biovolume >0.2 mm^3/L

4. Quality of Drinking Water for 2016 – 17

4.1 Schedule 2 Drinking Water Quality Standards

During the 2016-17 reporting period, South Gippsland Water implemented water quality monitoring programs consistent with requirements of the *Safe Drinking Water Act 2003* (the Act).

Schedule 2 of the Safe Drinking Water Regulations 2015 (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 for 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 5 below.

Table 5: 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
Microbiological organisms:		
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. Refer to Schedule 2 Regulation 12 of the Safe Drinking Water Regulations 2015.
Chlorine-based chemicals:		
Trihalomethanes (total)	One sample per month	0.25 milligrams per litre of drinking water
Other parameters:		
Turbidity	One sample per week	The 95th percentile of results for samples in any 12 month period must be less than or equal to 5 Nephelometric Turbidity Units.

4.1.1 Sampling frequency variations and other monitoring

There were no changes in sampling frequency in the 2016-17 for schedule 2 parameters.

Historical data and risk assessment carried out in 2014 indicated that the probability of non-compliance with the standard for the chlorine-based disinfection byproduct chemicals was low in water supply systems where chloramine (rather than chlorine) is used as the disinfectant in water treatment.

With a view to reducing analysis costs so that savings could ultimately be passed on to customers by way of water rate reductions, in 2014 South Gippsland Water applied to the Secretary to the Department of Health and Human Services (the department) for variations to sampling frequencies as follows:

- Reduction in monitoring for mono-, di- and tri- chloroacetic acids* from monthly to quarterly (every three months) for all South Gippsland Water localities
- Reduction in monitoring of trihalomethanes (total) from monthly to quarterly for all chloraminated supply systems; namely: Alberton, Cape Paterson, Inverloch, Lance Creek, Loch, Nyora, Poowong, Wonthaggi and Yarram

The applications were assessed and approved by the Secretary, and variation notices were published in the Victoria Government Gazettes S 260 (dated 1st Aug, 2014) and S 266 (dated 8th Aug, 2014).

**Note:* The chloroacetic acids were schedule 2 parameters under the Safe Drinking Water Regulations 2005, but are not under the Safe Drinking Water Regulations 2015

4.1.2 Analysis Results

Results of analysis for 2016-2017 are summarised in Tables 4 to 28 on subsequent pages in this report.

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 (03) 5662 0444, or by emailing sgwater@sgwater.com.au.

4.2 *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.

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 of the Safe Drinking Water Regulations, to contain E. 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 factors that would indicate the presence of *E. coli* are not present in the water in the water sapling 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 *E. 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 *E. 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 *E. 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.

4.2.1 Results: *Escherichia coli*

Monitoring for *E. coli* for the 2016-17 reporting period was conducted in accordance with 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 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 clear water storages (CWS) 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 samples 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 6.

Table 6: *Escherichia coli* results for the reporting period 1 July 2016 to 30 June 2017.

Water Sampling Locality	Frequency of sampling	Customer Tap samples collected weekly	CWS /Distribution Outlet samples collected per week	Total No. of samples collected in compliance period	Max. result (Orgs/100mL)	Average (Orgs/100mL)	No of samples where standard was not met
Alberton	weekly	1	0	52	0	0	0
Cape Paterson	weekly	1	1	102	0	0	0
Dumbalk	weekly	1	1	102	0	0	0
Fish Creek	weekly	1	1	104	0	0	0
Foster	weekly	1	1	102	0	0	0
Inverloch	weekly	2	1	152	0	0	0
Koonwarra	weekly	1	0	52	0	0	0
Korumburra	weekly	1	1	102	0	0	0
Lance Creek	weekly	1	1	102	0	0	0
Leongatha	weekly	2	1	156	0	0	0
Loch	weekly	1	1	102	0	0	0
Meeniyan	weekly	1	1	102	0	0	0
Nyora	weekly	1	0	52	0	0	0
Poowong	weekly	1	2	153	0	0	0
Port Franklin	weekly	1	0	52	0	0	0
Pt Welshpool	weekly	1	0	52	0	0	0
Toora	weekly	1	2	153	0	0	0
Wonthaggi	weekly	2	1	153	0	0	0
Yarram	weekly	1	1	102	0	0	0

4.3 Disinfection by product chemicals: Trihalomethanes

Trihalomethanes are a by-product of disinfection created by a reaction between disinfectants, particularity chlorine, and naturally occurring organic material such as humic and fulvic acids, which result from the decay of vegetable and animal matter. For the period July 1, 2016 to June 30, 2017 annual testing for trihalomethanes was conducted in accordance with SGW's routine monitoring program. Monitoring frequency for trihalomethanes was undertaken monthly for SGW's ten chlorinated localities and quarterly for the remaining nine chloraminated localities following approval by the Secretary to the Department of Health and Human Services (DHHS) in August 2014.

A summary of results for trihalomethanes (total) is provided in Table 7.

Table 7: Trihalomethane results for the reporting period 1 July 2016 to June 2017.

Water sampling locality	Frequency of sampling*	Customer tap samples collected	CWS samples collected per week	No. of non-complying samples	Max. result mg/L	Average mg/L	Complying with regulation (Yes/No)
Alberton	quarterly	4	0	0	0.013	0.006	Yes
Cape Paterson	quarterly	4	0	0	0.016	0.013	Yes
Dumbalk	monthly	12	0	0	0.017	0.112	Yes
Fish Creek	monthly	12	18**	0	0.180	0.128	Yes
Foster	monthly	12	0	0	0.120	0.089	Yes
Inverloch	quarterly	4	0	0	0.018	0.014	Yes
Koonwarra	monthly	12	0	0	0.150	0.118	Yes
Korumburra	monthly	12	0	0	0.120	0.094	Yes
Lance Creek	quarterly	4	0	0	0.017	0.013	Yes
Leongatha	monthly	12	0	0	0.130	0.094	Yes
Loch	quarterly	4	0	0	0.017	0.009	Yes
Meeniyan	monthly	12	0	0	0.140	0.101	Yes
Nyora	quarterly	4	0	0	0.027	0.013	Yes
Poowong	quarterly	4	0	0	0.025	0.012	Yes
Port Franklin	monthly	12	0	0	0.130	0.101	Yes
Port Welshpool	monthly	12	0	0	0.096	0.076	Yes
Toora	monthly	12	0	0	0.110	0.079	Yes
Wonthaggi	quarterly	4	0	0	0.015	0.014	Yes
Yarram	quarterly	4	0	0	0.013	0.006	Yes

* SGW made application to the Secretary to the DHHS in 2016 to vary the frequency of Trihalomethane monitoring in 9 chloraminated systems. Approval was granted and published in the Victorian Government Gazette S 260 (dated 1st Aug 2014) and S 266 (dated 8th Aug, 2014).

** Monitoring is also conducted at the Fish Creek basin outlet due to overall higher levels of THM for the Fish Creek system. Samples are collected monthly in cooler months and fortnightly in warmer months when THM formation is greater.

4.4 Ozone-based disinfection by-product chemicals

Water supplied by South Gippsland Water is not treated with ozone and therefore by-products derived from ozone are not a significant risk to drinking water supplied and are not required to be measured.

4.5 Turbidity

Turbidity is a 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).

4.5.1 Results: Turbidity

Monitoring for compliance with the water quality standard turbidity was conducted in accordance with the Safe Drinking Water Regulations 2015. A summary of turbidity monitoring results is presented in Table 8.

Table 8: Turbidity results for the reporting period 1 July 2016 to 30 June 2017.

Water sampling locality	Frequency of sampling	Customer tap samples collected weekly	Total No. of samples collected in compliance period	Max. result NTU	Maximum 95th percentile of turbidity results in any 12 months (NTU)	Complying with regulation
Alberton	weekly	1	52	2.2	0.2	Yes
Cape Paterson	weekly	1	52	0.6	0.2	Yes
Dumbalk	weekly	1	52	1.2	0.2	Yes
Fish Creek	weekly	1	52	1.3	0.2	Yes
Foster	weekly	1	52	0.9	0.3	Yes
Inverloch	weekly	2	104	0.5	0.2	Yes
Koonwarra	weekly	1	52	0.2	0.1	Yes
Korumburra	weekly	1	52	0.5	0.2	Yes
Lance Creek	weekly	1	52	0.2	0.2	Yes
Leongatha	weekly	2	104	0.4	0.2	Yes
Loch	weekly	1	52	0.3	0.2	Yes
Meeniyan	weekly	1	52	0.3	0.2	Yes
Nyora	weekly	1	52	0.3	0.1	Yes
Poowong	weekly	1	52	0.2	0.2	Yes
Port Franklin	weekly	1	52	1.8	0.3	Yes
Port Welshpool	weekly	1	52	0.6	0.2	Yes
Toora	weekly	1	52	1.7	0.4	Yes
Wonthaggi	weekly	2	104	1.0	0.2	Yes
Yarram	weekly	1	52	0.3	0.2	Yes

4.5.2 Actions undertaken in relation to non-compliance for turbidity

Based on the calculated 95% upper confidence level (UCL) of the mean, drinking water supplied in all localities complied with the water quality standard for turbidity and no actions were required in relation to non-compliance.

5. Other Algae, pathogen, chemical or substances that may pose a risk to human health

As part of South Gippsland Water's drinking water quality management system, specific water quality parameters that have the 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.

5.1 Aluminium (Acid-soluble)

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 Australian Drinking Water Guidelines aesthetic guideline value of 0.2 mg/L. As stated in the *ADWG 2011*, "no health-based guideline is set for aluminium at this time but this issue be kept under review." Table 11 presents a summary of Acid-soluble Aluminium results for the reporting period 1 July 2016 to June 30 2017.

Table 11: Aluminium (Acid-soluble) test results in drinking water customer tap samples reporting period 1 July 2016 to 30 June 2017.

Water sampling locality	Sampling frequency	Total No. of samples	Minimum result mg/L	Maximum result mg/L	Number of samples where standard was not met
Alberton	monthly	12	<0.01	0.05	0
Cape Paterson	monthly	12	<0.01	0.06	0
Dumbalk	monthly	12	<0.01	0.05	0
Fish Creek	monthly	12	0.02	0.04	0
Foster	monthly	12	<0.01	0.02	0
Inverloch	monthly	12	0.02	0.05	0
Koonwarra	monthly	12	<0.01	0.03	0
Korumburra	monthly	12	<0.01	0.05	0
Lance Creek	monthly	12	0.02	0.04	0
`Leongatha	monthly	12	<0.01	0.03	0
Loch	monthly	12	<0.01	0.04	0
Meeniyan	monthly	12	<0.01	0.13	0
Nyora	monthly	12	<0.01	0.04	0
Poowong	monthly	12	<0.01	0.06	0
Port Franklin	monthly	12	<0.01	0.02	0
Port Welshpool	monthly	12	<0.01	0.02	0
Toora	monthly	12	<0.01	0.02	0
Wonthaggi	monthly	12	0.02	0.06	0
Yarram	monthly	12	<0.01	0.05	0

5.2 Arsenic

Arsenic is a naturally-occurring element which can be introduced to water through the 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 12.

Table 12: Arsenic results for the reporting period 1 July 2016 to 30 June 2017.

Water treatment plant	Localities supplied	Sampling frequency	Result mg/L	Number of samples where standard was not met
Devon North	Alberton	Annually	<0.001	0
	Yarram			
Dumbalk	Dumbalk	Annually	<0.001	0
Fish Creek	Fish Creek	Annually	<0.001	0
Foster	Foster	Annually	<0.001	0
Korumburra	Korumburra	Annually	<0.001	0
Lance Creek	Cape Paterson	Annually	<0.001	0
	Inverloch	Annually	<0.001	0
	Lance Creek	Annually	<0.001	0
	Wonthaggi	Annually	<0.001	0
Leongatha	Leongatha	Annually	<0.001	0
	Koonwarra			
Meeniyan	Meeniyan	Annually	<0.001	0
Poowong	Loch	Annually	<0.001	0
	Nyora			
	Poowong			
Toora	Port Franklin	Annually	<0.001	0
	Post Welshpool			
	Toora			

5.3 Chlorine

Chlorine is used as a disinfection agent for drinking water supplies and is a parameter tested in both process and verification monitoring. Two types of chlorine residual are monitored in SGW supply localities depending on the nature of disinfection chemicals used. Chloraminated systems are tested for total chlorine residual while chlorinated systems are tested for free chlorine. In water, chlorine separates to make what is known as free chlorine while total chlorine refers to the sum of free chlorine and combined chlorine (chlorine that has reacted with ammonia and certain nitrogen compounds).

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 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.

When used as a disinfectant, free chlorine residual in major Australian reticulated supplies ranges from 0.1 mg/L to 4 mg/L, with typical concentrations in the reticulation of about 0.2 to 0.4 mg/L.[3]

SGW conducts weekly field testing for residual chlorine in all reticulation system regulatory sampling localities. Results for the reporting period 1 July to 30 June, 2017 are listed in Table 13 and 14 below.

5.3.1 Free Chlorine

Table 13: Free Chlorine results for the reporting period 1 July 2016 to 30 June 2017.

Water sampling locality	Sampling frequency (minimum)	Total No. of samples	Maximum result mg/L	Average result mg/L	Number of samples where standard was not met
Dumbalk	weekly	52	1.33	0.37	0
Fish Creek	weekly	52	2.4	0.43	0
Foster	weekly	52	0.95	0.42	0
Koonwarra	weekly	52	0.40	0.04	0
Korumburra	weekly	52	1.26	0.56	0
Leongatha	Two weekly	104	1.27	0.60	0
Meeniyan	weekly	52	1.22	0.43	0
Port Franklin	weekly	52	1.04	0.74	0
Port Welshpool	weekly	96	1.96	0.93	0
Toora	weekly	52	1.57	1.01	0

[3] Sourced from the Australian Drinking Water Guidelines Version 3.2 CAS NO 7782-50-5 (endorsed 2014)

5.3.2 Total Chlorine

Table 14: Total Chlorine results for the reporting period 1 July 2016 to 30 June 2017.

Water sampling locality	Sampling frequency (minimum)	Total No. of samples	Maximum result mg/L	Average result mg/L	Number of samples where standard was not met
Alberton	weekly	68	4.1	2.9	0
Cape Paterson	weekly	52	1.5	0.3	0
Inverloch	Two weekly	120	3.5	2.2	0
Lance Creek	weekly	52	4.9	3.8	0
Loch	weekly	68	3.3	2.0	0
Nyora	weekly	68	3.9	2.9	0
Poowong	weekly	52	3.9	2.5	0
Wonthaggi	Two weekly	121	3.3	2.0	0
Yarram	weekly	71	4.3	3.0	2

5.4 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 15.

Table 15: Copper results for the reporting period 1 July 2016 to 30 June 2017.

Water sampling locality	Frequency of sampling	Total number of samples	Min. result mg/L	Max. result mg/L	Number of samples where standard was not met
Alberton	quarterly	4	<0.001	0.002	0
Cape Paterson	quarterly	4	0.009	0.011	0
Dumbalk	quarterly	4	0.007	0.015	0
Fish Creek	quarterly	4	0.002	0.003	0
Foster	quarterly	4	0.007	0.018	0
Inverloch	quarterly	4	0.006	0.008	0
Koonwarra	quarterly	4	0.006	0.018	0
Korumburra	quarterly	4	0.006	0.044	0
Lance Creek	quarterly	4	0.011	0.031	0
Leongatha	quarterly	4	0.005	0.320	0
Loch	quarterly	4	0.005	0.044	0
Meeniyan	quarterly	4	0.005	0.017	0
Nyora	quarterly	4	0.004	0.014	0
Poowong	quarterly	4	0.007	0.015	0

Port Franklin	quarterly	4	0.001	0.002	0
Port Welshpool	quarterly	4	0.003	0.021	0
Toora	quarterly	4	0.003	0.014	0
Wonthaggi	quarterly	4	0.007	0.016	0
Yarram	quarterly	4	<0.001	0.003	0

Table 15 (continued): Copper results for the reporting period 1 July 2016 to 30 June 2017.

Note: Samples are taken for analysis from the reticulation system. Copper levels may be higher at 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 03 5682 0444.

5.5 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 16.

Table 16: Cyanogen chloride results for the reporting period 1 July 2016 to 30 June 2017.

Water treatment plant	Localities supplied	Sampling frequency	Total number of samples	Maximum result mg/L	Number of samples where standard was not met
Devon North	Alberton Yarram	Annually	1	<0.05	0
Lance Creek	Cape Paterson Inverloch Lance Creek Wonthaggi	Annually	1	<0.05	0
Poowong	Loch Nyora Poowong	Annually	1	<0.05	0

5.6 Fluoride

Naturally-occurring fluoride concentrations in drinking water are largely dependent on the type of 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. The *Code of practice for fluoridation of drinking water supplies* (2009) states that the annual average concentration for fluoride in drinking water must not exceed a level of 1 mg/L.

Under the *Health (fluoridation) Act*, an obligation is imposed on suppliers of fluoridated water to achieve a dose rate that confers a dental health benefit on consumers. Based on annual average maximum daily air temperature (which has been shown to correlate closely with water consumption), and as specified in the *Code of practice for fluoridation of drinking water supplies*, the optimal fluoride concentration for drinking water supplied in the South Gippsland region is 0.9 mg/L. While fluoridated water suppliers must aim for this optimal concentration in operating a fluoride dosing facility, an annual average fluoride concentration of greater than or equal to 0.6 mg/L (which is the minimum concentration that confers a dental health benefit) is deemed as meeting the obligation.

5.6.1 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 9.

Table 9: Fluoride results for non-fluoridated supplies in for the reporting period 1 July 2016 to 30 June 2017.

Water treatment plant	Localities supplied	Sampling frequency	Total No. samples	Result mg/L	Number of samples where standard was not met
Devon North	Alberton Yarram	Annually	1	0.05	0
Dumbalk	Dumbalk	Annually	1	0.06	0
Fish Creek	Fish Creek	Annually	1	0.05	0
Foster	Foster	Annually	1	0.05	0
Korumburra	Korumburra	Annually	1	0.05	0
Leongatha	Leongatha Koonwarra	Annually	1	0.06	0
Meeniyan	Meeniyan	Annually	1	0.08	0
Poowong	Loch Nyora Poowong	Annually	1	0.11	0
Toora	Port Franklin Post Welshpool Toora	Annually	1	0.05	0

5.6.2 Actions undertaken in relation to non-compliance in non-fluoridated supplies

Drinking water monitored at distribution entry point sites at all water treatment plants for non-fluoridated supplies complied with the ADWG guideline value for fluoride, and there were no actions required in relation to non-compliance.

5.6.3 Results: Fluoride in fluoridated supply

For the fluoridated supply of Lance Creek, monitoring is conducted in accordance with the *Code of practice for fluoridation of drinking water supplies* (2009); refer to Table 10 for results.

Table 10: Fluoride results for fluoridated (Lance Creek) supply system in the reporting period 1 July 2016 to 30 June 2017.

Water sampling locality	Frequency of sampling	Total No. of samples	Operating target range mg/L	Min. result mg/L	Max. result mg/L	Average result mg/L	Complying with regulation (yes/no)	Meeting obligation (yes/no)
Cape Paterson	Weekly	52	0.9±0.1	0.09	0.92	0.67	yes	yes
Inverloch	Weekly	52	0.9±0.1	0.07	0.93	0.67	yes	yes
Lance Creek	Weekly	52	0.9±0.1	0.05	0.94	0.68	yes	yes
Wonthaggi	Weekly	52	0.9±0.1	0.07	0.92	0.68	yes	yes

5.6.4 Actions undertaken in relation to non-compliance for fluoride in fluoridated supplies

No actions were required in relation to non-compliance; drinking water in all fluoridated localities complied with both the *Health (fluoridation) Act 1973* and the ADWG guideline for maximum allowable fluoride concentration. Based on the requirement that the annual average fluoride concentration be greater than or equal to 0.6 mg/L, the obligation imposed by the *Health (fluoridation) Act* with regard to conferring a dental health benefit was also fulfilled.

5.7 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 17.

Table 17: Lead results for the reporting period 1 July 2016 to 30 June 2017.

Water sampling locality	Frequency of sampling	Total number of samples	Min. result mg/L	Max. result mg/L	Number of samples where standard was not met
Alberton	quarterly	4	<0.001	<0.001	0
Cape Paterson	quarterly	4	<0.001	<0.001	0
Dumbalk	quarterly	4	<0.001	<0.001	0
Fish Creek	quarterly	4	<0.001	<0.001	0
Foster	quarterly	4	<0.001	<0.001	0
Inverloch	quarterly	4	<0.001	<0.001	0
Koonwarra	quarterly	4	<0.001	<0.001	0
Korumburra	quarterly	4	<0.001	<0.001	0
Lance Creek	quarterly	4	<0.001	<0.001	0
Leongatha	quarterly	4	<0.001	<0.001	0
Loch	quarterly	4	<0.001	<0.001	0
Meeniyan	quarterly	4	<0.001	<0.001	0
Nyora	quarterly	4	<0.001	<0.001	0
Poowong	quarterly	4	<0.001	<0.001	0
Port Franklin	quarterly	4	<0.001	<0.001	0
Port Welshpool	quarterly	4	<0.001	<0.001	0
Toora	quarterly	4	<0.001	<0.001	0
Wonthaggi	quarterly	4	<0.001	<0.001	0
Yarram	quarterly	4	<0.001	<0.001	0

5.8 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 both the aesthetic-based and health-based guideline values for manganese; refer to Table 18.

Table 18: Manganese results for the reporting period 1 July 2016 to 30 June 2017.

Water sampling locality	Frequency of sampling	Total number of samples	Min. result mg/L	Max. result mg/L	Number of samples where standard was not met
Alberton	monthly	12	<0.001	0.019	0
Cape Paterson	monthly	12	0.002	0.011	0
Dumbalk	monthly	12	<0.001	0.004	0
Fish Creek	monthly	12	0.005	0.025	0
Foster	monthly	12	0.003	0.089	0
Inverloch	monthly	12	0.006	0.014	0
Koonwarra	monthly	12	<0.001	0.005	0
Korumburra	monthly	12	<0.001	0.015	0
Lance Creek	monthly	12	0.005	0.012	0
Leongatha	monthly	12	0.002	0.007	0
Loch	monthly	12	0.002	0.006	0
Meeniyan	monthly	12	<0.001	0.004	0
Nyora	monthly	12	0.003	0.011	0
Poowong	monthly	12	0.003	0.009	0
Port Franklin	monthly	12	0.004	0.034	0
Port Welshpool	monthly	12	<0.001	0.025	0
Toora	monthly	12	0.008	0.064	0
Wonthaggi	monthly	12	0.006	0.014	0
Yarram	monthly	12	<0.001	0.014	0

5.9 Nitrate and Nitrite

Nitrates and nitrites are naturally occurring oxides of nitrogen. They can increase in some waters (particularly groundwater) from intensive farming and sewage effluent. 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 was conducted in five chloraminated South Gippsland Water localities in 2016-17. All localities complied with the guideline values for nitrate and nitrite; refer to Tables 19 and 20.

Table 19: Nitrate results for the reporting period 1 July 2016 to 30 June 2017 – chloraminated systems

Water sampling locality	Frequency of sampling Winter and Spring	Frequency of sampling Summer & Autumn	Total No. of samples	Min. result mg/L	Max. result mg/L	No of samples where standard was not met
Alberton	one per month	two per month	18	0.16	1.10	0
Inverloch	one per month	two per month	18	0.15	2.10	0
Loch	one per month	two per month	18	0.29	3.40	0
Nyora	one per month	two per month	18	0.14	3.50	0
Yarram	one per month	two per month	18	0.15	1.20	0

Table 20: Nitrite results for the reporting period 1 July 2016 to 30 June 2017 – chloraminated systems

Water sampling locality	Frequency of sampling Winter and Spring	Frequency of sampling Summer & Autumn	Total No. of samples	Min. result mg/L	Max. result mg/L	Number of samples where standard was not met
Alberton	one per month	two per month	18	0.004	0.028	0
Inverloch	one per month	two per month	18	0.012	0.140	0
Loch	one per month	two per month	18	0.008	0.460	0
Nyora	one per month	two per month	18	0.006	0.012	0
Yarram	one per month	two per month	18	0.002	0.006	0

5.10 N-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 21.

Table 21: Nitrite results for the reporting period 1 July 2016 to 30 June 2017 – chloraminated systems

Water treatment plant	Localities supplied	Sampling frequency (sampler per time period)	Total number of samples	Result mg/L	Complying with regulation Yes/no
Devon North	Alberton	Annually	1	<0.000003	yes
	Yarram				
Lance Creek	Cape Paterson	Annually	1	<0.000003	yes
	Inverloch				
	Lance Creek				
	Wonthaggi				
Poowong	Loch	Annually	1	<0.000003	yes
	Nyora				
	Poowong				

5.11 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 22.

Table 22: Inorganic chemical monitoring results for the reporting period 1 July 2016 to 30 June 2017.

Parameter	Sampling frequency	No. of samples per water supply system/locality	Total No. of samples taken in 2016 - 2017	Maximum results mg/L	ADWG guideline value mg/L	Number of samples where standard was not met
Antimony	annually	19	one per locality	<0.001	0.003	0
Barium	annually	10	one per system	0.023	2	0
Beryllium	annually	10	one per system	<0.001	0.06	0
Boron	annually	10	one per system	0.03	4	0
Cadmium	annually	19	one per locality	<0.0002	0.002	0
Chromium	annually	19	one per locality	<0.001	0.05	0
Cyanide	annually	10	one per system	<0.005	0.08	0
Mercury	annually	10	one per system	<0.001	0.001	0
Molybdenum	annually	10	one per system	<0.001	0.05	0
Nickel	annually	19	one per locality	<0.001	0.02	0
Selenium	annually	20	one per system	<0.001	0.01	0
Silver	annually	10	one per locality	<0.001	0.1	0
Sulphate	quarterly	40	one per locality	35	500	0
Zinc	annually	19	one per locality	0.013	3	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.

5.12 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 2016-17 period; refer to Table 23.

Table 23: Organic chemical monitoring results for the reporting period 1 July 2016 to 30 June 2017.

Parameter	Sampling frequency	No. of samples per water supply system/locality[4]	Total No. of samples taken in 2016-17	Maximum results mg/L	ADWG Guideline value mg/L	Number of samples where standard was not met
1,1-dichloroethane	Annually	One per system	10	<0.001	a	-
1,2-dichloroethane	Annually	One per system	10	<0.001	0.003	0
2,4,5-T	Biannually	Two per system	20	<0.00001	0.1	0
2,4,5-TP	Biannually	Two per system	20	<0.00001	b	-
2,4,6-T	Biannually	Two per system	20	<0.0001	b	-
2,4,6-trichlorphenol	Annually	One per system	10	<0.001	0.02	0
2,4-D	Biannually	Two per system	20	0.00006	0.03	0
2,4-DB	Biannually	Two per system	20	<0.00001	b	-
2,4-DP	Biannually	Two per system	20	<0.00001	b	-
2,6-D	Biannually	Two per system	20	<0.0001	b	-
4-Chlorophenoxyacetic Acid	Biannually	Two per system	20	<0.00001	b	-
Atrazine	Biannually	Two per system	20	<0.002	0.02	0
Benzene	Annually	One per system	10	<0.001	0.001	0
Benzo(a)pyrene	Annually	One per system[5]	4	<0.000002	0.00001	0
Carbon tetrachloride	Annually	One per system	10	<0.001	0.003	0
Chloroacetic acid	Annually	One per locality	19	<0.005	0.15	0
Clopyralid	Biannually	Two per system	20	<0.00005	2	0
Dicamba	Biannually	Two per system	20	<0.00001	0.1	0
Dichloroacetic acid	Annually	One per locality	19	0.021	0.1	0
Fluoroxypyr	Biannually	Two per system	20	<0.00005	b	-
Glyphosate	Biannually	Two per system	20	<0.03	1	0
MCPA	Biannually	Two per system	20	0.00001	0.04	0
MCPB	Biannually	Two per system	20	<0.00001	b	-
Mecoprop	Biannually	Two per system	20	<0.00001	b	-
Metsulfuron methyl	Annually	One per system	10	<0.0001	0.04	0
Pentachlorphenol	Annually	One per system	10	<0.001	0.01	0
PFOA	Annually	One per system	10	<0.000002	b	-
PFOS	Annually	One per system	10	<0.000002	b	-
Picloram	Biannually	Two per system	20	0.00007	0.3	0
Prometryn	Biannually	Two per system	20	<0.002	b	-
Simazine	Biannually	Two per system	20	<0.002	0.02	0
Tetrachloroethene	Annually	One per system	10	<0.001	0.05	0
Trichloroacetic acid	Annually	One per locality	19	0.024	0.1	0
Trichloroethylene	Annually	One per system	10	<0.001	a	-
Triclopyr	Biannually	Two per system	20	0.00084	0.02	0

a Insufficient data to set an ADWG guideline value based on health considerations b No ADWG information available

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

[5] Monitoring conducted at Devon North, Korumburra, Lance Creek and Leongatha water treatment plants only

5.13 Raw water monitoring

For the purposes of risk management, the parameters listed in Table 24 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 2016-17 reporting period.

Table 24: Raw water monitoring results for the reporting period 1 July 2016 to 30 June 2017.

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

5.14 Radiological parameters

Several radionuclides emitting alpha and beta particles may occasionally be detected in Australian ground and surface waters. While there are no specific guidelines, the Australian Drinking water Guidelines advise that radionuclides should be identified and determined if gross alpha or beta activities exceed 0.5 Bq/L

Monitoring was not conducted for radiological parameters during the reporting period 1 July 2016 to 30 June 2017.

Data obtained from all water quality monitoring programs conducted by South Gippsland Water is available on request by telephoning Customer Service on 03 5662 04444 or emailing sgwater@sgwater.com.au.

6. Aesthetics

South Gippsland water strives to provide aesthetically-pleasing drinking water for all customers.

Actions taken to manage aesthetic characteristics include:

- Monitoring and management of algae blooms in raw water reservoirs;
- 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; and,
- 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 28, 29, 30 and 31. For manganese results, refer to Table 18.

6.1 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, and it has a strong influence on water stability; that is, the tendency of water to be either corrosive, stable, or scale-forming with regard to the surfaces it comes in to contact with.

While water stability is complex and influenced by a number of factors, soft water of low pH and low alkalinity will generally 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, a *thin* layer of calcium carbonate on surfaces can be beneficial in that it provides protection against corrosion.

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 28.

Table 28: Total Alkalinity measured in calcium carbonate ($CaCO_3$) equivalents monitoring results for the reporting period 1 July 2016 to 30 June 2017

Water treatment plant	Localities supplied	Sampling frequency	Total number of samples	Minimum result mg/L as $CaCO_3$	Maximum result mg/L as $CaCO_3$
Devon North	Alberton Yarram	Quarterly	4	23	36
Dumbalk	Dumbalk	Quarterly	4	43	80
Fish Creek	Fish Creek	Quarterly	4	32	40
Foster	Foster	Quarterly	4	45	52
Korumburra	Korumburra	Quarterly	4	36	77
Lance Creek	Cape Paterson Inverloch Lance Creek Wonthaggi	Quarterly	4	53	72
Leongatha	Leongatha Koonwarra	Quarterly	4	32	44
Meeniyan	Meeniyan	Quarterly	4	35	65
Poowong	Loch Nyora Poowong	Quarterly	4	73	110
Toora	Port Franklin Post Welshpool Toora	Quarterly	4	42	63

6.2 Colour

Colour may be imparted to water 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 29.

Table 29: Colour (true) monitoring results for the reporting period 1 July 2016 to 30 June 2017

Water treatment plant	Localities supplied	Sampling frequency (sampler per time period)	Total number of samples	Mean result HU	Maximum result HU
Devon North	Alberton Yarram	Monthly	12	<2	2
Dumbalk	Dumbalk	Monthly	12	<2	2
Fish Creek	Fish Creek	Monthly	12	<2	4
Foster	Foster	Monthly	12	<2	4
Korumburra	Korumburra	Monthly	12	<2	4
Lance Creek	Cape Paterson Inverloch Lance Creek Wonthaggi	Monthly	12	<2	6
Leongatha	Leongatha Koonwarra	Monthly	12	<2	4
Meeniyan	Meeniyan	Monthly	12	<2	2
Poowong	Loch Nyora Poowong	Monthly	12	4	10
Toora	Port Franklin Post Welshpool Toora	Monthly	12	<2	2

6.3 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 the period 1 July 2016 to 30 June 2017

Water treatment plant	Localities supplied	Sampling frequency (samples per quarter)	Total number of samples	Mean result mg/L as $CaCO_3$	Maximum result mg/L as $CaCO_3$	Number of samples where standard was not met
Devon North	Alberton	Quarterly	4	28	31	0
	Yarram					
Dumbalk	Dumbalk	Quarterly	4	110	160	0
Fish Creek	Fish Creek	Quarterly	4	53	63	0
Foster	Foster	Quarterly	4	37	44	0
Korumburra	Korumburra	Quarterly	4	54	67	0
Lance Creek	Cape Paterson	Quarterly	4	88	99	0
	Inverloch					
	Lance Creek					
	Wonthaggi					
Leongatha	Leongatha	Quarterly	4	67	71	0
	Koonwarra					
Meeniyan	Meeniyan	Quarterly	4	96	130	0
Poowong	Loch	Quarterly	4	53	63	0
	Nyora					
	Poowong					
Toora	Port Franklin	Quarterly	4	37	43	0
	Post Welshpool					
	Toora					

* Calcium carbonate equivalent (unit) is used as a convenient method of comparison in chemistry. It 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. 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, however, mean that alkalinity and hardness are the same. 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

6.4 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 31.

Table 31: Iron results for the 2016 - 17 financial year

Water sampling locality	Frequency of sampling (samples per time period)	Total number of samples	Min. result mg/L	Max. result mg/L	Number of samples where standard was not met
Alberton	quarterly	4	<0.01	0.03	0
Cape Paterson	quarterly	4	<0.01	0.01	0
Dumbalk	quarterly	4	<0.01	0.03	0
Fish Creek	quarterly	4	<0.01	0.02	0
Foster	quarterly	4	<0.01	0.03	0
Inverloch	quarterly	4	<0.01	0.02	0
Koonwarra	quarterly	4	<0.01	0.02	0
Korumburra	quarterly	4	<0.01	<0.01	0
Lance Creek	quarterly	4	<0.01	<0.01	0
Leongatha	quarterly	4	<0.01	<0.01	0
Loch	quarterly	4	<0.01	<0.01	0
Meeniyan	quarterly	4	<0.01	<0.01	0
Nyora	quarterly	4	<0.01	<0.01	0
Poowong	quarterly	4	<0.01	0.02	0
Port Franklin	quarterly	4	<0.01	0.02	0
Port Welshpool	quarterly	4	<0.01	<0.01	0
Toora	quarterly	4	<0.01	0.03	0
Wonthaggi	quarterly	4	<0.01	0.02	0
Yarram	quarterly	4	<0.01	0.03	0

6.5 pH

pH is a measure of the hydrogen ion concentration of water. It 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 chemistry of disinfection (and the effects of pH) where chloramine is used instead of chlorine is different. A higher pH is actually beneficial in chloraminated systems as this slows the natural decay of monochloramine and prevents the formation of dichloramine and trichloramine, which can cause unpleasant taste and odours. A consequence of maintaining a higher pH is that occasional exceedance of the ADWG guideline can occur. Such instances are addressed with watermain flushing to remove aged water from the system.

The results for chlorinated system pH are illustrated in table 32. Based on mean pH values all pH results were compliant and within the ADWG range for chlorinated systems.

Table 32: pH results for chlorinated system in 2016 - 17 financial year

Water sampling locality	Frequency of sampling (samples per time period)	Total number of samples	Minimum result pH	Maximum result pH	Mean result pH	Number of samples not compliant with aesthetic guideline
Dumbalk	weekly	52	7.8	8.2	8.0	0
Fish Creek	weekly	52	7.6	8.6	8.1	1
Foster	weekly	52	7.5	8.1	7.7	0
Koonwarra	weekly	52	7.4	8.1	7.8	0
Korumburra	weekly	52	7.4	8.2	7.6	0
Leongatha	weekly	104	7.2	7.9	7.6	0
Meeniyan	weekly	52	7.3	8.0	7.7	0
Port Franklin	weekly	52	7.8	8.7	8.3	6
Port Welshpool	weekly	52	7.4	8.2	7.8	0
Toora	weekly	52	7.5	8.0	7.7	0

Based on mean pH values, pH compliance was maintained in all chloraminated system localities and complied with the ADWG range. Please see Table 33. The localities of Yarram and Alberton recorded pH slightly above guideline values during the reporting period. This increase in pH is due to low flow in the reticulation system. The Alberton sample point is located at a primary school which has periods of little water usage over school holidays. pH increases due to low flow and existing concrete pipe work leaching calcium carbonate.

Table 33: pH result for chloraminated systems in 2016 - 17 financial year

Water sampling locality	Frequency of sampling (samples per time period)	Total number of samples	Minimum result pH	Maximum result pH	Mean result pH	Number of samples not compliant with aesthetic guideline
Alberton	one per week	67	7.8	9.6	8.7	7
Cape Paterson	one per week	52	7.5	8.2	7.8	0
Inverloch	two per week	104	7.7	8.7	8.2	0
Lance Creek	one per week	52	7.9	9.0	8.3	0
Loch	one per week	52	7.9	8.6	8.2	0
Nyora	one per week	67	7.9	8.8	8.2	0
Poowong	one per week	52	7.8	8.8	8.2	0
Wonthaggi	two per week	104	7.6	8.7	8.2	0
Yarram	one to two per week	68	7.5	9.3	8.1	3

7. Analysis of results

7.1 Comparison of results for Schedule 2 Safe Drinking Water Regulations 2015 parameters for the 2016-2017 reporting period with previous two financial years

A comparison of analysis results over the 2016 – 2017 and previous two financial years is presented in Figures 2, 3 and 4. Consistent compliance is illustrated and in measure with the water quality standards listed in Schedule 2 of the Safe Drinking Water Regulations 2015, these being *Escherichia coli*, Trihalomethanes and Turbidity.

A decline in compliance with the trihalomethane water quality standard can be observed for the 2014-15 period. This is due to one exceedance of the compliance limit for Fish Creek that occurred as a result of an aeration pump failure at the water treatment plant; refer to part 4 of the 2014-15 report (available on South Gippsland Water's website for details). A return to 100 percent compliance with the trihalomethane standard water quality standard is observed for 2016 - 2017 period.

Percentage of customers supplied with drinking water that compiles with the water quality standards is illustrated in Figure 2 and 3.

Figure 2: Comparison of sample compliance with water quality standards for the 2016-2017 reporting period with previous two financial years for *E.coli*

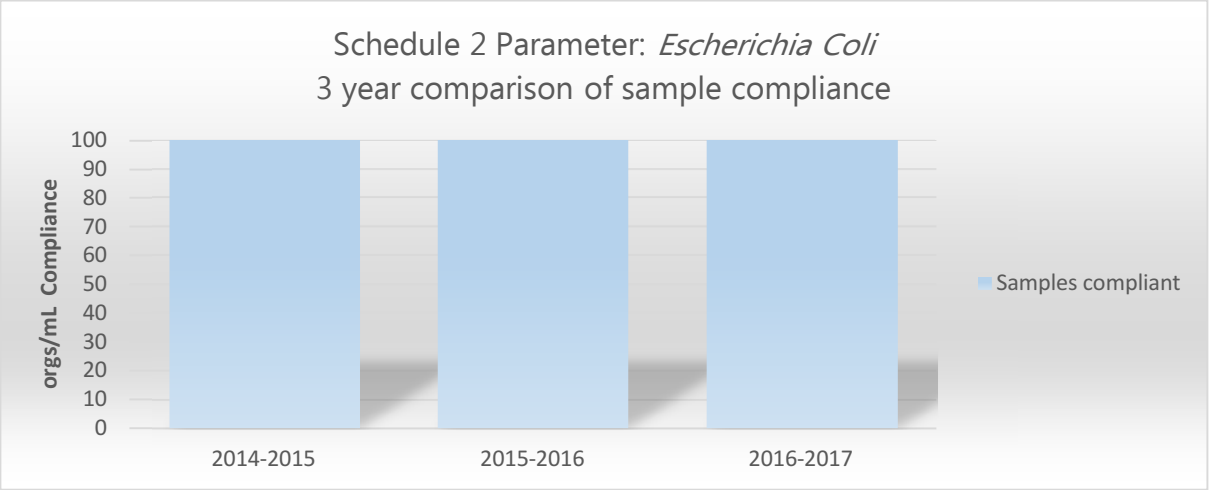


Figure 3: Comparison of sample compliance with water quality standards for the 2016-2017 reporting period with previous two financial years for Trihalomethane (Total) mg/L

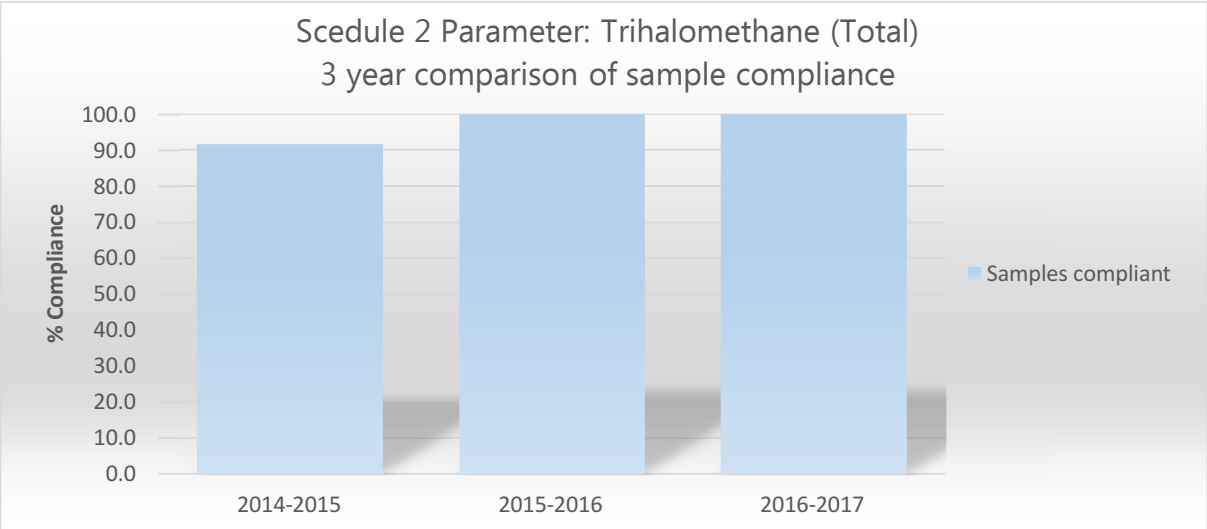


Figure 4: Comparison of sample compliance with water quality standards for the 2016-2017 reporting period with previous two financial years for Turbidity (NTU)

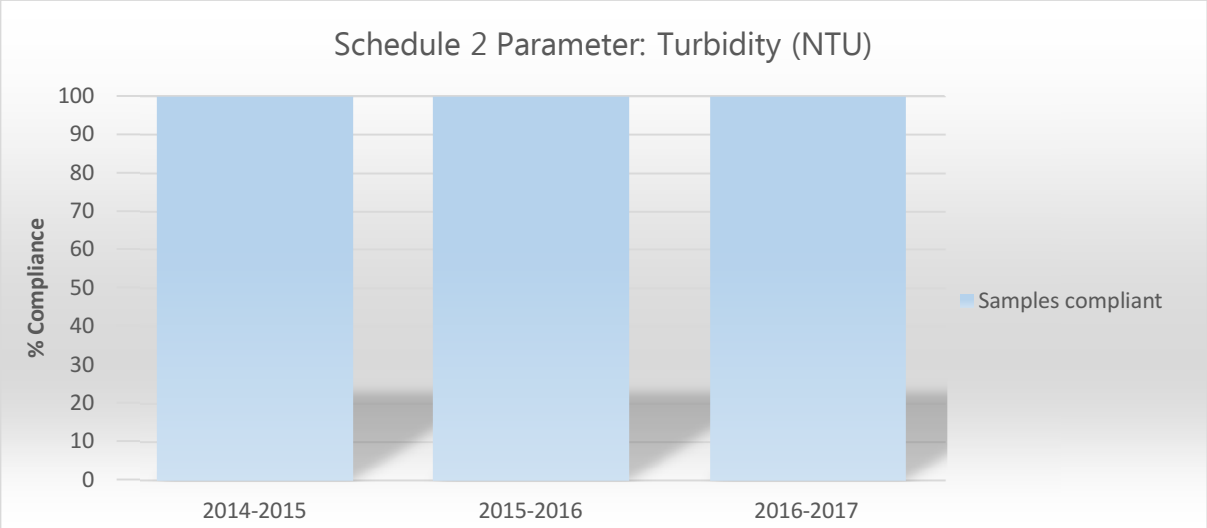


Figure 5: Percentage of water sampling localities where the drinking water complied with the water quality standards

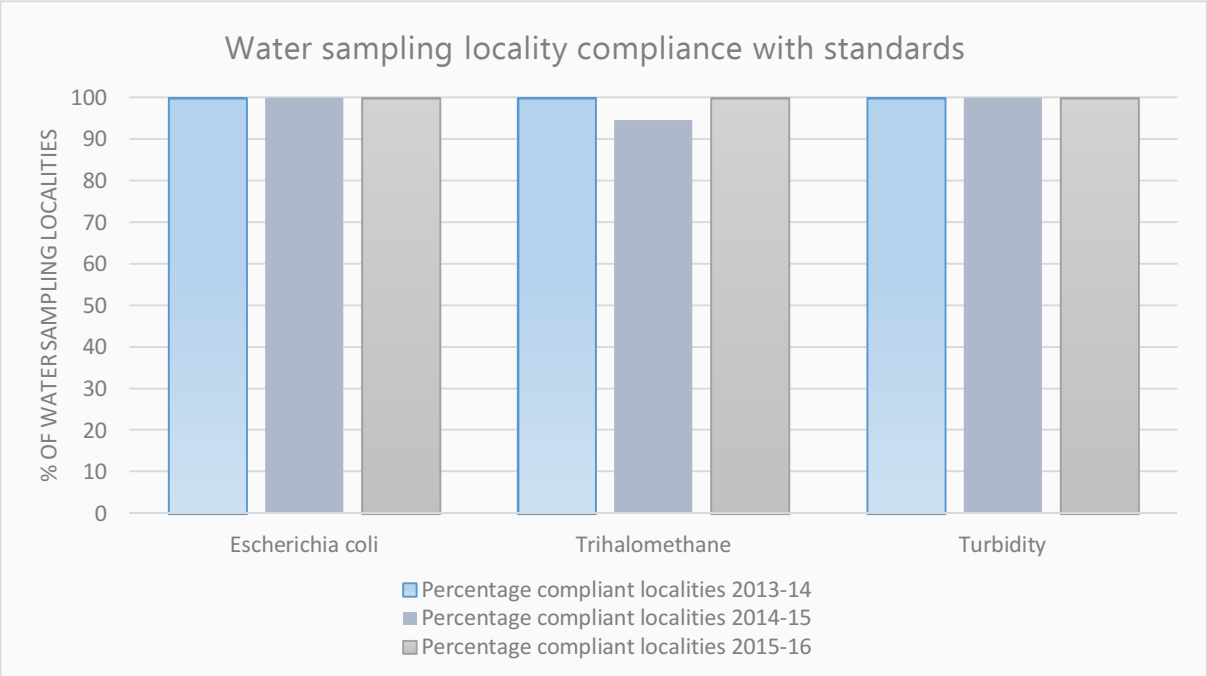
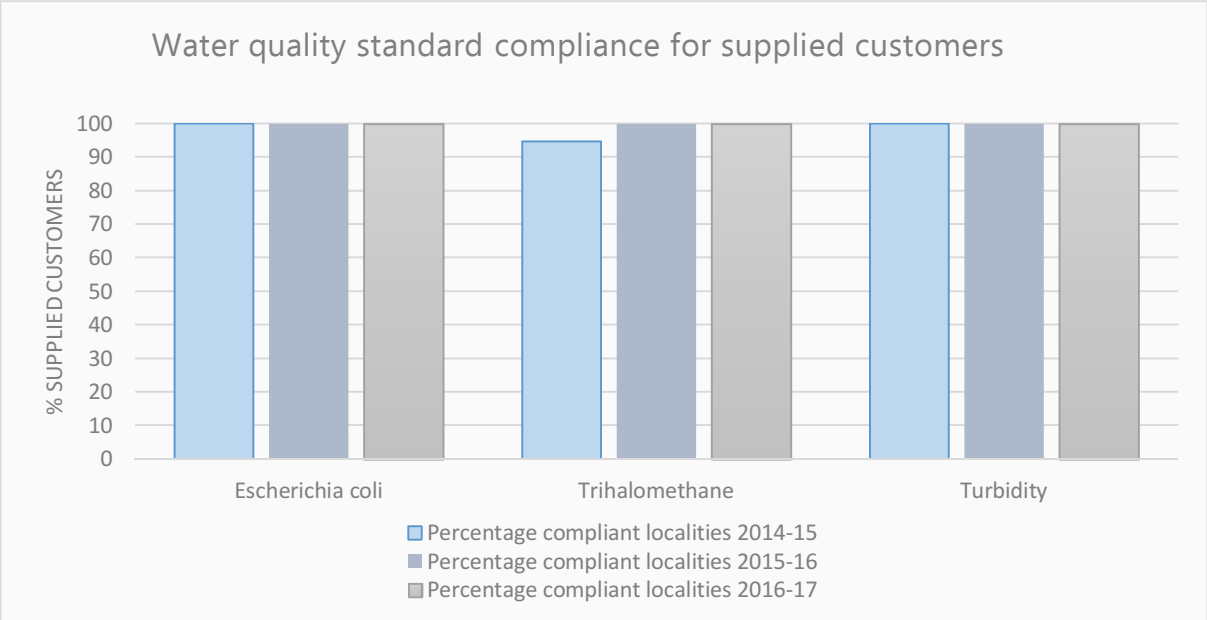


Figure 6: Percentage of customers supplied with drinking water that compiles with the water quality standards



7.2 Comparison of results for other water quality parameters for the 2016-2017 reporting period with previous two financial years

A comparison of results for the 2016-2017 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 34. The comparison is based on percentage compliance with the health-related guideline values of the *Australian Drinking Water Guidelines 2011.*

Table 34: 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*		
	2014-15	2015-16	2016-17
Arsenic	100 %	100 %	100 %
Aluminum	98 %	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 %

Table 34 (continued): Percentage of samples compliant with health-related guidelines from the ADWG

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 *	Not monitored	100%	Not monitored
Gross Beta *	Not monitored	100%	Not monitored

*Radiological parameters monitored once every seven years as per risk-based monitoring program. No monitoring occurred in the 2016 -2017 reporting period.

8. Complaints relating to water quality 2016 – 2017

South Gippsland Water records and attends to all complaints relating to drinking water quality to ensure the highest level of customer satisfaction. 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.

Table 35 below illustrates the four complaint types and the number of complaints received for each over the 2016 - 2017 year.

A comparison of the number of complaints with that of previous two reporting periods is provided in Figure 7.

Table 35: Customer complaints summary for 2016 -2017

Type of complaint	Number of complaints	Number of complaints per 100 customers (connected properties) supplied
Discoloured Water	96	0.48
Taste/Odour	28	0.14
Air in Water	5	0.02
Other	6	0.03

Figure 7: Customer complaints according to complaint type compared to previous reporting periods

Type of complaint	Number of Complaints			Comparison with previous reporting periods	Comments
	Current reporting period	2015/16 reporting period	2014/15 reporting period		
Alleged illness	0	2	3	Decrease in the number alleged illness report from previous two reporting periods.	Nil
Dirty/Discoloured Water	96	99	36	A decrease of three complaints from previous reporting period.	
Taste or odour	28	22	32	Increase of four complaints from previous reporting period.	Five complaints related to treatment of algal bloom in the Devon North raw water basin.
Air in Water	5	5	2	No change from previous reporting period.	Complaints due to mains/hydrant works.
Other	7	0	5	Increase of seven other complaints compared to previous reporting period.	Complaints include corrosion of internal household plumbing

Table 36: Individual complaint types by water sampling locality for the 2016 – 17 reporting period

Water Sampling locality	Types of complaint					Total Complaints
	Alleged illness	Dirty/Discoloured Water	Taste or Odour	Air in water	Other	
Alberton	0	4	1	0	0	**5**
Cape Paterson	0	0	1	0	0	**1**
Dumbalk	0	0	0	0	0	**0**
Fish Creek	0	1	0	0	1	**2**
Foster	0	33	4	2	1	**40**
Inverloch	0	0	2	0	0	**2**
Koonwarra	0	0	0	0	0	**0**
Korumburra	0	10	3	0	2	**15**
Lance Creek	0	0	0	0	0	**0**
Leongatha	0	2	1	1	0	**4**
Loch	0	1	0	0	0	**1**
Meeniyan	0	0	0	0	0	**0**
Nyora	0	0	0	1	0	**1**
Poowong	0	0	1	0	0	**1**
Port Franklin	0	2	0	0	0	**2**
Port Welshpool	0	17	0	0	0	**17**
Toora	0	20	5	0	0	**25**
Wonthaggi	0	3	2	0	2	**7**
Yarram	0	3	9	0	0	**12**

8.1 Management of complaints

8.1.1 Dirty/Discoloured water

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 water mains over time; and/or
- Unintended scouring of water mains following high flows or recharging of the system.

Corrective actions to address discoloured water include:

- Use of aeration and potassium permanganate dosing systems at water treatment plants to oxidise manganese and maximise physical removal through filtration;
- 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 flushing regimes for 'problem-spot' areas.
- Provision of a commercial cleaning product which removes discolouration marks from laundry items in response to individual customer complaints.

There were 96 complaints received in relation to discoloured water in the 2016 - 17 financial year.

Of the 33 complaints received for dirty water in the locality of Foster, many of these related to a manganese dosing issue at the Foster water treatment plant and the illegal extraction of water from fire hydrants in town causing high flows in parts of the reticulation system and the scouring of sedimentation in pipes.

A mains break to the trunk main coming from the Toora WTP saw a cluster of complaints from customers in the town of Toora. Scouring of reticulation pipe work resulted following the break causing dirty water issues for a short period.

8.1.2 Taste and odour

Taste and odour complaints result primarily from:

- Algae-related compounds in the water;
- Manganese and/or iron sediment in the water;
- Chlorine in water.

Corrective actions to address taste and odour include:

- Routine monitoring of supplied water for taste and odour, manganese, iron, turbidity, pH and chlorine;
- Specific 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.

There were 28 complaints relating to taste and odour issues received from customers in 2016-17.

8.1.3 Air in water

Air in water complaints are generally received following the implementation of air-scour 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 will correct the problem.

There were 5 complaints involving air in water from South Gippsland Water customers in the 2016-17 reporting period.

8.1.4 Other complaints

Other complaints generally relate to concerns that are beyond the control and responsibility of South Gippsland Water, such as death of aquarium fish or garden plants, and problems with domestic plumbing or appliances. Results of monitoring programs that may be relevant are reviewed, and

additional investigation may be 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 a total of 6 complaints/enquiries in this category for 2016-17.

Complaints in this category may also include general queries from customers experiencing illness or dermatological conditions. No complaints of this nature were received by SGW in the 2016 - 17 reporting period.

SGW encourages customers with health concerns to consult a medical professional for diagnosis and treatment. To provide assurance to customers, additional monitoring to verify quality of supplied drinking water to the customer's residence is carried out. Details of the complaint and results of both monitoring and diagnostic testing (if provided) are recorded via an Illness Complaint Record Form.

Largely, customers are seeking reassurance with regards to water quality rather than alleging that drinking water is the cause of their health problem. In the unlikely event that investigation of reported illness did produce evidence that water quality might be a factor, 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.

9. 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. A risk management plan audit was carried out by a Department of Health and Human Services approved auditor in June 2016. Audit outcomes can be found in the SGW Annual Drinking Quality Report 2015 -16 available from the SGW website www.sgwater.com.au. The next SGW risk management plan audit will take place in the first half of 2018.

10. Undertakings under Section 30 of the Safe Drinking Water Act 2003

Section 30 of the *Safe Drinking Water Act 2003* allows for the Secretary to the Department of Health and Human Services to accept a written undertaking from a water supplier that certain actions will be performed. Water suppliers can apply to the Secretary for an undertaking in the event that they are, or are likely to be, in contravention of the Act or its associated regulations.

There were no undertakings for South Gippsland Water in the 2016 - 17 reporting period.

11. Further information/Appendices

Appendix 1: South Gippsland Water Drinking Water Policy

Drinking Water Quality Policy

South Gippsland Water

"Committed to high-quality drinking water"

South Gippsland Water is committed to the management of its water supply systems to ensure the provision of safe, high-quality drinking water that consistently meets customer expectations, the National Health and Medical Research Council's Australian Drinking Water Guidelines, and relevant legislation and regulatory requirements. In order to achieve this objective, in partnership with stakeholders and relevant agencies, the Corporation will:

- Implement and maintain a Drinking Water Quality Management System to identify and minimise risks to drinking water quality at all points from catchment to consumer.
- Develop and implement an appropriate drinking water quality monitoring program and reporting system to provide relevant and timely information, and ensure confidence in the water supply and its management.
- Implement appropriate contingency and incident response systems to effectively manage incidents that may adversely affect drinking water quality.
- Review and assess the performance of the Drinking Water Quality Management System with respect to this Policy to ensure continual improvement and best practice management.
- Integrate into the Corporation's planning, the needs and expectations of its consumers, stakeholders, regulators and employees to ensure both effective and economical solutions for managing drinking water supplies.
- Ensure compliance with all Acts, regulations, guidelines and standards relevant to drinking water quality.

This Policy requires all managers and employees at South Gippsland Water involved in the supply of drinking water to be responsible for understanding, implementing, maintaining and continually 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 Corporations 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:–

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David Schultz - Chair — Date: 27 July 2017

Philippe du Plessis - Managing Director — Date: 27 July 2017

Operations Water - POW/WQ-001 Approved: 22/06/2017