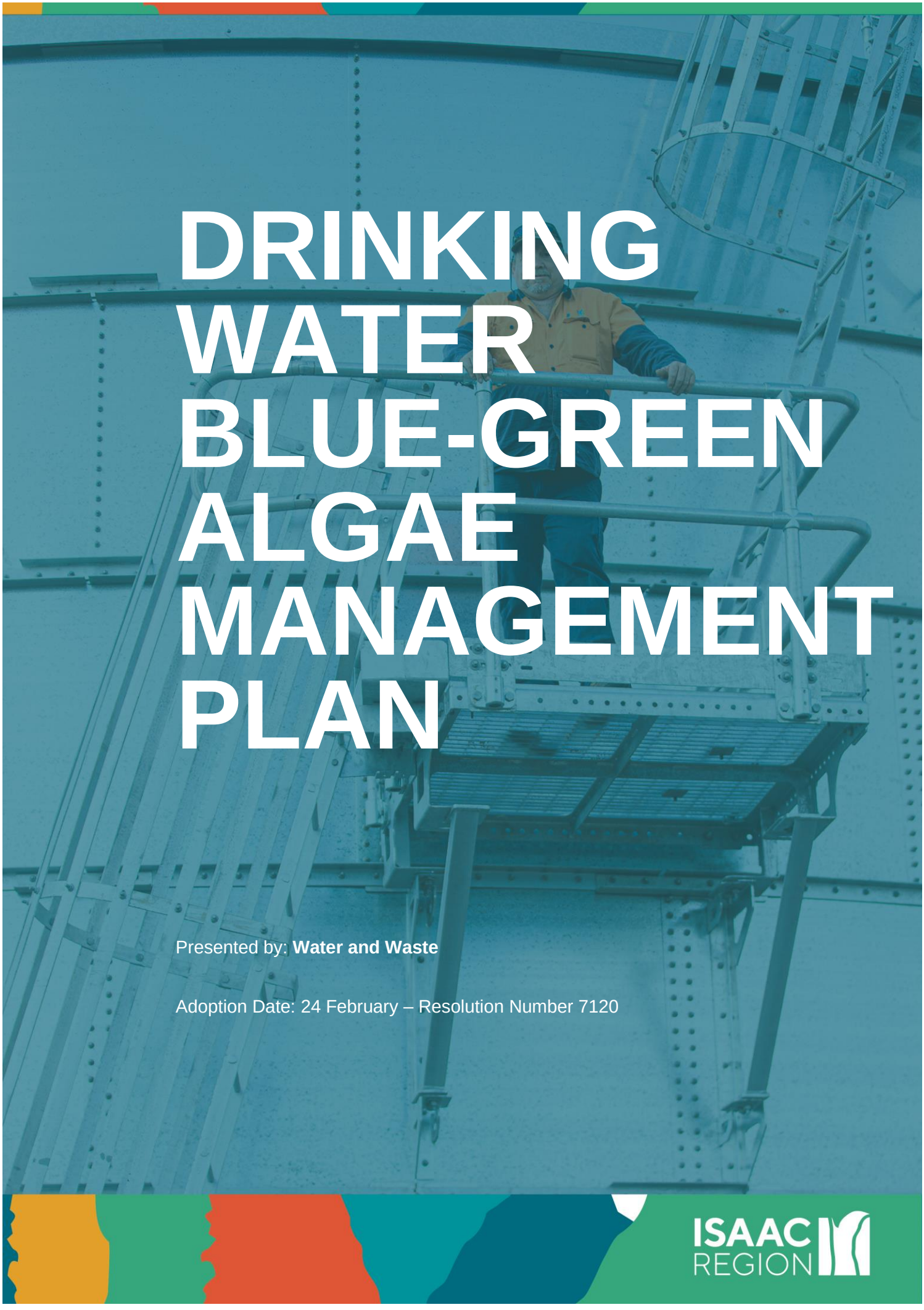

DRINKING WATER BLUE-GREEN ALGAE MANAGEMENT PLAN

Presented by: **Water and Waste**

Adoption Date: 24 February – Resolution Number 7120

ISAAC REGION

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INTRODUCTION

Blue-Green Algae (BGA), also known as cyanobacteria, become problematic for water treatment plants when their cell density dramatically increases because they are able to release toxins in the water which require special treatment to remove. In general, a cyanobacteria bloom is said to have occurred when the cell density is greater than 6,500 cells/mL

The purpose of this document is to provide a framework to assist Isaac Regional Council (IRC) management and operational staff in managing BGA outbreaks in raw water sources. This protocol is used to determine response levels and subsequent actions required following the detection of a BGA bloom.

SCOPE

The protocols outlined in this document apply to each of IRC's raw water sources. IRC operates 8 water supply systems, each with its own water source. These water supplies that are storage based may be owned and operated by Sunwater or IRC or the resources sector. Thus, a BGA risk arises from both the source water as well as storages in the supply systems:

- Carmila – shallow bores (2) adjacent to Carmila creek delivered through IRC infrastructure to the Carmila WTP. The bore field is replenished via a shallow weir upstream of the bores.
- Clermont – Theresa Creek Dam (TCD) owned and operated by IRC delivered through IRC infrastructure to the Clermont WTP.
- Dysart – Bingegang Weir on the Mackenzie River (operated by Sunwater) via Billington Mitsubishi Alliance **(**BMA's) Calvert's Dam and Dysart storage (onsite turkeys nest dam, offtake and supply infrastructure for all sources owned and operated by BMA). Raw water delivered to raw water storage tank at Dysart WTP.
- Glenden – Bowen River (offtake and supply infrastructure owned by Sunwater) via Newlands mine, owned and operated by Glencore. Raw water delivered through Glencore pipeline to the Glenden WTP.
- Middlemount – Bingegang Weir on the Mackenzie River (operated by Sunwater) via Tralee Dam (offtake and supply infrastructure owned and operated by Anglo American).
- Moranbah – Burdekin dam and/or Eungella dam (both dams are owned and operated by Sunwater) via Sunwater, BMA and IRC infrastructure to the Moranbah WTP.
- Nebo – IRC Nebo bores (6) drawing from the Nebo Aquifer and delivery to the Nebo WTP
- St Lawrence – IRC St Lawrence Creek Weir via IRC offtake infrastructure to the St Lawrence WTP.

Algae is unlikely to cause issues for Carmila or Nebo water sources as both these supplies use bore water. If, however, algal contamination is identified by customer complaints and subsequent laboratory analysis, the same response protocols can be applied as outlined in this management plan.

The protocols, roles and responsibilities outlined in this document apply to each of IRC's raw water sources as outlined above. They are to be implemented by IRC managers, coordinators and operations and maintenance staff nominated herein.

ROLES AND RESPONSIBILITIES

The roles and responsibilities of the various stakeholders for the IRC water supply systems are outlined in Table 1. Communication and cooperation between all parties is critical to ensure that drinking water quality and/or supply security is not compromised.

Table 1: Summary of Stakeholder Roles and Responsibilities

RESPONSIBILITIES	IRC	BMA	ANGLO AMERCIAN	GLENCORE	SUNWATER	DOH	DOR
Receive inquiries from the public	Y	Y	Y	Y	Y	Y	Y
Provide general advice	Y	N	N	N	N	Y	Y
Inspect the bloom	Y	Y	Y	Y	Y	Y	N
Analyse the bloom	Y	Y	Y	Y	Y	Y	N
Communicate the findings	Y	N	N	N	Y	Y	Y
Mitigation and management	Y	Y	Y	Y	Y	N	N

Isaac Regional Council

Drinking water service providers are required under the *Water Supply (Safety and Reliability) Act 2008* to manage the quality of drinking water to protect public health, including the management of any risks posed by Harmful Algal Blooms (HABs) – including the treatment of algae affected water used for drinking water supplies. IRC own and operate the Teresa Creek Dam which supplies the Clermont Township. IRC also own the St Lawrence Creek Weir that supplies St Lawrence Township and licenced bores that supply Carmila and Nebo Townships. In addition, water service providers provide:

- Routine monitoring of HAB's in supplemented freshwater systems under their control (e.g. reservoirs, weir pools, irrigation systems).
- Community and stakeholder information relating to their operations (e.g. signage, website, fact sheets, brochures).
- Management of public health risks associated with HABs in recreational lakes.

Under the *Sustainable Planning Act 2009*, Local Governments are also responsible for the planning and regulation of development activities to maintain local social, economic and environmental values. Also, IRC have the responsibility for local management of water quality issues as part of the *Environmental Protection Act 1994* where Local Government Development Application review and approval processes in line with the *Sustainable Planning Act 2009*.

Anglo American

Anglo American is the owner of the offtake and storage infrastructure that supply raw water to Middlemount. This infrastructure is maintained by Anglo American

Billington Mitsubishi Alliance (BMA)

BMA is the owner of the offtake and storage infrastructure that supply raw water to Dysart.

Glencore

Glencore is the owner of the offtake and storage infrastructure that supply raw water to Glenden.

Sunwater

Sunwater own and operate the Burdekin and Eungella storage dams which supply the Moranbah Township. Sunwater also owns and operates the Bingegang Weir storage on the Mackenzie River for supply to Dysart and Middlemount.

Mackay Regional Council Laboratory

Mackay Regional Council Laboratory receives all water samples and stores results within a data storage system called Monitor Pro. All samples unable to be measured for certain parameters are outsourced to other laboratories with the required capabilities. Alerts are provided via email indicating current level of alert to be adhered to.

Queensland Department of Health (DoH)

Public health risks associated with HABs in drinking water storages are to be managed by the drinking water service provider. The DoH or the relevant Public Health Unit may provide advice on assessing and managing the public health risk posed by a HAB in a drinking water storage and may take enforcement action under the *Public Health Act 2005* where the drinking water service provider fails to adequately manage the risk.

DoH Forensic and Scientific Services may provide analytical services for the identification and enumeration of HABs (primarily for drinking water storages) and the detection and quantification of HAB toxins (in fresh and marine waters).

In addition, DoH or the local Public Health Unit may provide the following:

- Advice to the managers of a drinking water storage, or a drinking water service provider drawing from a surface water affected by a HAB, on assessing and managing the associated public health risks.
- Advice to the relevant parties regarding the public health risks associated with eating fish, shellfish and crustaceans caught in waters affected by a HAB, or irrigating food crops with water affected by a HAB.

Department of Resources (DOR)

DOR is responsible under the *Water Act 2000* for the management of the State's non-tidal waters and the regulation of resource operation licence holders and water service providers. It is also the lead agency for the management of catchment resources such as land and vegetation. Through its responsibilities DOR provides the following services:

- Detection response measures, assessment and evaluation of HABs in un-supplemented freshwater systems.
- Advice to individuals, the community, stakeholders and other government agencies on issues related to the monitoring of and management of freshwater HABs.
- Community and stakeholder information (e.g. web site, fact sheets, brochures).

DOR is also responsible under the *Water Act* for drinking water service providers (such as local governments) who are responsible for ensuring public health is protected by managing water quality risks associated with HABs in their service in accordance with their approved Drinking Water Quality Management Plan (DWQMP) (as required under the *Water Supply (Safety and Reliability) Act 2008)*.

If a drinking water service provider detects algal toxins above the Australian Drinking Water Guideline (ADWG) health guideline value in the treated drinking water or are concerned about their ability to manage the impacts of the HAB under the approved drinking water quality management plan, they must report the incident or event to the Queensland Water Supply Regulator (QWSR) within DOR. DoH is subsequently advised of these incidents.

Where issues related to HABs have not been identified and managed through the DWQMP and are relevant to the service being supplied, the drinking water service provider may, with approval, amend the DWQMP. Where a drinking water service provider has not adequately assessed and managed the risk associated with HABs, DOR may require an amendment to their DWQMP. If necessary, DOR can also direct a drinking water service provider to undertake particular measures to ensure the protection of public health.

RESPONSE PROTOCOLS

Prevention is better than treatment for the management of algal blooms. Effective preventative actions include catchment and source water management, reducing nutrient loading, and changing reservoir stratification and mixing.

Dam management (under IRC control) through silt removal, that harbour organics that can release algae, must be incorporated into maintenance programs as prevention measures.

Other key issues include protection of soils from erosion, public awareness of the effects of phosphorus-containing products, nutrient management strategies, water quality monitoring and the management of point and diffuse sources of nutrients.

Despite the use of preventative actions blooms may still occur. In order to minimise the impact of algal blooms on the community, the Drinking Water Blue-Green Algae Management Plan (DWBGAMP) includes actions to manage cyanobacteria blooms.

Identifying and Responding to a Blue-Green Algal Bloom

BGA blooms require a quick, well-planned and coordinated response to limit the risk of a negative impact on public health. Cooperation from all relevant stakeholders and an appropriate monitoring program are key to ensuring algal growth is identified early and bloom potential is mitigated where possible.

The different responses to algal blooms are based on the identification of algal type, counts and the presence of toxins. Where laboratory results are not available immediately, field assessments (such as visual inspection) will be useful to determine the possibility of risk associated with a potential bloom. Regular visual monitoring of raw water sources for algae is advisable particularly during high risk periods. Algal concentrations and distribution can change rapidly under favourable conditions and changes of wind direction so inspection may be necessary on a daily basis.

Testing for total algal levels are conducted weekly in raw water and if levels are detected ≥500 cells/mL algal toxins are then measured. Toxins in the treated water is conducted monthly at Clermont, Dysart, Glenden, Middlemount, St. Lawrence and Moranbah WTPs through Mackay Regional Council (MRC) NATA Laboratory. Council and are notified of any detections of cells (≥500 cells/mL) or toxins as soon as practicable.

Classification of Response Levels

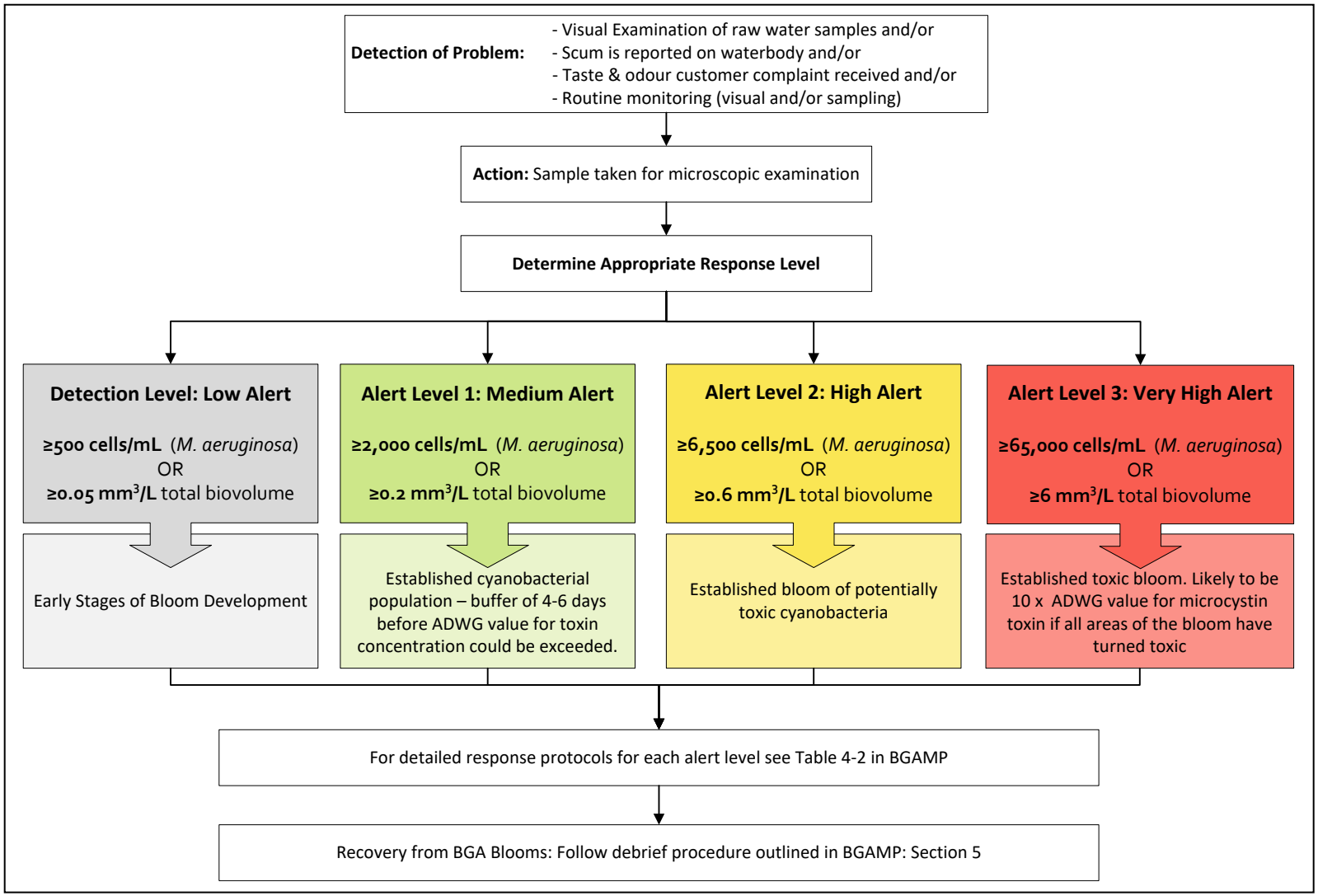
ADWG recommends that water authorities use the following cyanobacteria cell density targets to determine the next course of action. Threshold cell counts are based on tracking worst case, potentially toxic *Microcystis aeruginosa* populations whereas biovolumes account for equivalent total concentrations of other cyanobacteria species.

1. DETECTION LEVEL: Low Alert
    - ≥500 cells/mL (*M. aeruginosa*) or ≥0.05 mm^3/L (total cyanobacteria biovolume)
      This indicates the early stages of bloom development. Tastes and odours may be present in the water and regular inspection and testing should be commenced to monitor population growth and potential bloom development.
2. ALERT LEVEL 1: Medium Alert
    - ≥ 2,000 cells/mL (*M. aeruginosa*) or ≥0.2 mm^3/L (total cyanobacteria biovolume)
      This describes an established cyanobacterial population which may have localised high cell counts. A cell density in this range is expected to provide a buffer of 4-6 days before the ADWG value for toxin concentration could be exceeded (depending on growth activity and presence of potentially toxic species).
3. ALERT LEVEL 2: High Alert

- ≥ 6,500 cells/mL (*M. aeruginosa*) or ≥0.6 mm^3/L (total cyanobacteria biovolume)
  These cell numbers indicate an established bloom of potentially toxic cyanobacteria.

4. ALERT LEVEL 3: Very High Alert
   - ≥ 65,000 cells/mL (*M. aeruginosa*) or ≥6 mm^3/L (total cyanobacteria biovolume)
     This describes an established toxic bloom and is likely to be 10 times the ADWG value for the microcystin toxin if all areas of the bloom have turned toxic. These conditions are indicative of a significant increase in the risk of adverse human health effects. If at this level treatment is insufficient and toxins are passing through to the treated water supply, a contingency water source may be required (e.g. alternate raw water source or delivery of tankered water).
     Immediate notification of Health authorities is required if this has not already occurred at lower alert levels.

Response Level Flow Chart



The flowchart on the following page outlines the processes required to determine the correct BGA response level. The flowchart should be consulted each time new test results are received.

Bloom Response Plan Details

Table 2: Alert Level Response Protocols (Water Quality Research Australia, 2010

LEVEL	THRESHOLD DEFINITION	RECOMMENDED ACTIONS	RESPONSIBLE PERSON(S)
Detection Level	**LOW ALERT** ≥500 cells/mL (*M. aeruginosa*) OR ≥0.05 mm^3/L total biovolume	• Retest to confirm detection • Continue weekly sampling at offtake • Regular visual inspection of water surface for scums adjacent to offtakes	WTP Operator
		• Notify the WTP Operator to increase visual inspection of water source to twice weekly • Consider the need for sampling at other locations around the water source or upstream water storages • Monitor biovolume/cell counts for changes in required response level • Notify MO&M Water and Wastewater of algae detection and provide weekly status updates	Water and Wastewater Supervisor/Process Engineer / Water and Waste Assets and Compliance Officer (A&CO)
		• Notify IRC (Supervisors. Process Engineer, MO&M and A&CO) via an Exception notification when either threshold value is exceeded • Continue weekly algae identification and cell counts and report results	MRC Laboratory
Alert Level 1	**MEDIUM ALERT** ≥2,000 cells/mL (*M. aeruginosa*) OR ≥0.2 mm^3/L total biovolume	• Continue weekly sampling at offtake and add second sample from a representative location in source water	WTP Operator
		• Establish variability of the offtake sample over time • Monitor biovolume/cell counts for changes in required response level • Notify MO&M Water and Wastewater of Alert Level concentration	Water and Wastewater Supervisor/ Process Engineer/ A&CO

LEVEL	THRESHOLD DEFINITION	RECOMMENDED ACTIONS	RESPONSIBLE PERSON(S)
		• Notify health authorities and agencies as appropriate • Decide on requirement for toxicity assessment or toxin monitoring • Liaise with BMA/Anglo-American/Glencore/Sunwater (if appropriate) to commence visual inspection and testing of upstream water storages owned and/or operated by external stakeholders. Remedial action should be taken if required (e.g. adjust draw-off level, destratification, biomanipulation, alternate sources, etc.) • Investigate cause of elevated algae levels – liaison with external stakeholders may be required	Manager Operations and Maintenance (MO&M)/Water and Wastewater A&CO
		• Notify IRC (Supervisors. Process Engineer, MO&M and A&CO) via an Exception notification when either threshold value is exceeded (if not already notified for the same incident) • Continue weekly algae identification and cell counts and report results • Manage subcontracting of toxicity testing if required	MRC Laboratory
Alert Level 2	**HIGH ALERT** ≥6,500 cells/mL (*M. aeruginosa*) OR ≥0.6 mm^3/L total biovolume	• Increase monitoring to twice weekly at offtake and a representative sample as per Level 1 • Begin weekly sampling for toxin monitoring in the raw and treated water • Increase visual inspection of water source to daily	WTP Operator
		• Continue monitoring biovolume/cell counts for changes in required response level • Notify Manager Water and Wastewater of Alert Level concentration	Water and Wastewater Supervisor/Process Engineer/ A&CO
		• Seek advice from health authorities on risk to public health, i.e. health risk assessment considering toxin monitoring data, sample type and variability, effectiveness of available treatment • Advise consumers that potentially toxic BGA levels are rising and water restrictions or alternate supplies may be enforced if necessary • If toxin monitoring (of treated water) is recommended by relevant health authorities, coordinate this with MRC for inclusion in analysis • Liaise with external stakeholders (if necessary) to implement remedial strategies to improve source water quality or change water source • Notify all relevant persons – CEO, Mayor etc.	Manager Operations and Maintenance (MO&M)/ Water and Wastewater A&CO/ Director Water and Waste

LEVEL	THRESHOLD DEFINITION	RECOMMENDED ACTIONS	RESPONSIBLE PERSON(S)
		• Notify IRC (Supervisors. Process Engineer, MO&M and A&CO) via an Exception notification when either threshold value is exceeded • Perform twice weekly algae identification and cell counts and report results • Perform algae identification and cell counts for additional sites as required • Manage subcontracting of toxicity testing if required	MRC Laboratory
Alert Level 3	**VERY HIGH ALERT** ≥65,000 cells/mL (*M. aeruginosa*) OR ≥6 mm^3/L total biovolume	• Continue monitoring of source water as per Level 2	WTP Operator
		• Notify relevant health authorities immediately for advice on risks to public health • Assess effectiveness of available treatment and consider switching to an alternate water source for supply • Advise consumers that potentially toxic BGA levels are rising and water restrictions or alternate supplies may be enforced if necessary (if not already done) • Liaise with external stakeholders (if necessary) to implement remedial strategies to improve source water quality or change water source (if not already in progress) • Notify all relevant persons – CEO, Mayor etc.	Manager Operations and Maintenance (MO&M)/ Water and Wastewater A&CO/ Director Water and Waste
		• Notify IRC (Supervisors. Process Engineer, MO&M and A&CO) via an Exception notification when either threshold value is exceeded • Continue twice weekly algae and toxin testing and reporting as per Level 2 • Perform weekly toxin monitoring in source and treated water if not already done • Continue toxin monitoring after cell numbers significantly decline	MRC Laboratory

Declining Cell Count

As the cell count and/or biovolume of a bloom declines, the response level may be lowered accordingly. To safely lower a response level, the following requirements must be met:

1. Raw water BGA samples must be within the limits of the lower response level for cell count and total biovolume **for 2 consecutive weeks**.
2. Toxicity testing (if conducted) must return a zero result **for 3 consecutive weeks**.

Algal cell and toxin levels can fluctuate rapidly given the right conditions, so it is necessary that sufficient time has passed to ensure any changes in concentrations have stabilised before reductions in response levels are made.

If the response level is being lowered to below the Detection Level, follow the recovery actions detailed in the Section below.

RECOVERY FROM BGA BLOOM

This section identifies the various steps that must be undertaken after an incident has occurred, such as reviewing the performance of staff and Protocols, restoration of public confidence and rectification of infrastructure.

Debrief

The information gathered during the investigation should be collated and reviewed with recommendations made for improving the incident process to:

- Investigate the cause of the incident.
- Evaluate the effectiveness of the response plan.
- Identify aspects of the response effort that worked well and areas for improvement.
- Note any additional issues that arose and may need to be considered further.

Investigate the Cause

The Supervisors. Process Engineer, MO&M and A&CO Water and Wastewater should investigate the cause of the incident. This will involve interviewing operational staff and external stakeholders to determine the source of the contamination, identify any inputs from human/industry activities (e.g. farming, mining, etc.) reason for contributing conditions.

Analysis environmental factors (such as air and water temperatures, rainfall, wind speed and direction) in the lead up to and during the incident should be conducted to identify any trends which may be used to recognise early warning signs for potential future events.

Review of Performance

The information gathered during the investigation should be collated and reviewed with recommendations made for improving the incident management plan and staff performance. A debrief meeting (workshop or phone conference) should be held to discuss the outcomes of the data review, assess the response protocols to acknowledge successful implementation by staff and identify any areas requiring improvement.

An action list of recommendations should be developed with timeframes and responsible persons assigned to each action. Recommendations may include staff training, capital works and/or operational changes.

Restoration of Public Confidence

Following an incident, media releases should be issued to inform consumers that the incident has ended. A summary of the actions taken to achieve this result and minimise the impact on consumers should be included to further help restore public confidence. Personal correspondence should also be sent to consumers that were significantly impacted by the incident.

Infrastructure Recovery

Any changes to infrastructure during the incident will need to be rectified once it has ended. Additional chemical dosing lines and mobile package chemical systems (if required) should be removed to restore the site to its original condition. Any warning signs or access restrictions placed in public areas should also be removed.

Debrief Report

A debrief report should be prepared following an incident as a record of the event and actions taken. The report should include:

- Event title/location, date(s) of event occurrence, date of debrief meeting
- List of meeting attendees
- Description of the event including the impact
- Summary of issues, actions taken, proposed course of action, persons responsible for follow up actions and timeframe for completion
- Distribution list – should include all meeting attendees and relevant stakeholders
- Appendices – should include testing reports and a timeline of the event

MONITORING

Regular monitoring is important to ensure that algal growth is identified early so that effective treatment strategies can be commenced to minimise the risk to public health. A range of parameters should be included in routine monitoring to track conditions which could lead to an algal event. The frequency and scope of sampling should be increased during bloom conditions to monitor algae growth and decline.

Monitoring Purposes and Parameters

Monitoring has a range of purposes according to the following categories:

- **Operational monitoring (O)** → used to assess WTP processes and equipment. Data used as triggers for immediate short-term corrective action to improve water quality. Not typically used to assess compliance with agreed levels of service.
- **Drinking Water Quality Monitoring (DWQ)** → verification of water quality in the distribution system and as supplied to the consumer (performance monitoring). Data used to assess compliance with agreed levels of service and regulations.
- **Monitoring of Consumer Satisfaction (CS)** → assessment of consumer comments and complaints, which can provide valuable information on potential problems that have not been identified by performance monitoring.
- **Investigative and Research Monitoring (I&R)** → strategic programs designed to increase understanding of a water supply system, to identify and characterise potential hazards, and to fill gaps in knowledge. Includes baseline and emergency response monitoring.

Water quality monitoring parameters recommended for inclusion in the DWBGAMP are shown in Table 3.

Table 3: Summary of Water Quality Monitoring Parameters for DWBGAMP

MONITORING PARAMETERS	RAW WATER	TREATED WATER	CRITICAL VALUES/ CONDITIONS
Nutrient levels	O, I&R	-	• Phosphorus >0.35 µg/L promotes algae growth • Nitrogen >1000 µg/L promotes algae growth • Can be useful in locating pollution sources in catchment area
DO	O, I&R	-	• >4 mg/L at all depths is recommended
Algae Count and Identification	O, I&R	O, DWQ	
pH	O, I&R	O, DWQ	• pH >8.0-8.5 is linked to algae growth
Turbidity	O, I&R	O, DWQ	
Light attenuation (Secchi depth)	I&R	-	
Water Depth	I&R	-	• Data required for modelling
Water Temperature	O, I&R	O	• 20ºC, or greater than 2ºC stratification, promotes algae growth • Data required for modelling
Total chlorophyll	I&R	O, DWQ	
Wind Speeds	I&R		• Calm, non-turbulent conditions promote algae growth • Data required for modelling
Odour and taste compounds	-	O, CS, DWQ	• Varies according to compound and testing method
Algae Toxins	O, I&R	O, CS, DWQ	
WTP Flowrates	O	O	

Routine Monitoring

Routine monitoring of raw water sources should be conducted year-round. Monitoring should include:

- Weekly visual inspection of the water sources
- Monthly sampling for algal counts and identification

During high risk periods, such as late spring and summer, sampling for algal analysis should be conducted weekly.

An agreement should be made between IRC and the relevant owners and operators of raw water supply infrastructure for Dysart, Glenden, Middlemount and Moranbah WTPs detailing monitoring responsibilities, frequencies and notification protocols for privately owned offtakes and storages.

Bloom Monitoring

Once bloom conditions have been reached (Alert Level 2), monitoring should be increased to twice weekly at the offtake and a representative sample point (this may change depending on bloom location and wind conditions).

Visual and Odour Based Assessment

Visual and odour-based assessments are an important monitoring tool that can be used to identify the presence of algae before sampling results are available. These assessments should be performed by an operator trained to recognise the presence and types of algae at low concentrations. Even at very low concentrations BGA can produce earthy, musty and grassy odours, therefore careful odour assessment can detect the presence of algae before it is easily visible and before levels become dangerous. Algae colonies will typically form scums on the surface of the water source and give the water a green tinge as the bloom develops.

While conducting these assessments, the operator should note any likely contributors to algal growth conditions. These may include:

- Decomposing organic matter
- Stagnant waters
- Agricultural run-off
- Shallow and narrow areas

Where possible, action should be taken to minimise the impact of these hazards on the water source.

Sampling

It is important that the BGA cell counts measured are representative of the entire area. An effective sampling program should consider factors such as:

- Seasonal variations
- Weather conditions
- Equipment and staff availability
- Requirements of laboratory analysis

Sampling Procedure

Integrated depth sampling provides the most representative sample of a water source at the sampling location, however if equipment is not available surface samples can be collected. When sampling is being conducted, gloves should be worn at all times to avoid direct to skin contact with the algae.

Water sampling procedure:

- Avoid contact with the suspect water as acute skin and respiratory irritation can occur after short-term exposure to water containing cyanotoxins.
- Wear gloves and wash hands afterwards.
- Collect water in a watertight plastic or glass bottle with a wide mouth. A clean, disposable water bottle is suitable if no other containers are available.
- Clearly identify each sample container.
- Sample surface water where the bloom is most dense (100 milliliters is sufficient, no more than 500mL). Ensure sufficient space is left at the top of the container to allow mixing.
- Thoroughly wash the exterior of the bottle with clean water.

- Samples should reach the laboratory within 24 hours and be kept at approximately 4°C during transport (an ice brick and small esky is usually adequate).
- Do not freeze the water as algal cells may be damaged making identification difficult.

If possible, samples should be taken in the late afternoon will then be couriered to the MRC Laboratory for analysis. If required to enable accurate laboratory testing, samples should be preserved according to the protocols developed by MRC Laboratory.

BGA Identification

Samples will be analysed at the MRC Laboratory to determine algal cell counts and speciation. Upon detection of BGA in the sample, the relevant Water and Wastewater Operations Team Leader will be notified (the IRC Manager Water and Wastewater will also be notified directly if the Alert Level 3 threshold is breached) and a summary report issued outlining total and species cell counts.

BGA species can appear similar to harmless green algae species and may or may not be toxic so identification is necessary to determine the correct response protocol is implemented. If a bloom is detected by visual and odour assessment, the operator shall take a sample of the suspected outbreak for analysis by MRC.

Sample Variability

Cell counts determined from sampling can be highly variable. When collecting samples and reviewing cell count results, wind conditions, dispersion of colonies/scums and a variation allowance of ±20% for cell counts (already incorporated into the response level thresholds) should all be considered.

As a result of this variability, a declining cell count can only be confirmed after 2 consecutive weeks of cell count results in a lower response level. To minimise the effects of cell count variations on sampling, samples should be taken from the same location and at a similar time each day. Any adverse weather or site conditions at the time of sampling should be noted in the operator log sheet.

REFERENCES

ID	NAME
Water Directorate	Blue-Green Algae Management Protocols – 2014
Queensland Water Directorate	Blue Green Algae Management Protocols
Water Quality Research Australia	Management Strategies for Cyanobacteria (blue-green algae): A Guide for Water Utilities – Research Report 74
Queensland Government	Harmful algae – Queensland government response plan
Queensland Government	Harmful algal bloom response plan and operational procedures
Australian Government National Health and Medical Research Council Natural Resource Management Ministerial Council	Nation Water Quality Management Strategy, Australian Drinking Water Guidelines 6 2011, Version 3.5 Updated August 2018

APPENDIX A: BGA ALERT CONTACT LIST

ORGANISATION	CONTACT NAME	CONTACT DETAILS
IRC	Isaac Regional Council	WaterandWastewaterenquiries@isaac.qld.gov.au (07) 4846 3500 or 1300 ISAACS
BMA	Brett Garner (Moranbah & Dysart)	0417 712 009 or (07) 4885 8891
GLENCOREIELD	Brisbane Office	(07) 3833 8500
SUNWATER	Ray Benson (Moranbah) 0407 541 700 Jason Smith (Dysart) 0455 372 600 Main Office (Glenden) Jason Smith (Middlemount) 0455 372 600	Main Office contact (07) 3120 0000
MRC LABORATORY	Kimberly Giles 0475 835 373	(07) 4961 9042
QUEENSLAND HEALTH	Mackay	(07) 4885 5800
DEPARTMENT OF RESOURCES	General enquiries	13QGOV (13 74 68)