



Inter-agency
**Blue-Green Algae
Monitoring Protocol**
May 2024

Alternative Formats

You can request a copy of this document in other formats, such as:

- Paper Copy
- Large Print
- Braille
- Other languages

To get a copy of this document in another format contact:

Email: nieainfo@daera-ni.gov.uk

Contents

1. Blue-Green Algae: Background to monitoring protocol	4
2. Roles and Responsibilities (with respect to blue-green algae)	6
The General Public	6
DAERA Marine and Fisheries Division	6
Northern Ireland Environment Agency	6
DAERA Veterinary Science and Animal Health	7
Food Standards Agency	7
Public Health Agency NI	7
Local Council Environmental Health	7
Northern Ireland Water	7
Drinking Water Inspectorate	8
Water Business Owners/Controllers	8
3. Categories of Water	9
3.1 Sites with little or no recreational activity	9
3.2 Sites with high recreational activity which are not candidate or identified bathing waters	9
3.3 Candidate or identified bathing waters	10
3.4 Commercial and recreational sites from which primary products* (food and feed) are placed on the market	10
3.5 Drinking water abstraction waters	10
4. DAERA Response Protocol	12
Tiered approach to Surveillance and Monitoring	13
Tier 1 verification of records and visual assessment	13
Tier 2 toxin monitoring	13
5. DAERA Bathing Water Monitoring Protocol	14
5.1 Water sample analysis	14
5.2 Use of public health guideline values	15
5.3 Monitoring frequency and Alert Level Framework	15
5.4 Decision to remove restrictions	18

1. Blue-Green Algae: Background to monitoring protocol

The public should be aware of the dangers posed by the occurrence of blue-green algal blooms. Blue-green algae also known as cyanobacteria, are microscopic, plant-like organisms that occur naturally in fresh, brackish and seawaters throughout the world. While usually green or blue-green in colour, they may also be yellow-brown or red depending on the species. Normally, blue-green algae are not visible in the water, however, when suitable weather conditions combine with a ready supply of nutrients, high concentrations can occur to form algal blooms and scums which discolour the water.

Blooms of blue-green algae often produce toxins (cyanotoxins), which can include neuro-(nerve) toxins, hepato-(liver) toxins, skin irritants, and inflammatory agents. These toxins are largely retained within the blue-green algae cells during their development and growth and are released when the cells die. Algal blooms can occur throughout the year, but they are most common from May through to October. The duration of blooms may last for a few days to months until conditions change, and the blue-green algae die and decompose. The behaviour of blooms is unpredictable and their location within a water body can change quickly throughout the day. They can float to the surface or move horizontally due to wind and currents. Therefore, a bloom that may be visible at one location one day may not be visible the next. Decaying blooms can also appear as scum or foam along the shoreline as a result of being carried by wind.

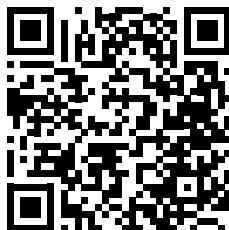
Due to the natural occurrence and large number of water bodies where blue-green algal blooms may occur, the Department of Agriculture, Environment and Rural Affairs (DAERA) cannot monitor and sample every bloom in Northern Ireland. A tiered approach is used for bloom investigations from active monitoring of identified and candidate bathing waters, to remote image verification of locations with a lower recreational use value.

DAERA undertakes a programme of water quality monitoring for identified (under the Bathing Water Regulations) and candidate bathing waters between 1st June and 15th September each year, and responds to reports of pollution incidents, taking samples where necessary to investigate potential sources of pollution.

Due to the diverse and increasing human requirements and pressures placed on water resources, DAERA is encouraging everyone to get involved in citizen science to help monitor blooms of blue-green algae, thereby highlighting any potential public health risks. The Bloomin' Algae App enables members of the public to submit a photo of the bloom taken on their phone and state what activity takes place at the location, so that the potential risks to people and

animals can be gauged. The submitted records are verified by trained environmental experts, enabling rapid feedback to the app user to verify blue-green algae presence, or something potentially less harmful, and appropriate next steps they should take. Records will be used to alert local authorities to provide early warnings of risks to other water users. The app is free to download directly from Google Play or App Store.

For further information and guidance on the Bloomin' Algae App scan below:



Members of the public can also report a suspected bloom through e-mail:

emergency-pollution@daera-ni.gov.uk

with a photo, if possible, and details on the location of the potential bloom.

2. Roles and Responsibilities (with respect to blue-green algae)

The General Public

Members of the public are encouraged to take personal responsibility for themselves, their children and pets, and heed any signage at water bodies regarding risks of blue-green algae or specific signs with 'advice against bathing'. However, even if there is no signage at a location, should the appearance of a water body concern you, **when in doubt, stay out**, and do not let pets swim in, play in or drink water that looks discoloured or has scum on the surface.

Members of the public should report any suspected blue-green algal bloom as above via the Bloomin' Algae App or via the emergency pollution email:

emergency-pollution@daera-ni.gov.uk

DAERA Marine and Fisheries Division

DAERA Marine and Fisheries Division (MFD) monitors identified and candidate bathing waters for blue-green algae blooms, including toxins, to protect bathers' health under The Bathing Waters Regulations (Northern Ireland) 2008. MFD will inform bathing water operators of incidents of blue-green algae at identified or candidate sites. MFD also manages inland fisheries and the Public Angling Estate under the Fisheries Act (Northern Ireland) 1966.

Northern Ireland Environment Agency

The Northern Ireland Environment Agency (NIEA) is an agency within DAERA. NIEA is responsible for identifying and confirming the presence of blue-green algae blooms reported through the Bloomin' Algae App. NIEA is responsible for informing operators, Local Council Environmental Health Departments and Northern Ireland Water of any confirmed blooms where possible. NIEA is also the competent monitoring authority for Lough Neagh and catchment rivers under The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017 and undertakes a programme of water quality monitoring to report upon the ecological health of our water environment. Under The Water (Northern Ireland) Order 1999, the Department and NIEA have a responsibility to promote the conservation and cleanliness of waterways and must have regard to the needs of industry and agriculture; the protection of fisheries; the protection of public health; the preservation of amenity and the conservation of flora and fauna; and the conservation of geological and physiographical features of special interest including archaeological, historical, architectural or traditional interest.

DAERA Veterinary Science and Animal Health

DAERA Veterinary Science and Animal Health Group is responsible for advising and acting upon animal health issues.

Food Standards Agency

The Food Standards Agency (FSA) is a non-ministerial government department (NMGD) working across England, Wales and Northern Ireland to protect public health and consumers wider interest in food. FSA will provide advice to food businesses and consumers on the safety of consuming fishery products harvested from water bodies affected by blue-green algae blooms.

Public Health Agency NI

The Public Health Agency (PHA) provides specialist advice and guidance relating to the health of the public in Northern Ireland working in partnership with other agencies. The Public Health Agency has four core functions:

- health protection;
- health and social wellbeing improvement;
- public health support to commissioning and policy development; and
- Health and Social Care (HSC) research and development.

The health protection services include surveillance, intelligence gathering, risk assessment, scientific and technical advice and access to specialist health protection and public health microbiology services for the HSC, emergency responders, local government and the public during emergencies, at all levels.

Local Council Environmental Health

Local Council Environmental Health have responsibility for providing advice to waterbody owners and the public regarding public health issues in council area. PHA provides advice to local councils on health and safety for recreational water and waterside users.

Northern Ireland Water

Northern Ireland Water Ltd. (NI Water) is a government-owned company with the Department for Infrastructure (Dfi) as its sole shareholder. The Dfi is responsible under The Water and

Sewerage Services (Northern Ireland) Order 2006 to supply and distribute water, and NI Water performs the Department's water supply functions. NI Water is therefore responsible for providing all public water and sewerage services in Northern Ireland.

The public drinking water quality in Northern Ireland is assessed against standards set in The Water Supply (Water Quality) Regulations (Northern Ireland) 2017. The regulations set out the requirements to be met by NI Water when supplying water for domestic or food production purposes.

Drinking Water Inspectorate

The Drinking Water Inspectorate (DWI), within NIEA, regulates the provision of drinking water by NI Water to ensure the protection of public health. DWI independently assesses the quality of the public drinking water supply to provide reassurance that the water is safe to drink.

Water Business Owners/Controllers

Water businesses are responsible for warning and advising users of any potential dangers of their waterways. This requires liaising with local councils and PHA on public health related issues.

3. Categories of Water

There are five main categories of surface waters which require blue-green algae responses. Each requires a different approach and may have different authorities taking on the primary statutory public health responsibilities.

3.1 Sites with little or no recreational activity

Use of the Bloomin' Algae App is strongly recommended for bloom identification and verification. Consideration should be given to erecting permanent signs at 'frequently offending sites', warning of the possibility of harmful blooms and with QR code to the Bloomin' Algae App. Local Councils, NI Water, Inland Fisheries, and site operators may have responsibilities to erect warning signs. Sampling or formal monitoring is not proposed as reporting via the App is rapid, uses less resources, and provides the basic confirmation detail required, unless public authorities or site operators wish to undertake further monitoring.

3.2 Sites with high recreational activity which are not candidate or identified bathing waters

Use of the Bloomin' Algae App is also strongly encouraged for initial identification of potential bloom occurrences with subsequent laboratory verification. This provides an initial first step in confirming whether sites need to close for recreational activities. Under 'business as usual' NIEA can undertake Tier 1 monitoring of bloom samples to confirm presence of blue-green algae (see Section 4). Determining presence of blue-green algae does not however show the levels of toxins in the water, which are the best way of understanding risk to health (Tier 2 analysis). However, as these sites are not identified or candidate bathing waters, any Tier 2/toxin analysis required would have to be organised by the local council/site operator. The operator should consider erecting permanent signs, warning of the possibility of harmful blooms and with QR code to the Bloomin' Algae App. Organisers of events should undertake appropriate risk assessments of water quality prior to commencement.

FSA published food safety advice on the risks of consuming fish from blue green affected waterways based on samples of fish from Lough Neagh in 2023. FSA is planning further surveillance sampling of Lough Neagh during 2024/25 to continue to inform their food safety advice.

3.3 Candidate or identified bathing waters

Under [The Quality of Bathing Water Regulations \(Northern Ireland\) 2008](#) identified or candidate bathing waters are monitored by DAERA through its Bathing Waters Programme during the bathing season. NIEA will be notified of possible bloom observations following routine water quality monitoring of sites by the DAERA bathing waters monitoring team. For inland sites with a risk of blue-green algae proliferation, consideration should be given by the bathing water operator (usually the local council) to erecting permanent signs, warning of the possibility of harmful blooms and with QR code to the Bloomin' Algae App to encourage reporting by the public or the bathing water operator (this would be in addition to any site inspections/visual observations undertaken by the DAERA bathing waters monitoring team).

A Tier 1 screen to verify the Bloomin' Algae App submission and to confirm the presence of blue-green algae will be undertaken by NIEA.

Tier 2 (toxin-based) monitoring is necessary to allow adequate management measures to be put in place and for provision of accurate advice to bathing water operators, which is a statutory obligation for DAERA under the Bathing Water Regulations. The bathing water operator has a statutory obligation to post any 'advice against bathing' where deemed necessary following monitoring results (see protocol detail in Section 5).

3.4 Commercial and recreational sites from which primary products* (food and feed) are placed on the market

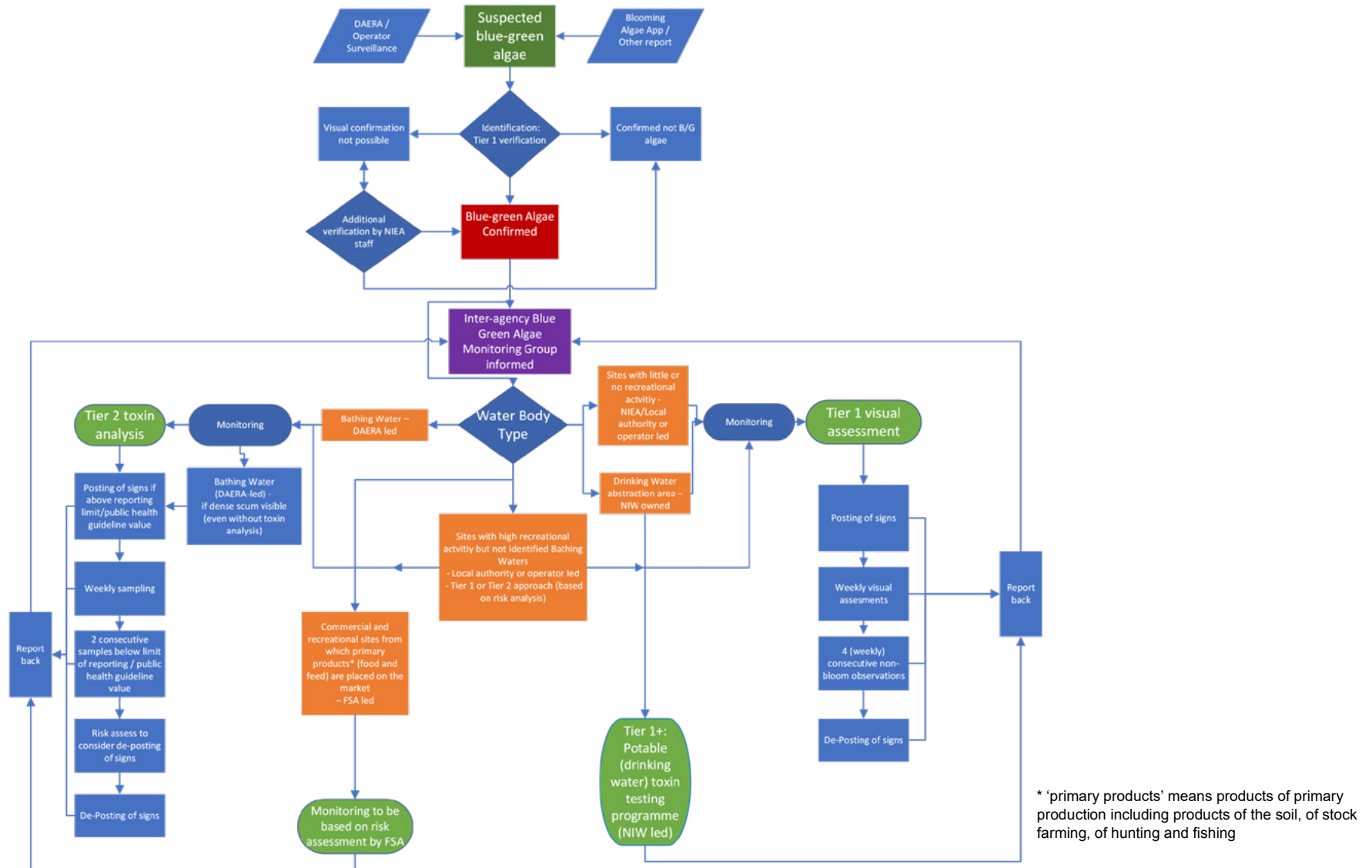
*"Primary products" means products of primary production including products of the soil, of stock farming, of hunting and fishing, as defined in Article 2(1)(b) of Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs (legislation.gov.uk). In such areas the Food Standards Agency will lead the approach to monitoring based on a risk assessment.

3.5 Drinking water abstraction waters

Waters used for the abstraction of drinking water are protected areas under The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017. The rivers, lakes and groundwater that currently (or will in the future) be used to supply more than 10m³/day of water for human consumption, or serve more than 50 people, are identified as Drinking Water Protected Areas (DWPAs). Therefore, for the public drinking water supplies, the objective is to ensure the necessary protection of the raw water supply by avoiding deterioration in water quality; also, to reduce the level of treatment required in producing drinking water that meets the requirements of the Drinking Water Regulations. Where a DWPA is at risk, a safeguard

zone (SgZ) should be established around a drinking water abstraction site. This zone identifies an area where land use practices are most likely to be causing, or have caused, water quality to deteriorate. NI Water must therefore be informed as soon as possible of any reports of possible bloom observations and or confirmation of the presence of blue-green algae. NI Water will ensure sampling and analysis of the treated drinking water in line with the Drinking Water Regulations.

4. DAERA Response Protocol



Tiered approach to Surveillance and Monitoring

Tier 1 verification of records and visual assessment

NIEA will complete verification of submitted records, either from reports via surveillance staff, or via the emergency pollution hotline, or via the Bloomin' Algae App. When required, qualitative assessments of potentially toxic blue-green algae from samples based on taxonomy will be used to confirm a blooms presence. It is recommended that regular visual inspections of the water are made for evidence of bloom and scum formation.

Tier 2 toxin monitoring

Where sites are being used for water-based recreational or commercial activities that involve submersion in water or exposure to water spray, it is recommended that cyanotoxin concentrations are determined and [World Health Organization \(WHO\) Guidelines \(2021\)](#) applied. This is particularly the case when a bloom is decaying to confirm that it is safe to re-enter the water. For sites that are not identified or candidate bathing waters, it is the responsibility of the site operator/owner to undertake such testing. Details of how public health guidelines are applied in bathing waters is provided in the next section.

5. DAERA Bathing Water Monitoring Protocol

5.1 Water sample analysis

Cyanotoxin-based monitoring programmes provide the most appropriate information in terms of protecting public health. This is because the toxins pose actual risk, rather than the potential risk posed by the presence of blue-green algae cells. The analytical methods for cyanotoxins such as microcystins that are currently being used in commercial and research laboratories include enzyme-linked immunosorbent assay (ELISA) and protein phosphatase inhibition assay (PPIA). Both ELISA and PPIA field test kits are useful as they provide an initial estimate of the level of dissolved microcystins in a sample (lysis is needed to measure intracellular microcystins) within certain concentration ranges, or above/below a specified concentration. In the first instance, the ELISA method will be trialled as an acknowledged rapid and sensitive method. While such methods are not specific enough to distinguish between individual microcystin variants, in practice they may be sufficient for current risk assessments where all microcystins are assumed to be as toxic as a commonly occurring structural variant, microcystin-LR.

ELISA field test kits could be used for initial analysis of water samples under the Tier 2 approach in the above protocol diagram. However, these need to be corroborated with microscopic techniques (to confirm species) and specific and quantitative cyanotoxin analysis by a suitably accredited laboratory (usually using liquid chromatography-tandem mass spectrometry).

If ELISA is unavailable, blue-green algae biovolume or cell counts measured by a referenced method should be used, accompanied with periodic corroboration via cyanotoxin analysis. This will be particularly important as we develop an understanding of actual toxicity during bloom formation and decay in the local situation.

A tiered approach is therefore recommended:

1. Reporting by DAERA bathing waters staff of any visual signs of blue-green algae for Tier 1 verification (NIEA).
2. Visual assessment to identify if blue-green algae are forming dense scums or mats at the bathing water.
3. Rapid test for microcystins (microcystins strip test and/or anatoxin strip test).
4. Take water samples for ELISA analysis in the laboratory.
5. Where microcystins are present from rapid tests and water samples, take periodic

reference samples for full cyanotoxin analysis at a suitable accredited laboratory and complete microscopic quantitative analysis (cell counts or biovolumes).

5.2 Use of public health guideline values

Based on [World Health Organization \(WHO\) Guidelines \(2021\)](#), freshwater recreational water bodies where bathing occurs should not contain:

- >24 µg/L total microcystins; or biovolume equivalent of >4 mm³ /L for the combined total of all blue-green algae where a known toxin producer is dominant in the total biovolume; or
- blue-green algae scums are consistently present.

From a review of other guidelines in use, more conservative levels of microcystin concentrations are advised:

- Canada¹: 10 µg/L
- Australia²: 10 µg/L
- USA³: 8 µg/L

Where microcystin concentrations exceed such thresholds, immediate advice against bathing should be issued. Note that all the above guideline values are based on the toxicity of the microcystin-LR (MC-LR) toxin. There are a large number of other microcystin toxins. However, there is not yet research available to support the establishment of guideline values for these.

Given the paucity of data on the toxicity of the blue-green algae blooms in 2023, a guideline of 10 µg/L guideline value for microcystin-LR (MC-LR) concentration is being adopted for NI waters in 2024.

5.3 Monitoring frequency and Alert Level Framework

The WHO Guidelines recommend that for sites where there is an established risk of blue-green algae proliferation such sites should have **baseline monitoring** established at a frequency of **fortnightly** over the bloom season.

It is recommended that based on reports on blue-green algae blooms in Lough Neagh in 2023, such fortnightly surveillance monitoring at Rea's Wood commences in April and continues through to early November. This is known as the "Green level - surveillance mode".

1 [Blue-green algae and their Toxins - For public consultation \(canada.ca\)](#)

2 [Guidelines for Managing Risks in Recreational Water \(nhmrc.gov.au\)](#)

3 <https://www.epa.gov/sites/default/files/2019-05/documents/hh-rec-criteria-habs-factsheet-2019.pdf>

Results from the surveillance fortnightly monitoring at Rea's Wood will be used to determine next steps, following the WHO Guideline Values and an Alert Level Framework summarised in the text and table below:

1. Where rapid test strips and ELISA analysis indicates presence of microcystins and/or anatoxins, and/or microscopy shows dominance of blue-green algae species with up to 1-4mm³/L biovolume, the site should be considered as at “Amber level - alert mode”, and the bathing water operator should be informed.
2. **Once at “Amber level - alert mode” the site should be moved to weekly monitoring** and the public advised to be aware of the presence of blue-green algae. The site will automatically move to weekly monitoring during the bathing season (1 June - 15 September).
3. If cyanotoxin concentrations or biovolumes exceed the guideline values then the site is moved to “Red level - action mode” - bathing water operators should be informed to advise against bathing, even if a dense scum is not yet visible.
4. If there is a **visible, thick scum covering most of the water surface**, the site should be immediately considered as at “Red level - action mode” and advice against all water sports should be issued by the relevant landowner/manager/operator.

	Green level - surveillance mode	Amber level - alert mode	Red level - action mode
Monitoring requirements:	Fortnightly visual assessment*, rapid test kit trialling, water sample ELISA analysis and/or biovolume analysis to establish a baseline.	Weekly visual assessment, rapid test kit trialling, water sample ELISA analysis and/or biovolume analysis. Cyanotoxin concentration corroboration at accredited laboratory.	Weekly visual assessment, rapid test kit trialling, water sample ELISA analysis and/or biovolume analysis. Cyanotoxin concentration corroboration at accredited laboratory.
Results:	No presence of microcystins. Biovolume of all cyanobacteria below 1 mm ³ /L.	Some visual evidence of patchy scum/mats/potential material. AND Presence of microcystins. Microcystin concentration below 10 µg/L. AND/OR Biovolume of all cyanobacteria between 1 and 4 mm ³ /L.	A visible, thick scum covering most of the water surface. AND/OR Microcystin concentration at or above 10 µg/L. AND/OR Biovolume of all cyanobacteria exceeds 4 mm ³ /L.
Advice to bathing water operators:	Bathing water operators informed at surveillance mode.	Bathing water operator and public informed to watch out for scums and when in doubt, stay out (encourage vigilance).	Bathing water operator to issue ' advice against bathing ' and public warned of risk to public health.

*Note that in addition to the blue-green algae surveillance programme, all identified and candidate bathing waters will have weekly visual assessments completed during the bathing season (1st June – 15th September) under the bathing waters programme.

If there is any record of blue-green algae or risk of this at a bathing water, that site will then move to the blue-green algae surveillance programme protocol. Experience in the 2023 season has shown that account should be taken of prevailing wind conditions, which can transport blooms and scums into different locations and either concentrate them further or disperse them.

For the north coast bathing waters that may become a recipient of blue-green algae originating in Lough Neagh, the inter-agency monitoring group records will be used to alert DAERA bathing waters team that blooms are in Lough Neagh or the Lower Bann and bathing water operators will be encouraged to submit any possible records of blue-green algae on the north coast sites, in addition to the weekly routine monitoring during the bathing season. The same alert level framework will be applied to any site that has blue-green algae confirmed.

5.4 Decision to remove restrictions

The decision as to when to remove restrictions such as 'advice against bathing' should take into account a variety of factors including the dominant species present, their toxicity and the presence of scum. It will be dependent on obtaining a favourable environmental risk assessment of the whole water body including:

- 2 samples below the limit of reporting (biovolume, specific and quantitative cyanotoxin analysis, cell count), ideally a week apart, after the last appearance of dense visible scum on the water/blue-green algal mats
- No weather and environmental conditions which could cause recurrence of the bloom.

For further information regarding Tier 1 Monitoring:

Northern Ireland Environment Agency
17 Antrim Road
Tonagh, Lisburn
County Antrim
BT28 3AL

Email: nieainfo@daera-ni.gov.uk

Telephone: 0300 200 7856

For further information regarding Tier 2 Bathing Waters Monitoring:

Marine & Fisheries Division
DAERA
17 Antrim Road
Tonagh, Lisburn
County Antrim
BT28 3AL

Email: bathingwaters@daera-ni.gov.uk

www.daera-ni.gov.uk