

# Planning for third cycle River Basin Management Plan 2021 - 2027

December 2019

## Consultation on Significant Water management Issues

### Appendix 9: Supporting documents

- Assessment of deteriorating river water bodies based on interim WFD Classification 2018.
- Comparison of Soluble Reactive Phosphorus (SRP) status in 2018 classification with SRP status in 2015 classification.
- Risk Assessment of NI surveillance lakes not meeting their objectives.

# Assessment of deteriorating river water bodies based on interim classification 2018

Planning for third cycle River Basin Management Plan 2021 -  
2027

Consultation on Significant Water Management Issues

Supporting Documents

December 2019

# Assessment of Deteriorating River Water bodies Based on Interim WFD Classification 2018

## 1.0 Introduction

The 2015 Water Framework Directive (WFD) river basin management plans set out the baseline status for water bodies, their objectives and a summary programme of measures to achieve these objectives and prevent deterioration in status. Compliance with the WFD requirement of no deterioration is formally assessed every six years i.e. by comparing 2021 status classifications with the 2015 baseline.

An interim classification for surface water bodies was published in 2018 to review progress towards meeting the objectives set for 2021 and to prioritise actions. This interim 2018 WFD status indicates a significant risk that the 2021 targets are unlikely to be met. In 2015, 37.4% of water bodies (rivers, lakes, transitional and coastal water bodies, and groundwater bodies) were at good status. The 2018 classification indicates that status has reduced slightly to 36.6%. For rivers alone the deterioration is more significant from 32.7% to 31.3%. Overall 10 % of river water bodies did improve to achieve good status through targeted actions. However, this was negated by deterioration elsewhere, mainly in river phosphorus, with 7.8% of river water bodies declining from 'good'.

## 2.0 Deterioration from WFD 2015 to WFD2018

This assessment focuses on the fifty-two river water bodies where overall status deteriorated between 2015 and 2018. The deteriorations were all by only one class. Of greatest concern are the thirty-two river water bodies which deteriorated from Good to Moderate status. Of these twelve were due to a decline in SRP status alone and eight due to a decline in SRP and another element(s).

## 3.0 Assessing true deterioration

In 2006, UKTAG produced a guidance paper<sup>1</sup> entitled "Prevent Deterioration of Status". It recognised that there needs to be a way of managing the risk of deterioration and reporting status changes as *"the intent is to report deterioration of status class, where it is certain there is an actual failure in meeting the status class requirements"*.

The guidance sets out reasons why a deterioration in status may not indicate a true decline in water quality. Any change in classification as a result of changes to tools and standards, new monitoring data or revision to water bodies is not considered to be related to a change in water quality. In addition a very small change may be enough to cause a face value class change which may not be statistically significant. The guidance therefore states that;

*"Deterioration of status for an individual water body will not be reported on the basis of a face value change in class as to do so would be clearly misleading"* and *"Deterioration of status for an individual water body will be reported where there is at*

---

<sup>1</sup>[https://www.wfduk.org/sites/default/files/Media/Setting%20objectives%20in%20the%20water%20environment/Prevent%20deterioration%20of%20status\\_Draft\\_010506.pdf](https://www.wfduk.org/sites/default/files/Media/Setting%20objectives%20in%20the%20water%20environment/Prevent%20deterioration%20of%20status_Draft_010506.pdf)

*least 95 percent confidence that the water body has deteriorated from one status class to a lower one.”*

Conversely a quality element may undergo a more significant larger change in score that has no impact on face value class. However our focus is on between class deterioration and within class deterioration will not be considered further at this stage.

Natural Resource Wales (NRW) produced an Operational Guidance Note<sup>2</sup> in May 2017 on *WFD Deterioration in water body status* which includes a section on using statistical confidence to identify where a deterioration has occurred using the following confidence ranges;

Uncertain: >50% and <75% confidence that status has deteriorated

Quite certain: >75% and < 95% confidence that status has deteriorated

Very certain: >95% and <99% confidence that status has deteriorated

Highly certain; >99% confidence that status has deteriorated

The approach taken by Wales is that where any face-value deterioration is flagged as ‘Uncertain’ then no further action is required. Where any face-value deterioration is flagged as ‘Quite certain’, ‘Very certain’ or ‘Highly certain’ they identify reasons for that deterioration and the measures necessary to restore the previous status.

The NRW work uses a statistical methodology to test for between class deterioration in status, which was developed by the Water Research Council for the Environment Agency in 2013<sup>3</sup>. This method uses the confidence of a site truly being in each of the five status classes as a basis for assessing if the face value class has improved, deteriorated or remained unchanged. It can therefore only be applied where confidence in class is available.

The test is achieved by computing a series of conditional probabilities; for example, if the site had a 10% chance of being at High status in time period A and a 20% chance of being at Good status in time period B, then there is a  $0.1 \times 0.2 = 0.02 = 2\%$  chance that it has deteriorated from High to Good status. Repeating this process for all 5 x 5 possible changes in status class builds up a complete probability matrix, and these results can then be aggregated to compute the overall confidence of deterioration.

For example, one river water body had deteriorated from Good status in 2015 to Moderate Status in 2018 based on Macrophytes. The macrophyte EQR and confidence in class results for the 2 survey years are provided in the table 1.

---

<sup>2</sup> [www.naturalresourceswales.gov.uk](http://www.naturalresourceswales.gov.uk) OGN 73 WFD – Deterioration in water body status

<sup>3</sup> Environment Agency Assessing Deterioration in WFD Status Final Report July 2013

Year	EQR	LEAFPACS Class	Bad	Poor	Moderate	Good	High
06/06/2013	0.745	Good	0.00	0.00	1.40	83.37	15.23
15/06/2015	0.591	Moderate	0.00	0.63	54.22	45.10	0.05

**Table 1: Example of a river water body which has declined from Good to Moderate due to Macrophyte classification**

Inserting this data into a probability matrix produces the following results:

		WFD2018					
			HIGH	GOOD	MODERATE	POOR	BAD
			0.05	45.1	54.22	0.63	0
WFD2015	HIGH	15.23	0	6.9	8.3	0.1	0
	GOOD	83.37	0	37.6	45.2	0.5	0
	MODERATE	1.4	0	0.6	0.8	0	0
	POOR	0	0	0	0	0	0
	BAD	0	0	0	0	0	0
		61	% Confidence that status has deteriorated				
		38.4	% Confidence that status has not changed				
		0.7	% Confidence that status has improved				

In this case there is <75% confidence that deterioration has occurred i.e. Uncertain.

Confidence in class is currently only available for Diatoms, Invertebrates, Macrophytes and SRP.

#### **4.0 Criteria setting to prioritise deteriorating river water bodies for further investigation**

In order to prioritise the 52 deteriorating river water bodies for investigation a number of criteria were devised. The number of river water bodies each criteria applies to are provided in brackets.

1. Where the deterioration is due to new monitoring this will not be considered a true deterioration and further investigation will not be recommended (10 river water bodies).
2. Where deterioration in cross border river water bodies is due to data provided by the Environment Protection Agency in the Republic of Ireland then NIEA will not investigate further (5).
3. Where deterioration is due to a change in the classification procedure further investigation will not be recommended (2).
4. Where confidence in class is available, the certainty that a true deterioration in status has occurred will be considered. If confidence in deterioration is >75% further investigation will be recommended as high priority (10).
5. Where confidence in class is available but confidence in deterioration is <75% further investigation will be recommended as low priority (16).
6. Where confidence in class is not available an investigation into the cause of deterioration will be recommended as high priority (8).
7. Where data collected during cycle two has been sampled but status is pending an investigation will be recommended as low priority (1).

# Comparison of Soluble Reactive Phosphorus (SRP) status 2018 mid cycle classification with 2015 SRP classification

Planning for third cycle River Basin Management Plan 2021 - 2027

Consultation on Significant Water Management Issues

Supporting Documents

December 2019

## Comparison of Soluble Reactive Phosphorus (SRP) status in 2015 and 2018 classification

Interim figures were published in September 2018 (the half-way point for the second cycle River Basin Management Plans) to show the overall water quality status for NI waterbodies.

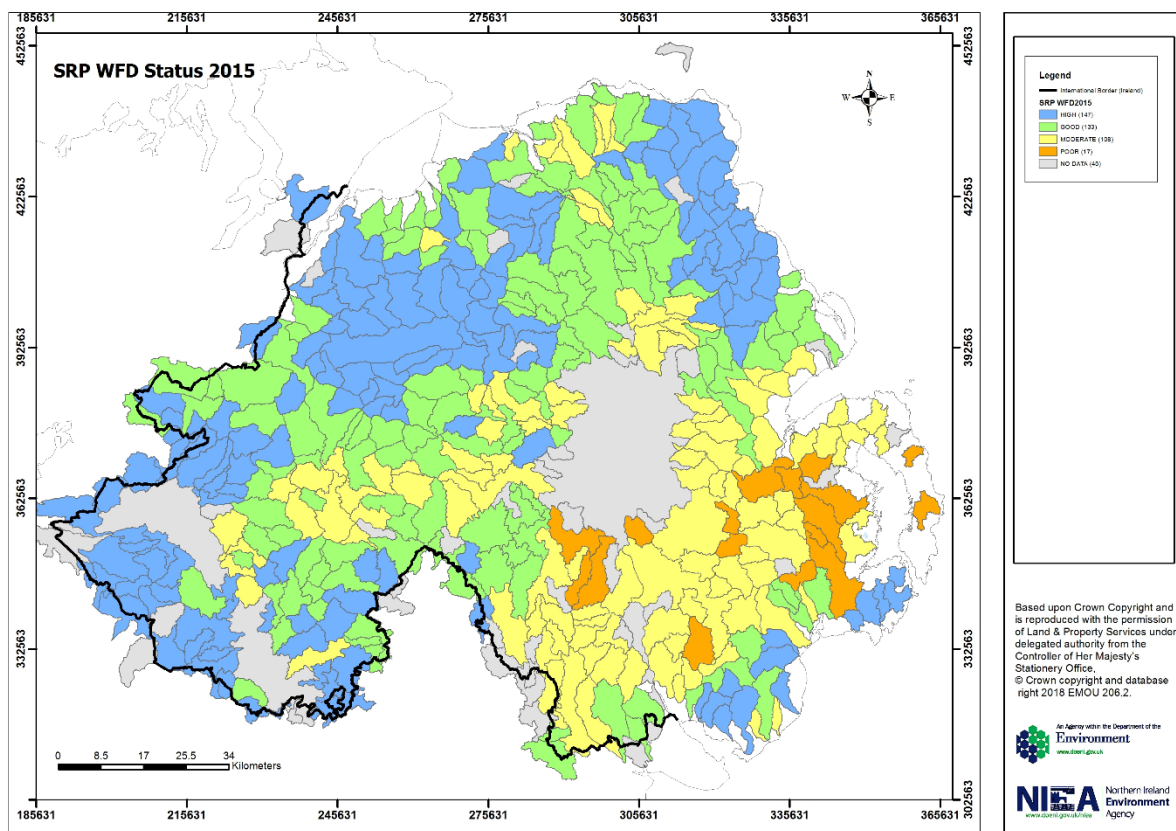
In 2015, 37.4% of water bodies (rivers, lakes, transitional and coastal water bodies, and groundwater bodies) were at good status. The 2018 classification indicates that status has reduced slightly to 36.6%. For rivers alone the deterioration is more significant from 32.7% to 31.3%. Overall 10 % of river water bodies did improve to achieve good status through targeted actions. However, this was negated by deterioration elsewhere, mainly in river phosphorus, with 7.8% of river water bodies declining from 'good'.

The percentage of individual assessments at good status or better has improved marginally from 81.3% for 2015 to 82.0% for 2018.

Diffuse Agricultural Pollution remains the most significant pressure affecting our water bodies leading to failures of good status across Northern Ireland. A comparison was therefore carried out looking at SRP status in 2015 and in 2018, as an indicator of changes in river nutrient levels.

The status of SRP in river water bodies in 2015 is illustrated in Map 1.

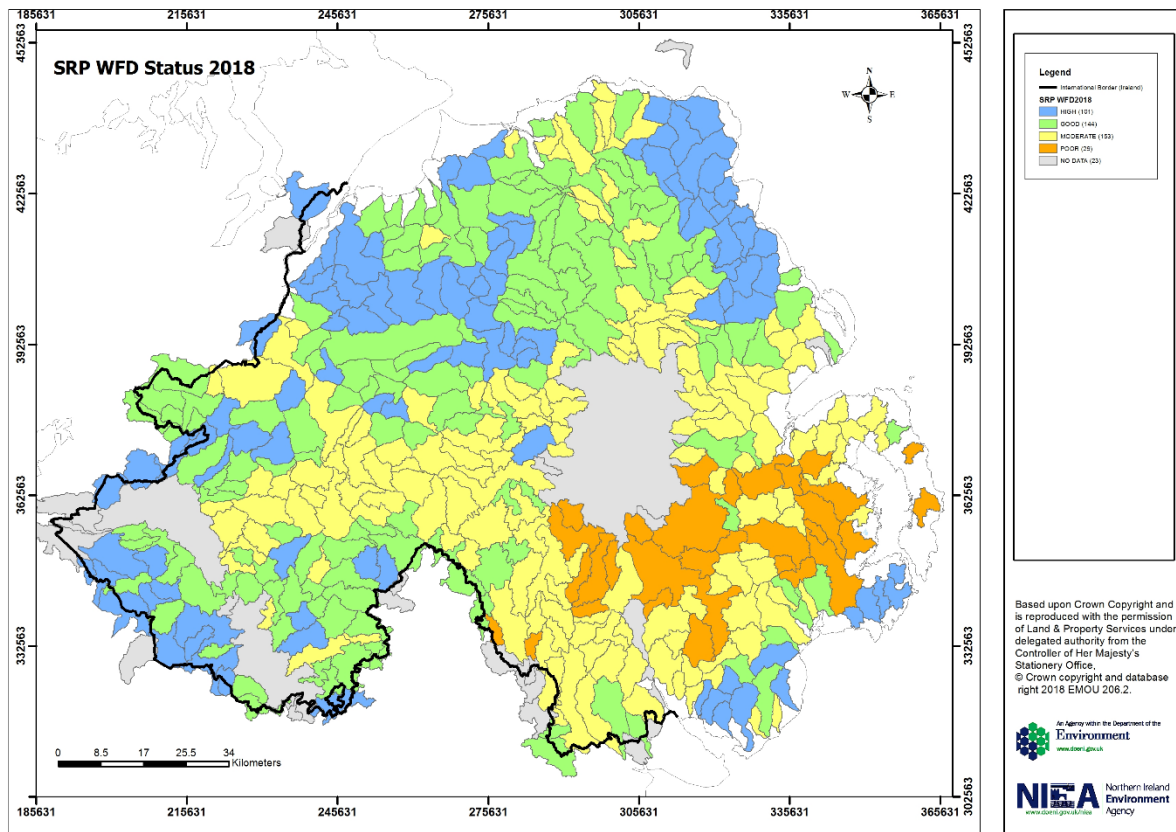
### Map 1 showing SRP status in NI river water bodies in 2015





The status of SRP in river water bodies in 2018 is illustrated in Map 2.

**Map 2 showing SRP status in NI river water bodies in 2018**



The breakdown comparing SRP status in NI 450 river water bodies in 2018 with SRP status in 2015 is shown in Table 1.

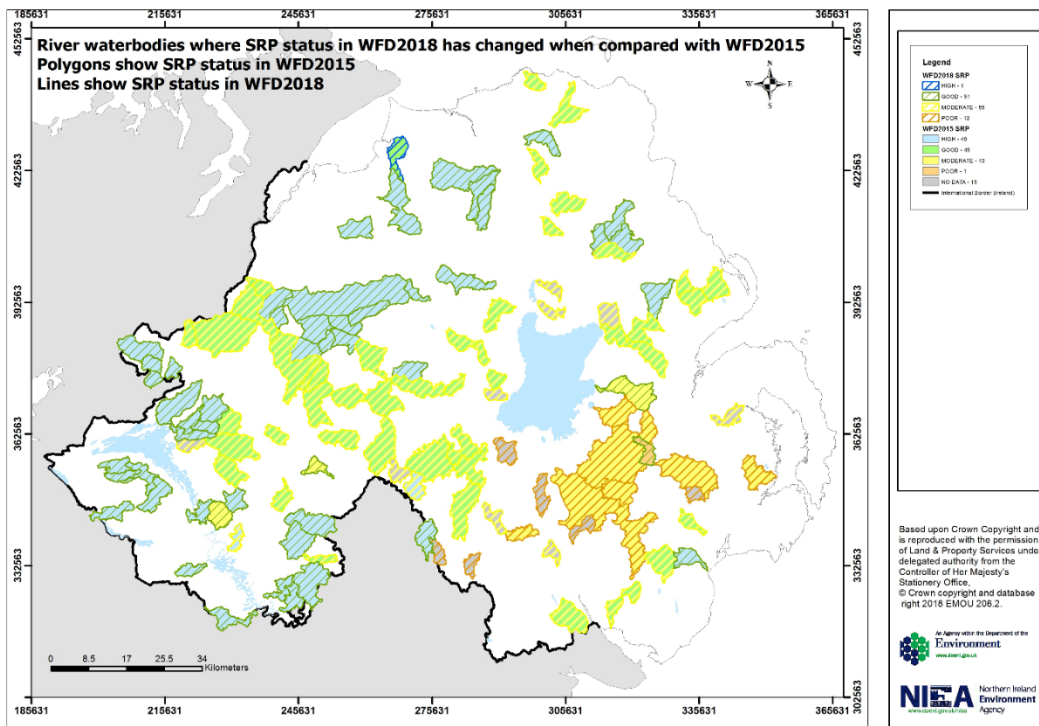
**Table 1 SRP status in 2018 compared to 2015**

	<b>No. of river water bodies (Total 450)</b>
<b>Deteriorated from 2015 to 2018</b>	
Deteriorated from High to Good	47
Deteriorated from Good to Moderate	44
Deteriorated from High to Moderate	2
Deteriorated from Moderate to Poor	7
	<b>100 (22%)</b>
<b>No data for SRP in 2015</b>	
New monitoring High 2018	4
New monitoring Good 2018	5
New monitoring Moderate 2018	9
New monitoring Poor 2018	6
	<b>24 (5%)</b>

	No. of river water bodies (Total 450)
<b>SRP Unchanged from 2015 to 2018</b>	
Remain High Status	96
Remain Good Status	88
Remain Moderate Status	98
Remain Poor Status	16
	<b>298 (66%)</b>
<b>SRP improved from 2015</b>	
Improved from Moderate to Good	3
Improved from Poor to Good	1
Improved from Good to High	1
	<b>5 (1%)</b>
<b>No river SRP data</b>	
Cross border river classified by Environmental Protection Agency	13
Artificial Water Body	1
No chemistry site	1
Classified by donor waterbody	3
Reported as No Data	1
Classified by lake	4
	<b>23 (5%)</b>

Where changes in SRP status have occurred between 2015 and 2018 these are illustrated in Map 3.

**Map 3 showing River water bodies where SRP status in 2018 has changed when compared to SRP status in 2015.**



A table comparing the number of river waterbodies at each of the five WFD classes for WFD2015 and WFD2018 is shown in table 2.

**Table 2 SRP river waterbody status in WFD2015 and WFD2018.**

<b>WFD Class</b>	<b>WFD2015</b>	<b>WFD2018</b>
HIGH	147	101
GOOD	133	144
MODERATE	108	153
POOR	17	29
BAD	0	0
No Data	45	23

The number of river waterbodies at High or Good in WFD2015 and WFD2018 along with the percentage is shown in table 3.

**Table 3 Number and Percentage of river waterbodies with SRP at High or Good in WFD2015 and WFD2018.**

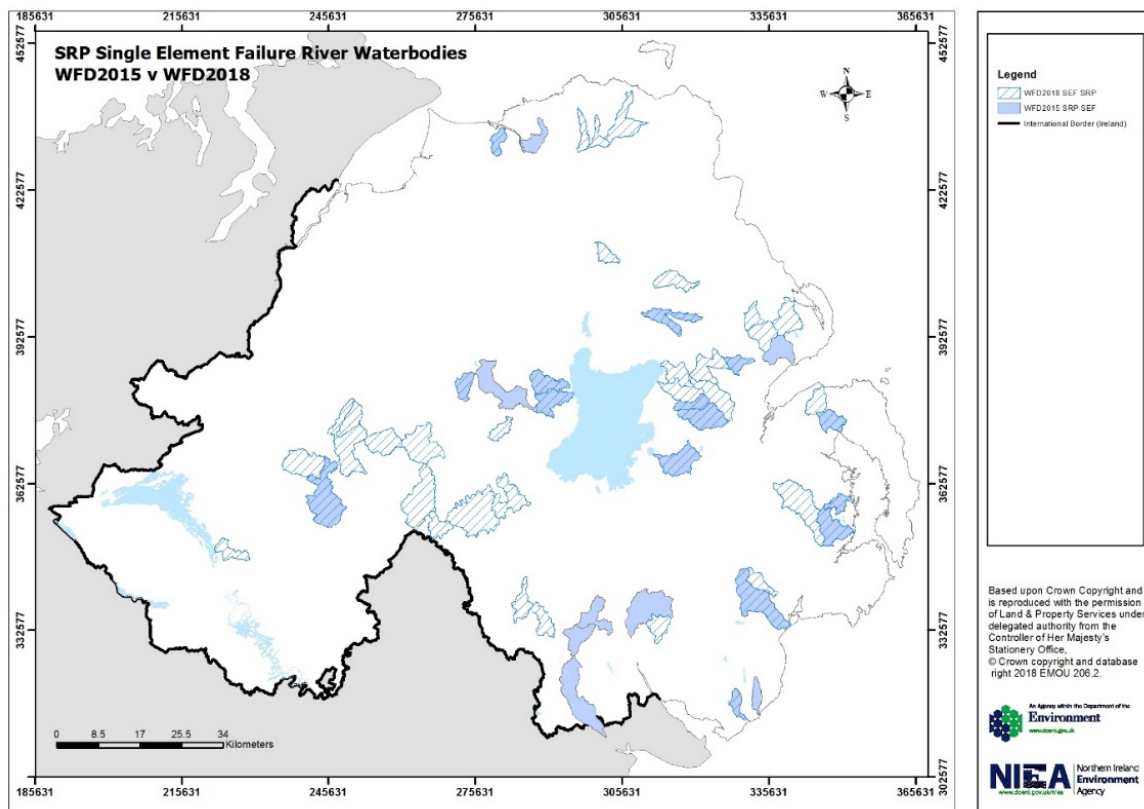
<b>HIGH or GOOD SRP status</b>	<b>WFD2015</b>	<b>WFD2018</b>
Number	280	245
Percentage	62.2	54.4

### **SRP Single Element Failures (SEF)**

In 2015 there were 23 water bodies failing on SRP alone. In 2018 this number had increased to 43 SEF for SRP.

The SEF SRP failures in 2015 and 2018 are illustrated in Map 4.

## Map 4 SEF SRP failures in 2015 and 2018



Of the 43 river waterbodies that are SEF for SRP in WFD2018;

15 were also SEF for SRP in 2015

5 had been SEF in WFD2015 but for an element other than SRP

23 are new SEF: 11 had been Multiple Element Failures (MFE) in WFD2015, 12 had been Good status in WFD2015.

### Summary

SRP status remained unchanged in 66% of NI river water bodies in 2018 compared to 2015.

New SRP data was collected in the 2<sup>nd</sup> River Basin Cycle in 5% of river water bodies

SRP status improved in 1% of river water bodies

SRP deteriorated in 22% of river water bodies

5% of river water bodies have no SRP data

# Assessing the Risk of NI Surveillance Lakes not meeting their objectives

Planning for third cycle River Basin Management Plan 2021 -  
2027

Consultation on Significant Water Management Issues

Supporting Documents

December 2019

# **Assessing the risk of NI lake water bodies not meeting their objectives**

## **1. Background**

In December 2009, the Water Framework Directive (WFD) River Basin Management Plan (RBMP) set out the baseline status for water bodies and set objectives for status for the next three River Basin Planning Cycles (RBC) i.e. 2015, 2021 and 2027. A Programme of Measures was published as part of the RBMP, setting out actions required to meet the objectives and to improve the status of all water bodies. In December 2013, the first report on Significant Water Management Issues (SWMI) was published and included an assessment of the progress made towards achieving the objectives based on long term trends.

The second RBMP was published in December 2015 and this second SWMI report also includes an assessment of the risk of water bodies not achieving their objectives.

The aim of this paper is to look at the different approaches to risk assessment for lake water bodies taken in the SWMI 2013 report compared to the approach taken in 2014, to assess the best option for use in the SWMI 2019 report. The risk of lakes not meeting their 2021 and 2027 objectives using the preferred approach will then be assessed.

## **2. SWMI Risk Assessment 2013**

For the SWMI 2013 report, a trend assessment was used to assess Chlorophyll *a* and Total Phosphorus (TP) levels for lake water bodies over a 13 year time frame. Predicted 2015 values were compared with 2015 objectives, and the 'One Out, All Out' policy was used, whereby a lake failing to meet its objectives based on either Chlorophyll *a* or TP was classified as being 'At Risk' of not meeting its 2015 objective. Any lake 'At Risk' of deteriorating a class was seen as 'May be At Risk' of not meeting their 2015 objective. Any other lakes were classified as being 'Not at Risk' and were therefore expected to meet their 2015 objectives.

## **3. Risk Assessment 2014**

A second risk assessment was undertaken internally in 2014 which was based on expert judgement and a weight of evidence approach.

The 'One Out, All Out' approach to overall classification and the face value approach to status assessments of individual elements can mask underlying trends e.g. a lake may remain within a status class for overall classification, or for an individual element, but still be improving or deteriorating. Similarly, a lake may change status class due to fluctuations around the boundary values or a change in tool requirements, rather than indicate a real change in water quality. Therefore, Ecological Quality Ratios (EQRs) as well as status for macrophytes, phytobenthos, phytoplankton and TP were looked at year on year to determine the direction of the

underlying trend for each lake water body. The information below details what type of data was considered for each element:

### **3.1 Macrophytes**

Macrophytes are surveyed a minimum of once per River Basin Cycle. Macrophyte classification is produced using the Free Index which consists of 6 metrics which are averaged to give an overall Free Index value. This index is then converted to an EQR and compared to the set boundaries to determine class. The overall EQRs, Free Indices and Confidence of Class (CoC) from each survey year were compared for each lake.

### **3.2 Total Phosphorus (TP)**

TP is sampled monthly from the shore and the classifications use the mean of three years data with site specific boundary values. EQRs from the TP classification tool were compared year on year to determine the TP trend.

### **3.3 Phytoplankton**

Phytoplankton is classified using the PLUTO tool. It requires three years' worth of monthly chlorophyll samples and phytoplankton species data (July, August and September samples for 3 years where possible). EQRs and CoC were compared year on year for each lake.

### **3.4 Phytobenthos**

Diatoms are sampled at least once within a RBC and assessed using the DARLEQ 2 tool, with sites averaged to give an overall lake EQR. This value was compared between survey years. The tool requires 3 samples per season to have a high confidence in class and caution was applied when looking at trends where only one season's data was available.

### **3.5 Assessment of underlying trend**

Based on the above parameters (3.1 – 3.4), it was then determined if each lake was improving, deteriorating or showing no change using the following rules:

- Where the underlying data for one or more of the elements described above show an improvement, regardless if a change in class occurred or not, the trend is described as showing an 'Underlying Improvement';
- Where the underlying data for one or more of the elements described above show a deterioration, regardless if a change in class occurred or not, the lake is described as showing an 'Underlying Decline'; and
- Where the underlying data for all of the elements described above show little change or where some elements show slight improvements and others show slight deteriorations but with no change in class, it is described as showing 'No Change'.

These trend assessments were then used to provide a risk assessment for each lake as follows:

- If the overall lake status is already at its objective status and the underlying trend is 'Underlying Improvement' or 'No Change', it is assumed the lake is 'Not at Risk'.
- If the overall lake status is already at its objective status but showing 'Underlying Decline', it is assumed the lake 'May be at Risk'.
- If the overall lake status is less than the objective status and the underlying trend is 'Underlying Decline' or 'No Change', the lake is assumed to be 'At Risk'.
- If the overall lake status is less than its objective status but showing 'Underlying Improvement', it is assumed that the lake will still not achieve the set objective in the timeframe and is therefore assumed to be 'At Risk'.

#### **4. Risk assessment of NI Lake Water Bodies Not Meeting their Objectives**

Classification was published for all water bodies in 2015. Based on the status results it was determined that the Risk Assessment approach taken in 2014 provided a more accurate predictor of status. An interim classification was published in 2018 to assess progress towards meeting water body objectives. The Risk Assessment approach was repeated looking at underlying trends and 2018 status to determine the risk of each lake water body not meeting the objective set for that lake to meet in 2021.

Overall, 11 lakes were assessed as 'At Risk', 3, as 'May be at Risk' and only 7 were assessed as being 'Not at Risk' of not meeting their 2021 objectives.

An exercise was then undertaken to predict 2021 status for each lake based on the results of the risk assessment process. If a lake was 'Not At Risk' or 'May be At Risk' of not meeting its 2021 objective, then the predicted status for 2021 remained unchanged i.e. 10 lakes. The 11 lakes assessed as being At Risk were predicted to have a 2021 status of one class lower than the original 2021 objective set in 2015.

Overall only 5 lakes have a prediction of Good status identified for 2021. The remaining 16 are not expected to reach Good status in this timeframe.