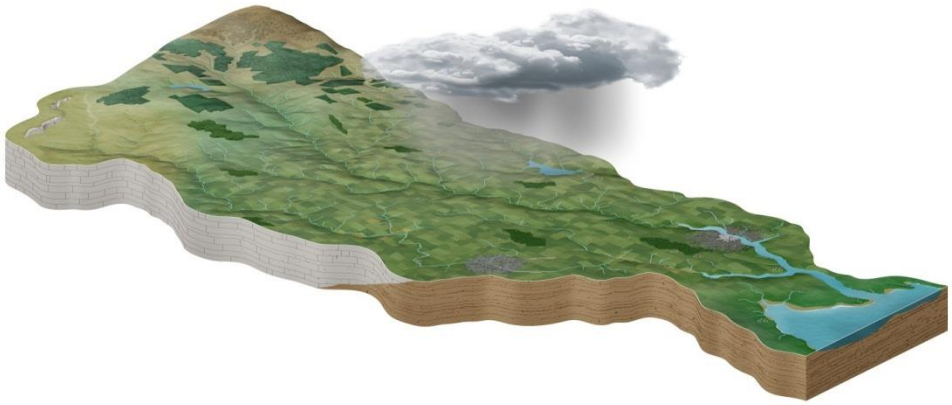
An approach to characterisation as part of implementation of the Water Framework Directive



V2 Revised

May 2015

Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

Table of Contents

List of Figures

List of Tables

1 Introduction

1.1 Purpose

The purpose of this document is to evaluate current approaches and views on WFD characterisation and to propose an approach that links characterisation, classification, monitoring activities and programmes of measures. This work was largely carried out by Jenny Deakin under a short term contract to the EPA in 2013 which benefitted greatly from discussions with, and input from, the following people:

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The approach was implemented in 2014/2015 within the EPA and this updated 2015 version reflects the lessons learned during the process. The most significant change is that consideration of the significant pressures that have already been mitigated has been moved from the Tier 1 risk characterisation assessment process into Tier 2. This is evident in Tables 1 and 2. The text has been updated accordingly.

1.2 Background and context

The Water Framework Directive (WFD) is a major piece of EU legislation designed to protect, preserve and improve the aquatic environment whilst encouraging the sustainable use of water. Characterisation of water bodies is a critical element of the work required under the Directive. It sets the scene for where the water resources are and how they function in the landscape, and provides the understanding of how they are impacted by the pressures caused by human activities. The outcome of characterisation is the identification of water bodies at risk of not meeting their WFD objectives. Article 5 of the WFD, supported by Annex II which contains some of the required detail, identifies three components in the characterisation of water bodies:

(a) an analysis of its physical characteristics, i.e., the physical information that describes the water bodies including water body boundaries, typologies, reference conditions, the geology and hydrogeology of groundwater bodies including the nature of the overlying strata, linked groundwater and surface water systems, etc.
(b) a review of the impact of human activity on the status of surface waters and groundwater, and
(c) an economic analysis of water use.

Programmes of measures are implemented in those water bodies identified as being at risk, and monitoring programmes are designed to assess whether the measures are effective. The characterisation process is therefore a major driver in designing appropriate monitoring networks and implementing measures. Measures have to be cost effective so the economic analyses, as well as other factors such as the beneficial uses of the water resources, help to prioritise the measures. The effectiveness of the measures is checked using the monitoring data, incorporating various

metrics such as status, trends and capacity[1] assessments, which are then fed back into the next characterisation cycle. Figure 1 provides a summary of the process.

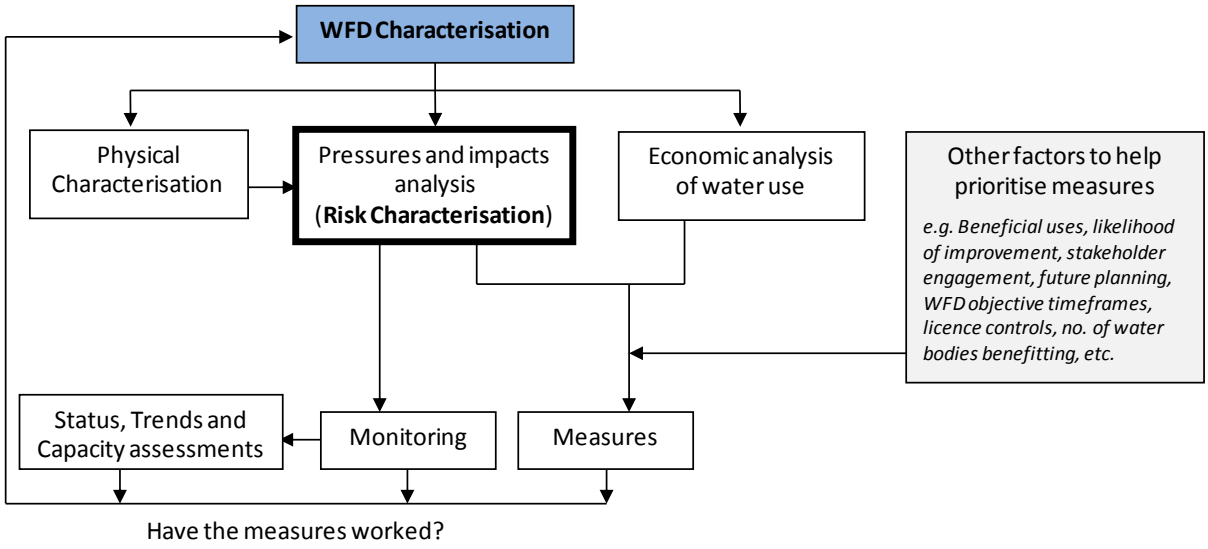

Figure 1. Characterisation in the WFD framework

1.3 The need for a new approach

The Directive, and the various EU Common Implementation Strategy, UK Technical Advisory Group and Irish WFD Working Group guidance documents on the application of the Directive, are clear on the purpose of characterisation and there is reasonably detailed information provided on what is required for the physical aspects of characterisation. However, the pressures and impacts analyses, and the linkages between the physical characteristics, status, impacts and the risks of not meeting the WFD objectives (i.e. risk characterisation), are more complex and there is less clarity on how to carry out the assessments of the risk of not meeting WFD objectives. This is indirectly acknowledged in Principle 49[2] of the Directive which states that the Commission '*may adopt guidelines to promote a thorough understanding and consistent application of the characterisation criteria*'.

During the first River Basin planning cycle in Ireland, resources were directed towards defining the water bodies, identifying potentially significant pressures, establishing the status tests, participating in an inter-calibration exercise to ensure that the ecological standards defining the status boundaries were consistent across the EU, and standardising the monitoring and reporting programmes. Due to the initial WFD timelines, there was limited opportunity to consider the significance of characterisation, not least of all because of the lack of data with which to assess the pressure-impact relationships in some water body types. Approaches to characterisation of groundwater bodies and surface water bodies in Ireland, as well as in the UK and elsewhere, have consequently evolved separately and slightly differently, with little acknowledgement of the interconnectedness and linkages across all the water body types. This has lead to some disparity and confusion in the use of some of the key concepts and the terminology.

[1] Capacity is a measure of the ability of a water body to absorb additional pressures before its Status changes. It is defined in Section 4.2.1.

[2] The term 'Principle' is used here to refer to the 'Whereas... ' statements in the early part of the Directive.

There are now significant advances in data availability, and in the understanding of the role of risk characterisation, including integrated assessments and improved catchment science, in driving Programme of Measures. There is a need for a clear and consistent integrated approach to characterisation that will meet Ireland's and EU demands, and will make information and decision making more open and accessible to stakeholders and other users, as required under Principle 46 of the Directive. It is timely in advance of the next round of characterisation, which is now overdue, to consider how best to structure a co-ordinated, efficient and scientifically defensible approach to characterisation, that is suitable for all water body types. The approach needs to encompass the relevant data, workflows and expertises at Local Authority, River Basin District and State Government body levels (Principle 14), and must take advantage of available information technologies (IT) to reduce the human and financial resource burden. Such an approach will assist in making the best use of Ireland's limited resources and will ensure that we can make substantial progress towards meeting the WFD objectives within our existing, and likely future, constraints.

1.4 Scope of this document

This document reviews characterisation within the WFD framework and previous approaches taken in Ireland and in the UK. A new integrated approach is proposed that will meet the requirements of the Directive and will be appropriate for Irish catchments, given the availability of data and modelling capabilities. The focus of this report is on the risk characterisation approach (Figure 1), i.e. how best to identify the areas at greatest risk of not achieving the WFD objectives, which is a major component of the characterisation process.

The physical characterisation methods are already well defined, and have been successfully implemented and subsequently refined in Ireland, so are not considered further. The purpose of the economic assessments is to set objectives and to justify certain exemptions including:

(a) designating water bodies as being 'highly modified' (Article 4(3))
(b) setting longer timeframes for achieving objectives (Article 4(4));
(c) setting less stringent objectives (Article 4(5));
(d) allowing new modifications that result in not meeting objectives (Article 4(7)).

The principle is that the normal WFD standards may be relaxed in circumstances when it would be disproportionately costly to achieve them, so long as certain conditions are met[3]. There is also a key requirement to ensure that any new proposed measures are cost effective (Article 11 and Annex III). The economic assessments therefore, do not influence the risk characterisation and are not considered further.

Finally, the means of prioritising which measures will be adopted in those areas identified through the risk characterisation as being at highest risk, involves a large variety of factors, including socio-economic factors, across all levels of government and the community, which is also beyond the scope of risk characterisation. Nevertheless, devising a common, integrated and transparent

[3] A report on the economic analysis of water use in Ireland was completed by CDM in 2004, and a guidance manual for determining disproportionate costs and cost-effectiveness was developed by Goodbody Economic Consultants in 2009. Cursory economic assessments of the measures were included in the river basin management plans.

approach to the risk characterisation is a key first step before prioritisation of measures can be considered.

2 Legislative framework

2.1 Characterisation in the WFD

Article 5 of the WFD states that characterisation is to be carried out for each river basin district, or for the portion of an international river basin district falling within its territory. There are three separate objectives that are of relevance in characterisation (Article 4.1):

- to prevent deterioration of the status of all water bodies;
- to protect, enhance and restore all water bodies with the aim of achieving Good Status by 2015, or by the dates set out in the river basin management plans;
- to reverse any significant and sustained upward trend in the concentration of any pollutant resulting from the impact of human activity on groundwater.

Artificial and heavily modified surface water bodies must also achieve Good Ecological Potential and Good Chemical Status by 2015, or by the dates set out in the river basin management plans. Further characterisation is to be carried out where necessary to establish a more precise assessment of the significance of the risk (Annex II(2.2)), to optimise the monitoring programmes and programmes of measures (Annex II(1.5)).

Since the implementation of the WFD, a number of guidance documents on different aspects of the WFD processes, including characterisation, have been developed to provide interpretation and a consistent approach to implementing the Directive. These include the Commission's Common Implementation Strategy (CIS) series, the United Kingdom Technical Advisory Group (UKTAG) series and some Irish specific guidance developed for the 2005 Characterisation reporting process (GW Working Group, 2001). The key documents consulted in the development of this approach are listed in the bibliography at the end of this report.

2.2 Irish surface water and groundwater regulations

The Surface Water Regulations (S.I. No. 272 of 2009) and the Groundwater Regulations (S.I. No. 9 of 2010) transpose the requirements of the WFD into Irish law, and in that transposition, there are two minor issues that arise.

Firstly, one of the main focuses of the Surface Water Regulations (Part I(2)(a)) is to protect the High and Good Status water bodies, while restoring the less than Good Status water bodies to Good Status. There is less emphasis on preventing the deterioration of water bodies that are already at less than Good Status. The reason for this is interpreted to be because the measures needed for restoring the less than Good Status water bodies to Good Status are considered to be largely more stringent than those that would be required to prevent deterioration, and would therefore take precedence under Part II(4)(a)(ii). However, it must be noted that where, for instance, the restoration target date set out in the river basin management plan for a less than Good Status water body is 2021, there must be no further deterioration of that water body in the meantime (Article

30). So while water bodies with restoration targets well into the future may not be an immediate priority for assigning measures in the early years of river basin planning, it is still important to consider the risk that further deterioration may occur so that interim measures may be implemented as required.

Secondly, there is a requirement in Article 43 of the Surface Water Regulations that the Agency will '*identify marked and sustained upward trends in the concentration of pollutants, groups of pollutants or indicators of pollution found in bodies or groups of bodies of surface water, including within-status trends, that would likely result in deterioration in status over time or give rise to non-compliance with a standard or objective established for an individual protected area*'. This trend analysis requirement for surface waters is not specified in the WFD, and has not been carried out to date, but having it in the regulations with very similar wording to the trend requirements for groundwater, shows the intent to make the surface water and groundwater assessments more consistent. The addition of the requirement for *within*-status trend assessments for surface water goes beyond that required for groundwater, but if it can be achieved, it will be a useful addition to the existing datasets and metrics.

3 Approach to risk characterisation in 2005

3.1 Overview

The initial characterisation was undertaken in Ireland in 2005. The work was carried out by consultants on behalf of the River Basin Districts, with support and guidance from a number of Irish technical working groups that were made up of representatives from various national bodies and river basin districts, research institutes and consultants. Similar work was being carried out in the UK at the same time, and there were Irish representatives on the UK technical and EU working groups to ensure that what was carried out in Ireland was consistent with that in the UK and elsewhere in Europe. This was particularly important to ensure consistency in the cross border river basins.

Considerable investment of resources was initially required to define the physical aspects of the water bodies, i.e. the boundaries, typologies, reference conditions, conceptual models, and background conditions. Consistent with the UK, all water bodies in Ireland were reported as being at one of four levels of risk of not meeting the WFD objectives:

1a, At Risk;
1b, Probably At Risk;
2a, Probably Not At Risk; and
2b, Not At Risk.

While the EU only required three risk categories (At Risk, Uncertain Risk and Not At Risk) it was felt that having four in Ireland and the UK would help prioritisation of additional actions and reflect the degree of uncertainty in the results (EPA, 2005).

The general approach to risk characterisation in 2005 was to identify the water bodies, list the pressures located in each, and determine the level of risk each pressure posed in terms of it causing the water body to fail to achieve its WFD objectives (UKTAG 2004). The approach combined the risk of contamination from a pressure occurring, with an expert assessment of whether the risk was significant in the context of causing the water body to fail to meet its WFD objectives, using some

newly developed risk threshold tools where applicable. A 'one out – all out' policy was adopted which meant that the highest risk reported against any pressure type was the overall risk category reported for that water body. Two examples of use of the risk thresholds are provided below:

1. Where groundwater abstraction was determined to be >15% of the long term average recharge, the water body was considered to be 'At Risk', where it was <5% it was 'Not At Risk', while all values in between were classed as 'Potentially At Risk' (Working Group on Groundwater and Working Group on Characterisation and Reporting, 2003).
2. Where the percentage of a river water body catchment area was >1.3% arable land, or >37% intensive grassland, or >0.03% urban, there was a ≥75% likelihood that the water body would not meet the Q4 biological rating (equated with Good Status) and would therefore be 'At Risk' (Working Group on Characterisation and Risk Assessment, 2004b).

3.2 Point sources

Slightly different approaches were taken for assessing the risk of point source pressures on surface water and groundwater. For point sources discharging to surface waters, an assessment of the compliance risk was incorporated. For example, an initial risk assessment was based on whether there was compliance with the discharge standards and monitoring requirements as set out in the relevant regulations and/or licence. Expert judgement was then used to consider this initial risk in the context of the receiving water to conclude whether the water body was at risk of not meeting its WFD objectives as a result of the facility. Where physical data for the receiving water body were lacking, additional expert judgement was required, e.g. for transitional and coastal waters, the location and depth of discharge, prevailing currents and dilution had to be taken into account (Working Group on Characterisation and Risk Assessment, 2004a).

For the groundwater point source assessments, it was assumed that there were no impacts (or risks) from licensed activities unless there were data to the contrary, and point source risk assessments were mainly carried out on the unlicensed activities or licensed activities where historic contamination was known. Where point sources were considered to be causing a water body to be At Risk, further characterisation was carried out, which largely meant subdividing the water body in a defensible way to isolate the part that was At Risk so that it could be managed separately (Groundwater Working Group, 2005).

3.3 Diffuse sources

There was less guidance available in 2005 for assessing the risks of diffuse sources of pollution because of the inherent complexity. For rivers, the approach taken was to (a) identify the pressure datasets relevant to each water body; (b) determine the level of impact using a set of risk thresholds linked to land use; and (c) adjust the assessment using impact data where available. Data availability was limited and determining the effect that specific diffuse pollution had on the biological elements relied heavily on expert judgement (Working Group on Characterisation and Risk Assessment, 2004b). This judgement was supported however, by a statistically significant regression model developed that linked the percentage of land use types within a catchment, with its biological condition as represented by the Q-value (Donohue, *et al*., 2006). The model was used to predict the likelihood of river water bodies having a Q-value ≥4, and therefore achieving Good Ecological Status,

based on the percentages of different land uses in the catchment. Those with a low likelihood of achieving Good Status were considered to be At Risk.

For impacts on groundwater due to diffuse sources of pollution, a source-pathway-receptor approach was taken that linked the sensitivity of the receptor with its susceptibility to contamination from the pressures in the catchment. The approach recognised that not all pressures in a catchment are potential sources of pollution to a receptor, and that the susceptibility depends on the nature of the hydro(geo)logical pathway link between the receptor and the pressure. Existing monitoring data were reviewed for evidence of impacts and therefore risks, and to develop threshold values for the levels of impact. Water bodies with the highest proportions of the receptor area characterised by high and moderate impact potential, as derived from the pathway susceptibility and the pressure loadings, were considered to be At Risk.

3.4 Issues for consideration in designing a new approach

There are a number of disadvantages with the previous approaches. Firstly, the risk characterisation assessments were very focussed on the pressures. Each pressure was assessed for its impact on every water body, and because the data availability on the pressures was limited, there was a heavy requirement for expert opinion at several stages in the process which made it very time consuming and arguably somewhat subjective.

Secondly, a similar level of assessment effort was required for each water body, because of the way the assessment process was structured, but also because there was a lack of suitable monitoring data that could facilitate any other sort of prioritisation approach.

Thirdly, the processes that were adopted, both in Ireland and elsewhere, were different for surface water and groundwater assessments which meant there was confusion in the use of language and inconsistencies in the approaches. This has led to differences in the way the different water body monitoring programmes have been structured, and may in turn impact on considerations of appropriate programmes of measures. Difficulties in dealing with interlinked water bodies are also becoming apparent with regard to the implementation of measures.

A significant objective in designing a new approach was to make greater use of IT automation techniques and to use a tiered, risk-based approach to ensure that the level of assessment effort, particularly the expert opinion effort, was commensurate with the level of risk of failing to meet the WFD objectives. Now that several years of monitoring data are available, it is possible to restrict the detailed pressure and impact assessments to only those water bodies where the monitoring data show that there is a high risk of not meeting the WFD objectives.

Ideally, characterisation is commenced at the start of a river basin management planning cycle to direct where the monitoring and measures are to be implemented during the cycle. Progress towards achieving the objectives is checked towards the end of the cycle using the monitoring data, specifically the status assessments (plus trend assessments for groundwater bodies). These assessments are then available for inputting into the next characterisation process at the start of the next cycle.

However, the timing of events in the first and current planning cycles in Ireland is less than ideal. The current cycle runs from 2009 to 2015. The last characterisation process in Ireland took place in 2005, and the next one will not be completed until the end of 2014, at the earliest, which is late in the current cycle. Nevertheless, the last status assessment was carried out in 2009 on data for the years 2007-2008, and the next one is due in 2014 using data for the years 2008-2013, so there will be up to date relevant monitoring data available for the next characterisation. There were no specific measures implemented as a result of the last characterisation, so for the next characterisation, just the effectiveness of the measures being implemented under other pieces of legislation will need to be considered (e.g. closed periods for slurry spreading as directed under the predecessors to the Good Agricultural Practice Regulations, S.I. No. 610 of 2010). The majority of the monitoring programme has been in place in Ireland for some time and has provided a strong baseline from which to monitor natural background conditions, the impacts of representative pressures, and now the effectiveness of the existing measures. If, and when additional measures are implemented as a result of the next characterisation process, consideration may need to be given to some adjustment of a portion of the monitoring resources so that the effectiveness of the new measures can be reviewed. Characterisation should be viewed as an ongoing process so that the monitoring and measures can be targeted, and adjusted as necessary, towards protecting and improving the water bodies at greatest risk.

In practice, therefore, the current timelines and schedules are less than ideal and it is probable that characterisation will be carried out together with the status and trend assessments, as the same data are used in both. If the characterisation approach can be more fully automated in the future, it is more likely that a working timeline that is more closely aligned with the ideal can be achieved.

4 A new approach

4.1 Key principles

Following a literature review and initial consultation with the people listed in the Introduction, eight key principles were indentified that needed to be considered in designing an integrated approach to WFD characterisation.

1. 'Risk' in the WFD context means the risk of not meeting the WFD objectives, i.e. achieving Good Status, no deterioration of status (for all water bodies), and reversing upward trends (groundwater bodies only). All activities carried out under the WFD, including measures and monitoring, are geared towards meeting these objectives. The WFD also promotes sustainable water use (Article 1(b) and (e)) within the context of these objectives.

   For the first planning cycle, the surface water assessments were largely focussed on the 'achieve Good Status' objective (Ní Chatháin, *et al*. 2012), while the groundwater assessments considered the additional 'no deterioration' and 'reverse upward trends' objectives. For clarity, it is helpful to consider the risk of not meeting each objective separately (since they can be different in different circumstances), and then combine them to arrive at a 'worst case' integrated WFD risk characterisation assessment for each water body type.

2. All water bodies are at risk from contamination, all the time, particularly those that are very sensitive, e.g. Protected Areas and High Status water bodies. However, it is not feasible to manage all water bodies to the same degree. The purpose of the WFD risk characterisation is to identify those water bodies at the highest risk of *not meeting the WFD objectives, within the specified timeframe where appropriate,* so that measures and monitoring under the Directive can be prioritised and targeted to best effect. This is different to being at risk of contamination.

3. A distinction needs to be drawn between the status of water bodies and their WFD Risk. For example, a water body may be at less than Good Status, but no longer be At Risk of not meeting the WFD objectives, because it has had significant investment in measures (e.g. a waste water treatment plant upgrade), and the trend assessment shows that it is improving and will have met the relevant WFD objective (achieve Good Status) by the target deadline.

4. Risk characterisation is carried out at the start of a RBMP cycle. It looks forward towards the target deadlines and highlights the areas where monitoring and measures need to be implemented and/or adjusted so that the objectives can be met on time. Status and trend reversal assessments are carried out at the end of a cycle, and look backwards to review whether the measures are working and the water bodies are improving. Further risk characterisation is carried out on those areas still At Risk to refine the measures and monitoring as appropriate. As almost the same data are used for the status and risk assessments, in practice they may be carried out concurrently.

5. High Status river water bodies are a special case. They are often highly sensitive oligotrophic water bodies that have little capacity for absorbing additional nutrients without significant ecological impacts. They support important diverse sensitive ecosystems, provide the reference conditions for status assessments, and act as refugia for species which are critical for repopulating degraded downstream reaches. It is widely acknowledged that High Status river water bodies have a high beneficial use and indeed it has been suggested that they should be considered as Protected Areas (Ní Chatháin, *et al*. 2012).

   However, strictly speaking, there is no special consideration given to High Status water bodies over that which is given to Good Status water bodies in the WFD. For instance, there is no specific requirement to restore water bodies to High Status; and prevention of deterioration of High Status water bodies is considered together with prevention of deterioration of all water bodies (Article 4(1)(a)(i)). Article 4(7) states that Member States will not be in breach of the Directive where degradation of High Status water bodies to Good Status occurs for the purposes of new sustainable human activities, provided that four conditions are met, i.e. all practicable steps are taken to mitigate the impacts; the reasons for the modifications and alterations are clearly set out in the RBMP; the reasons are of overriding public interest and benefits outweigh the environmental outcomes; and the benefits cannot be achieved by other means for reasons of technical feasibility or disproportionate cost.

   Nevertheless, where High Status water bodies, especially river water bodies, are deemed to be At Risk, they merit a high priority for programmes of measures for reasons of their high beneficial use. Whether or not they are At Risk however, depends on more than just their High

Status; it also needs to include information on the pressures, trends, capacity and the effectiveness of the existing measures. It is acknowledged that the capacity of High Status river water bodies will often be low because of their high sensitivity.

6. Further risk characterisation is required for water bodies that have been shown to be At Risk through an initial water body screening process. It is used to identify the most susceptible areas within the sub-catchment and the potentially significant pressures that are causing the problem, so that additional more focussed measures and monitoring can be carried out. Even more detailed risk characterisation may subsequently be necessary at a field or point source scale to identify and remediate significant issues.

7. Risk characterisation is used to drive action, which costs money, so there should be a reasonable degree of confidence in a decision that a water body is At Risk to justify specific monitoring and additional measures. Where confidence is low, it should be highlighted and further characterisation and/or monitoring, should be carried out to improve the confidence before significant investment in additional measures is made.

8. Risk characterisation needs to sit within the wider EPA and other national public authority, as well as Local Authority, licensing, enforcement and monitoring frameworks. Much of the characterisation effort required can be automated using GIS/IT tools, or is already being carried out either as part of existing work programmes (e.g. monitoring, inspections, licensing and enforcement) or incidentally to that work (e.g. an inspector assessing a WWTP application who notices significant contamination occurring upstream). As resources become more and more limited, it will be important that the knowledge gained through all this work is readily accessible to those doing the characterisation; and that, for instance, inspections, enforcement and community engagement strategies can be focussed into the areas at highest risk of not meeting the WFD objectives.

4.2 Three tiers of risk characterisation

A three tier risk characterisation approach has been adopted so that the level of assessment effort is commensurate with the level of risk posed. Tier 1 is a screening exercise and each successive tier encompasses more focussed analyses and assessments, at more detailed scales. The aim is to rule out water bodies and potential pressures that are not significant, so that the particular pressures causing the risk of failing the WFD objectives can be identified and mitigated. This approach enables measures to be selected that are appropriate for each tier of assessment, and that are largely focussed on the highest risk areas and the identified significant pressures. It also ensures that the more intensive, and therefore expensive, resource effort can be directed only towards those areas for which there is a reasonable degree of confidence in the risk characterisation. A summary of the three tiered approach is presented in Figure 2 and detailed descriptions of each tier are presented in the following sections.

4.2.1 Tier 1

Tier 1 is a screening exercise which is carried out at a river basin district or national scale. It is the scale at which the reporting is carried out and it should be possible that it can be largely an automated process in time, as the appropriate data become available. Tier 1 identifies the water

bodies that are At Risk (coloured red) or Not at Risk (coloured green) of not meeting each of their WFD objectives, based mainly on the available monitoring data, including assessments of status, trends and distance to threshold which are defined below.

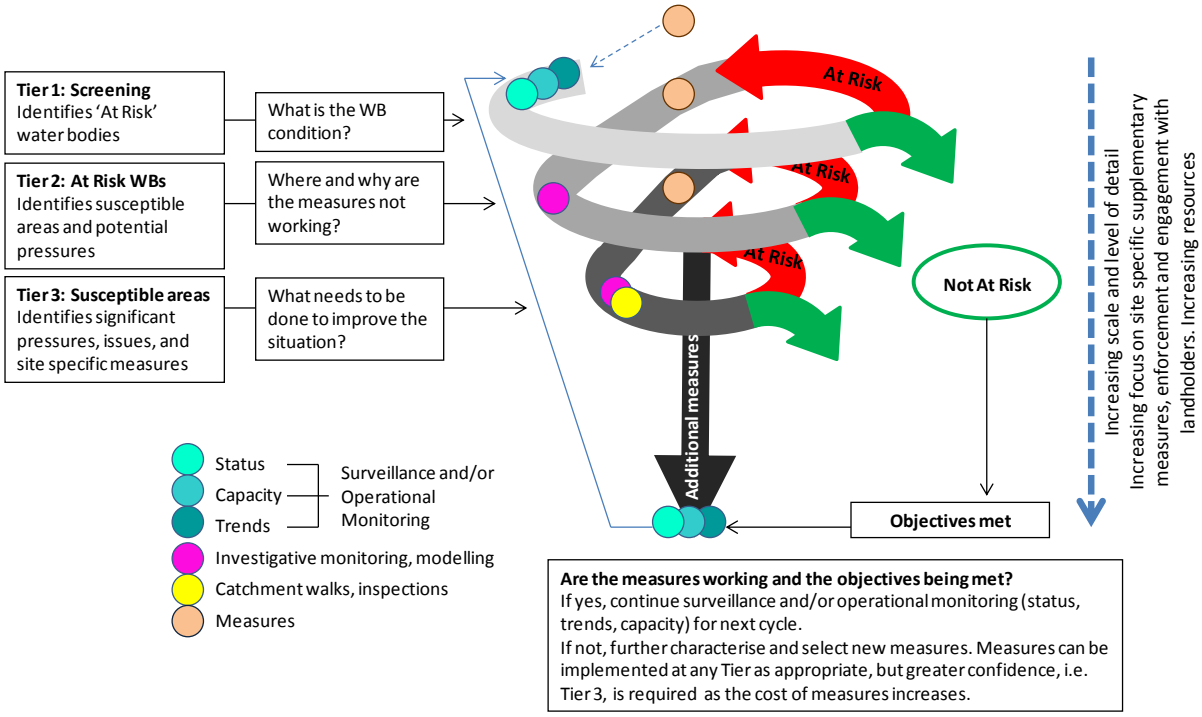

Figure 2. Three tiers of assessment approach

Water bodies that are At Risk are selected for a Tier 2 assessment to determine why, and to identify the critical source areas[4] within the water body catchment that are causing it to be At Risk. Where water bodies are Not at Risk, existing measures and surveillance monitoring are continued as appropriate to ensure that the long term conditions do not change.

A third option to Review is also available. Water bodies characterised as Review in the Tier 1 assessment are coloured amber as the degree of confidence in the characterisation is weak. For instance there may be no trend, or an upward trend that is not statistically significant, or there may be a lack of information as the water body is unmonitored. Water bodies for Review are not considered to be At Risk, but require further evidence that the objectives are being met, typically with ongoing monitoring and/or possibly modelling. Where necessary, depending on the nature of the uncertainty, they can also be included with the water bodies subjected to the Tier 2 assessment.

For each water body, the risk of not meeting each of the relevant objectives is considered separately, and on the basis of a 'one out – all out' policy, the resulting risks are combined to provide a 'worst case' risk characterisation for the water body. The methodology is presented in a matrix format in Table 1 for surface water bodies and Table 2 for groundwater bodies. While the methodologies are the same, the separate tables allow for the different groundwater and surface water status classification schemes, and the extra WFD objective (the trends assessment) for groundwater. Each of the elements of the matrix is described below.

[4] Critical Source Areas are areas within a catchment that contribute more pollutants than other parts. Further detail is provided in Section 4.2.2.

Table 1. Tier 1 risk screening – surface water bodies (Footnotes follow Table 2)

Assigning prelininary risk[1] Tier 1 screening for SW bodies		**Distance to threshold near[2]**			**Distance to threshold far**		
		WFD Objectives			WFD Objectives		
Previous Reported Status[3]	**Significant trend[4] in concentration or ecological metric**	*Achieve Good status*	*No deterioration of Status*	***Objectives combined[5]***	*Achieve Good status*	*No deterioration of Status*	***Objectives combined***
High	*Improving*	Not at risk	Not at risk	**Not at risk**	Not at risk	Not at risk	**Not at risk**
	None/stable/don't know	Not at risk	Review	**Review**	Not at risk	Not at risk	**Not at risk**
	Disimproving	Not at risk	At risk	**At risk**	Not at risk	At risk	**At risk**
Good	*Improving*	Not at risk	Not at risk	**Not at risk**	Not at risk	Not at risk	**Not at risk**
	None/stable/don't know	Not at risk	Review	**Review**	Not at risk	Not at risk	**Not at risk**
	Disimproving	Review	At risk	**At risk**	Review	At risk	**At risk**
Moderate	*Improving*	Review	Not at risk	**Review**	Review	Not at risk	**Review**
	None/stable/don't know	At risk	Review	**At risk**	At risk	Not at risk	**At risk**
	Disimproving	At risk	At risk	**At risk**	At risk	At risk	**At risk**
Poor	*Improving*	At risk	Not at risk	**At risk**	At risk	Not at risk	**At risk**
	None/stable/don't know	At risk	Review	**At risk**	At risk	Not at risk	**At risk**
	Disimproving	At risk	At risk	**At risk**	At risk	At risk	**At risk**
Bad	*Improving*	At risk	Not at risk	**At risk**	At risk	Not at risk	**At risk**
	None/stable/don't know	At risk	Review	**At risk**	At risk	Not at risk	**At risk**
	Disimproving	At risk	At risk	**At risk**	At risk	At risk	**At risk**

Table 2. Tier 1 risk screening – groundwater bodies

Assigning prelininary risk		**Distance to threshold near**				**Distance to threshold far**			
GW bodies Tier 1 screening		WFD Objectives				WFD Objectives			
Previous reported Status	**Significant trend in concentration or level**	*Achieve Good status*	*No deterioration*	*Reverse upward trend*	***Objectives combined***	*Achieve Good status*	*No deterioration*	*Reverse upward trend*	***Objectives combined***
Good	*Improving*	Not at risk	Not at risk	Not at risk	**Not at risk**	Not at risk	Not at risk	Not at risk	**Not at risk**
	None/stable/don't know	Not at risk	Review	Not at risk	**Review**	Not at risk	Not at risk	Not at risk	**Not at risk**
	Disimproving	Review	At risk	At risk	**At risk**	Review	At risk	At risk	**At risk**
Poor	*Improving*	Review	Not at risk	Not at risk	**Review**	Review	Not at risk	Not at risk	**Review**
	None/stable/don't know	At risk	Review	Not at risk	**At risk**	At risk	Not at risk	Not at risk	**At risk**
	Disimproving	At risk	At risk	At risk	**At risk**	At risk	At risk	At risk	**At risk**

Footnotes for Tables 1 and 2:

[1]Risk is defined as risk of not meeting the WFD objectives. 'Not at risk' means continue with current measures and surveillance montitoring. 'Review' means continue monitoring to improve confidence and/or progress to Tier 2 if required. 'At risk' means further measures are required; progress to Tier 2 to determine the susceptible areas and significant pressures.

[2]Initially the distance to threshold assessment will only apply to the chemical and quantity indicators and chlorophyll. If thresholds for the other biological quality elements are developed in the future, they can also be added. A threshold of within 25% of the indicative status boundary has been adopted as near, otherwise the distance to threshold is far. The sensitivity of the water body type can also be reflected in future, e.g. for some highly sensitive High Status river water bodies, the distance to threshold may always be near.

[3]The status is the reported Biological Status for surface water, and either the Chemical or Quantitative Status for groundwater. The indicators used for the trends and capacity assessments must be consistent with the quality or quantity elements driving the status. Where the confidence in the status assessment is low, the trend and capacity data will help to determine whether the water body is at risk of deterioration. Unless there is an improving trend, or a stable trend with high capacity, waterbodies are either for Review or At risk which will lead to additional data being collected that will improve the confidence.

[4]Significant trends are trends that are statistically ($P<0.05$) and environmentally significant. Trend assessments predict forward to 2021 for SW and 2027 for GW. Environmentally significant trends are trends that indicate that the Status will likely change by at least one class within the prediction period.

[5]Where more than one objective applies, the most stringent risk outcome takes precedence.

(a) Status

The status classification required at the Tier 1 screening level is the reported status classification, or part of that classification including ecological potential where appropriate, as required under Article 8 and Annex V of the Directive. Each water body discipline (e.g. rivers, groundwater, lakes, transitional waters and coastal waters) has its own status assessment methodology and there are different elements and indicator parameters used in different circumstances. For example, there are no biological status tests for groundwater bodies, and there is no requirement for assessments of fish in coastal waters.

The indicators used in the trends and distance to threshold assessments should be consistent with the water quality element or status test driving the status. For example, for a river water body where the Q-value and the water chemistry suggests eutrophication is the issue, the trends and capacity assessments are carried out for soluble reactive phosphorus and the mitigation of significant P pressures is considered. Dissolved inorganic nitrogen is more appropriate for transitional waters, while for quantitative pressures in groundwater, groundwater levels are assessed. Where more than one parameter is causing an impact, the risk assessment is carried out for each parameter and the worst case risk outcome is adopted. Identifying the trends and distance to threshold associated with each indicator is helpful for identifying the issues and therefore the pressures, and ultimately the appropriate measures.

In some instances, the confidence in the status classifications may be low, because for example, either the water body is not being directly monitored, or because the results for each of the biological quality element tests show conflicting results and the statistics show that there is a high probability of misclassification. In these cases, the trend and distance to threshold data will help to determine whether the water body is At Risk. Water bodies are only deemed to be Not at Risk where the trend data show an improvement, or where the trend is stable but the distance to threshold is far. Otherwise the outcome is for Review or At Risk, both of which will contribute to the provision of additional data that will improve the confidence in the status.

(b) Trends

The identification of statistically and environmentally significant trends for groundwater bodies is a specific requirement of the WFD and the Groundwater Daughter Directive. Guidance on trends in groundwater assessments (UKTAG 2009, EPA 2010) indicates that trends are environmentally significant if they indicate that the Good Status will be failed within two future river basin cycles, i.e. within the next 12 years. For reporting against the formal WFD trends objective, statistical trends should be extrapolated using data from at least the last 6 years (UKTAG, 2011). It is recommended by the UKTAG that for the purposes of assessing risk, trends are extrapolated using the worse case predictions of either at least the previous 3 or 6 years data.

The identification of trends in surface water bodies is not explicitly required in the WFD although it is referred to in the Irish Surface Water Regulations. There is therefore no specific guidance available at present to address the issue of what are significant trends. It is possible that the timeframes required to achieve environmental significance in groundwater, where lag times can be lengthy, may not be appropriate for surface water bodies. UKTAG (2007) for example, suggests that basing trends for surface water bodies on 3 years of data might be adequate. However, in view of the fact that groundwater contributes to stream flow in the vast majority of the rivers in Ireland, and that our

groundwater and surface water resources are interconnected and hydrologically linked, it is recommended that the same time frames are selected for the surface water body assessments, at least initially.

(c) Distance to threshold

The distance to threshold is a measure of the capacity of a water body to absorb extra pressures before its status changes. For example, a river water body at Good Status will have mean phosphate values in the range 0.025 to 0.035 mg/l. River water bodies with mean phosphate concentrations of 0.0325 mg/l are nearer the Good/Moderate Status boundary than those with a mean of, for example 0.0275 mg/l, and should therefore be a higher priority for protection from deterioration. Once the concentration is within 25% of the status threshold, it is considered to be 'near' but it is otherwise 'far'. The distance to threshold is not required to be assessed under the WFD but it is considered when granting discharge licences (as capacity), and it is a useful metric in risk characterisation that can currently be determined for some parameters using the existing datasets. Initially it will apply primarily to chemistry, phytoplankton using chlorophyll and groundwater level data, but there may also be potential to apply the concepts to macrophytes and other ecological assessment metrics in the future.

The capacity of a water body is indirectly linked to the sensitivity of its aquatic ecosystem. For example, a deep stratified lake at Good Status may be less sensitive to a given nutrient load than a shallow polymictic[5] lake at Good Status, because of the greater dilution effect and because there may be less of a response in phytoplankton due to the light limitation. Where both lakes have limited capacity, pollution from a farmyard might be a significant pressure in the shallow lake catchment as it would cause the available capacity to be quickly eliminated, but the same pressure might not be significant in the deep lake catchment. The relationships between capacity, sensitivity, trends and the risk outcome are demonstrated schematically in Figure 3.

Examples

The following examples are provided as a means of illustrating how the status, trends and distance to threshold interact in a Tier 1 assessment.

(i) Where its status is at less than Good, a water body will typically be characterised as being At Risk (of not achieving the Good Status objective), unless the trend data show that the water quality or quantity is improving, in which case the water body is suitable for Review.

(ii) Where there is no clear trend, water bodies with low capacity, i.e. the distance to threshold is near, will remain under Review. This is to ensure that further investigation can be considered in a timely manner before the status deteriorates. Water bodies with no trends but with high capacity are Not at Risk, as deterioration is not imminent.

[5] A polymictic lake is one that doesn't stratify properly and is mixed several times per year.

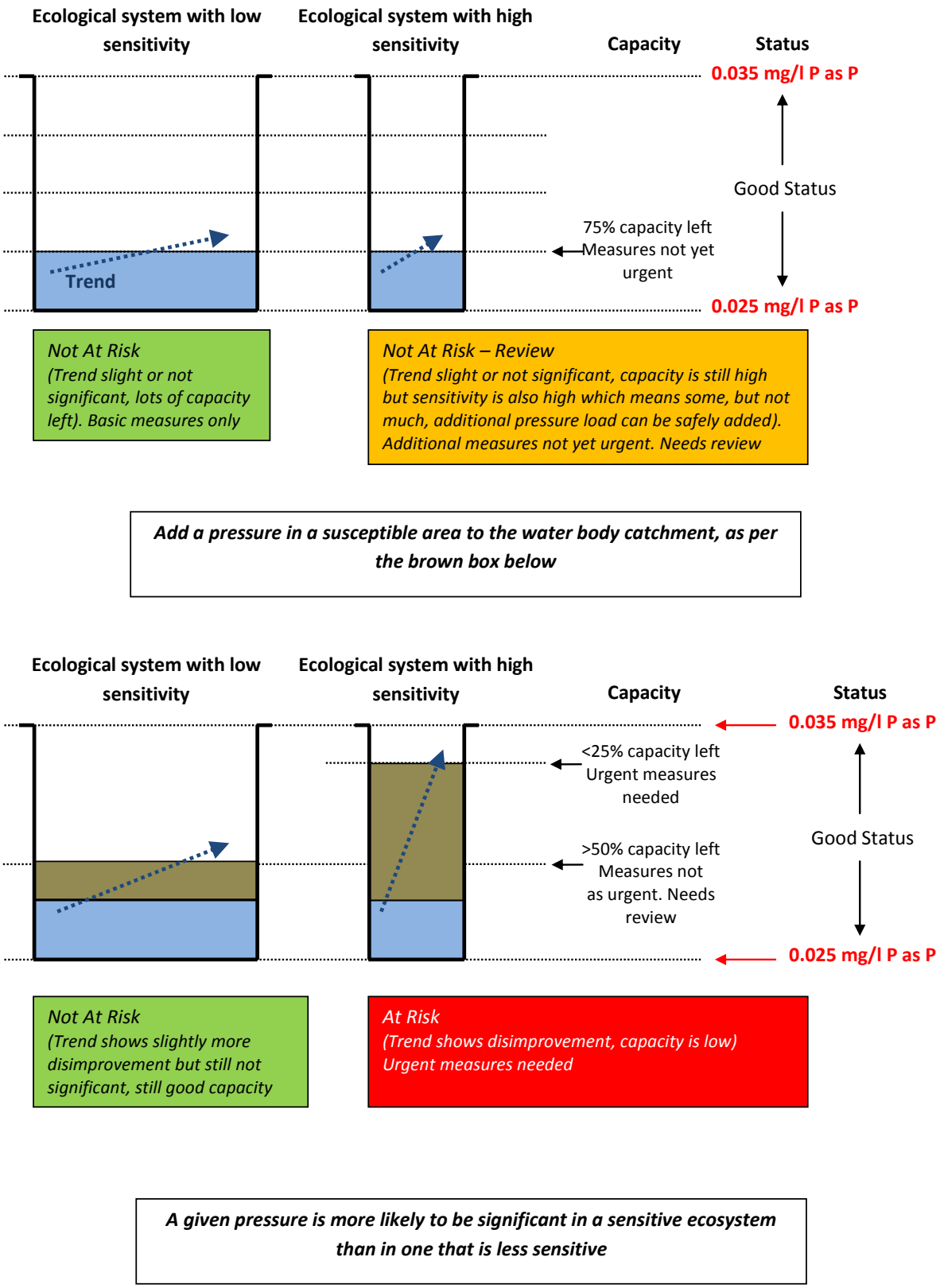

Figure 3. The relationship between capacity (i.e. distance to threshold), sensitivity, trends and risk.

Scope and limitations of Tier 1 assessments

The Tier 1 assessment approach is largely based on the chemical and physico-chemical quality elements used in the status assessments (such as nutrients, acidification and oxygenation conditions, etc.) and their indicators (e.g. dissolved inorganic nitrogen, soluble reactive phosphorus, pH, dissolved oxygen, etc), and it includes consideration of the trends and distance to threshold in relation to those elements. The approach has also been used to assess phytoplankton using chlorophyll as an indicator. Similarly, the approach is suited to assessments for specific pollutants, within the scope of their environmental quality standards. The approach can also be used for quantitative status assessments for groundwater by focussing on the elements that reflect the quantitative pressures, such as groundwater levels, flow contributions to rivers and saline intrusion. In time, and with further research, the methodology may eventually be applicable for some of the biological quality elements, e.g. macrophytes for lake assessments.

The methodology is not appropriate for elements that have pass/fail type assessments, such as those currently in use for assessing hydromorphological pressures and alien species, or for priority substances (see Section 4.5), for which assessments of trends or capacity are not appropriate. If the status assessment methods are further developed for some of these pressure types in the future, they can be included in the Tier 1 assessments.

4.2.2 Tier 2

Tier 2 assessments are carried out for the water bodies found to be At Risk from the Tier 1 assessments, and may also be appropriate for some of the water bodies for Review. They are carried out to identify where and why the water bodies are At Risk, using additional investigative monitoring and modelling as appropriate. Tier 2 assessments are carried out at the catchment or sub-catchment scale, depending on the size and location of the water body At Risk. For example, for a transitional water body At Risk, the Tier 2 assessment would be carried out on the whole of the river water catchment up-gradient. For a headwater stream, the sub-catchment would be more appropriate. Working with catchment and/or sub-catchments, rather than the water bodies, is important for the Tier 2 assessments because it allows for the interconnections and interactions between the different water body types and pressures on the land surface to be properly investigated (refer to Section 4.3).

The outputs of the Tier 2 assessments are the identification of susceptible areas and the potentially significant pressures, i.e. those parts of the catchment or sub-catchment which have the greatest potential to cause the water body to be At Risk of not meeting its objectives. Significant pressures are pressures that are known to be causing the water body to be At Risk of not meeting its WFD objectives. All pressures are considered to be potential pressures until such time as it can be demonstrated at the appropriate tier of assessment that they are significant.

For diffuse pressures, the susceptible areas are known as the Critical Source Areas (CSAs) and they can now be readily generated using the newly developed EPA Catchment Characterisation Tool (CCT). The CCT is the culmination of a five year EPA STRIVE-funded project and it combines and processes knowledge of the soil and geology layers, land uses, loadings, contaminant delivery pathways and the attenuation along those pathways, to the receptor of interest. Separate maps are generated for the delivery of nitrate, soluble phosphorus and sediment to the surface water and

groundwater receptors, to reflect the different pathways and attenuation processes appropriate to each.

An indicative example of the outputs of the CCT for diffuse sources of nitrate and soluble phosphorus is shown in Figure 4. Maps (a) and (b) highlight the areas of greatest pollution impact potential to groundwater from nitrate and soluble phosphorus respectively, both of which are controlled largely by thin subsoils and soils in the upland parts of the catchment. Soluble phosphorus is less of an issue for the groundwater receptor than nitrate because the soils and subsoils are clayey, and much of the phosphorus is bound up in the upper soil layers and thus cannot infiltrate to groundwater. Where the receptor of interest is the stream however (maps (c) and (d)), the greatest pollution impact potential is from phosphorus, as it is transported from the upper soils via overland flow which is prevalent on the clayey soils. The areas of highest pollution impact potential are the arable lands where the phosphorus loads are greatest. Nitrate is not common in overland flow as it is not retained in the upper soils in the same manner as phosphorus and is more likely to infiltrate or be denitrified in the poorly drained clayey soils if it is not taken up by the plants.

The locations of point sources and domestic waste water treatment systems can also be highlighted in the CCT, so that those that are potentially significant pressures can be considered at the Tier 2 level.

4.2.3 Tier 3

The final tier, Tier 3, investigates further the critical source areas and the potentially significant pressures from the Tier 2 assessments. Site specific investigations, such as catchment walks, field inspections, licence reviews, compliance checks, etc., are carried out so that the significant pressures can be identified, i.e. those pressures that are causing the water body to be At Risk. Investigative monitoring may be carried out if appropriate, and depending on the issue there may also be scope to utilise further scenario modelling to review possible outcomes for proposed changed operating scenarios.

Although Tier 3 assessments will be carried out at farm or field scale, the three-dimensional sub-catchment type approach is encouraged to ensure the linkages between the water body types and the pressures can be considered. Tier 3 will also usually involve stakeholder engagement strategies in selecting, agreeing and implementing suitable measures. It may be appropriate to temporarily redeploy some operational monitoring resources to confirm that the new measures are working.

An overview of the three tiers of the approach is shown in Table 3, where a worked example is also presented. At the end of the planning cycle, the status, trends and distance to threshold assessments are repeated to determine if the measures are working and to provide the information for the Tier 1 characterisation at the start of the next cycle when all water bodies are re-characterised. Where At Risk water bodies have not improved, the Tier 2 and/or Tier 3 risk characterisation processes can be repeated to improve confidence and understanding. Ultimately if improvements cannot be made, an economic assessment to determine whether remediation or mitigation represents a disproportionate cost may need to be made so that an exemption may be applied.

It is worth noting that the Tier 2 and Tier 3 assessments need not be restricted to water bodies that are At Risk or for Review only, as they can be carried out for any catchment or sub-catchment in the

country and may prove useful as pre-planning assessment tools. The impacts of changing land use, (e.g. increasing livestock units, or adding imported organic fertiliser), climate change scenarios, or

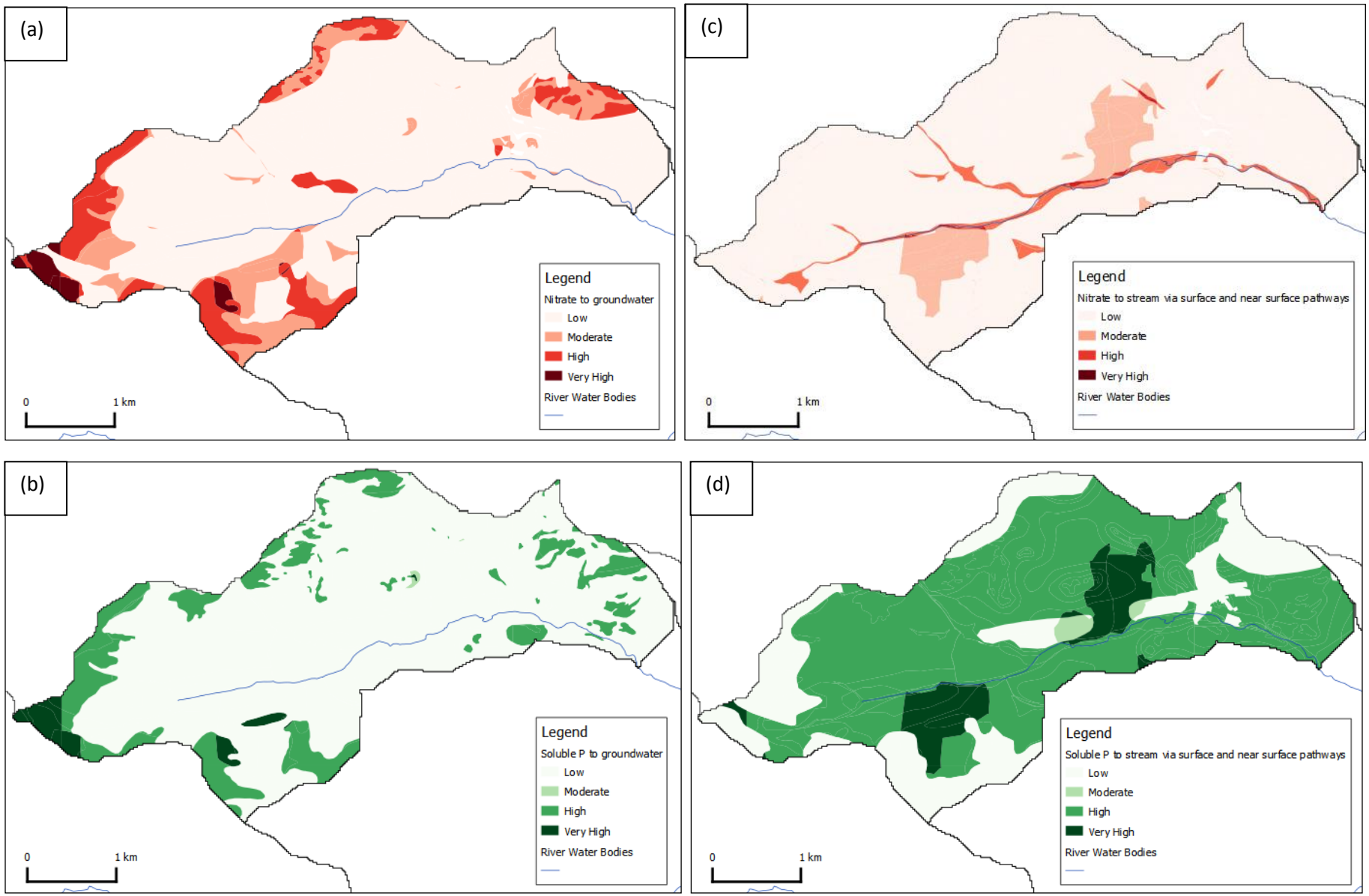

Figure 4. Diffuse pollution impact potential maps for the delivery of nitrate (a) and soluble phosphorus (b) to groundwater, and nitrate (c) and soluble phosphorus (d) to the stream via the surface and near surface pathways. Indicative maps only, produced using the Catchment Characterisation Tool.

Table 3. Tiers of Risk Characterisation summary

	Tier 1	Tier 2	Tier 3
Purpose of assessment	Identify water bodies At Risk and Not at Risk of failing to meet WFD objectives. Select the At Risk water bodies for further characterisation.	For the At Risk water bodies, identify the susceptible areas and the potentially significant pressures, i.e. the critical source areas. For water bodies under Review, conduct additional monitoring or assessment as required to improve confidence.	In the susceptible areas, or for the potentially significant pressures, further investigate to better understand why and how the issues are arising, so that specific measures can be identified at the local scale.
Outputs of the assessment	WBS that are At Risk, Not at Risk, or for Review.	Susceptible areas, i.e. critical source areas (CSAs), and potentially significant pressures.	Specific areas, issues of concern, significant pressures, point sources requiring inspections, etc. Agreed plan for remediation
Area and scale assessed	Target the RBD or the whole country, but work at the level of the water body as that is the monitoring unit, and integrate up to catchment scale.	Target the At Risk water bodies and Review water bodies where confidence is low. Work at the catchment or sub-catchment scale to facilitate linkages between water bodies and integrated management	Target the CSAs and work at the sub-catchment or farm/field scale. Maintain a three dimensional focus to understand linkages.
Tools	Monitoring data, previously reported status assessments, automated screening process.	Catchment characterisation tool, information from previous inspections, licensing and enforcement activities, monitoring data, subcatchment integrated assessments.	Site visits, catchment walks, calculations, models, field tests, investigative monitoring, catchment modelling tool, compliance checking, stakeholder engagement
Hypothetical Example: ***First RBMP cycle***	A river water body has moderately high P that is increasing, which has caused some impacts to the biology. The status is still Good but there is little capacity left to increase P levels before the ecological condition degrades further. There are diffuse agricultural pressures and an agglomeration within the catchment, but it is not clear which are the significant pressures causing the issue. The WB is in danger of deteriorating into Moderate Status before 2015 as per the RBMP, and is therefore At Risk.	As the water body has been found to be At Risk from the Tier 1 screening, it is selected for further characterisation in Tier 2. The Pathways Tool Level 2 is run and shows that the most susceptible areas for diffuse P pressures are the areas underlain by low permeability soils, subsoils and Poor aquifers, where there is arable farming. These areas are located in the lower part of the catchment. The licensing information shows that there is a licensed WWTP also located in the lower catchment. Sub-catchment monitoring data show that the upper part of the catchment is towards the upper end of Good Status, i.e. it has high capacity, and that the trend is stable. The upper part of the catchment is therefore Not at Risk. The lower part of the catchment is the susceptible area and the potentially significant	The arable farming areas and the agglomeration/WWTP in the lower part of the catchment are therefore selected for Tier 3 characterisation. The Pathways Tool Level 3 confirms that the P is largely being delivered to the stream during rainfall events and that P levels at baseflow are low, which suggests a rain driven overland flow pathway. This may indicate that the WWTP is not the key issue. The licensing information suggests that there is sufficient assimilative capacity in the stream to manage the P load. Catchment walkovers are carried out and show that there are three arable farms, but that cattle from an adjacent grazing farm have direct access to the stream. In conjunction with the farmers, the stream is fenced off on the grassland

		pressures are the arable farming and the agglomeration/WWTP.	farm and buffer strips are installed on the three arable farms. Monitoring resources from the upper catchment are switched to just downstream of the four farms to verify that the measures are working. Monitoring at the catchment outlet is continued.
Second RBMP cycle	The Risk Characterisation screening tests are run again. Monitoring data show that there was no improvement in the WB in the first two years after the measures were implemented (as the sub-surface water continued to impact on the stream) but the trend data show an improvement since then. However the trend is not yet significant and the water body still has little capacity to absorb any further P. The water body is no longer characterised as being At Risk but is selected for ongoing Review.	The monitoring data are reviewed to confirm that the apparent improving trend is significant. There is consistency found between the water body monitoring results and the results from the temporary monitoring downstream of the four farms. The capacity is also gradually increasing. The water body is characterised as being Not at Risk, and the monitoring that was being carried out downstream of the farms is discontinued.	

different development scenarios can also be tested. This enables assessments of the likely risks of future changes in land uses to be carried out.

4.3 Linkages between connected water bodies

The WFD acknowledges that the status of a water body may impact on the status of another, e.g. river water status can impact on transitional and coastal waters (Principle 17), and the quantitative status of a groundwater body may impact on the ecological quality of connected river and GWDTEs (Principle 20). It also states as principles that (a) the objective of achieving Good Status should be pursued for each river basin so that measures in respect of surface water and groundwater belonging to the same ecological, hydrological and hydrogeological system are coordinated (Principle 33); and (b) that there is a need for a greater integration of qualitative and quantitative aspects of both surface waters and groundwaters, taking into account the natural flow conditions of water within the hydrological cycle (Principle 34). It is the intent of the WFD that surface waters and groundwaters should be managed in an integrated way where they are hydrologically linked. In Ireland, groundwater plays a significant role in providing the baseflow to streams and rivers and the majority of groundwater resources are therefore hydrologically linked to surface waters.

Where a water body receives water from another water body, e.g. a river water body flowing into another river body, or a lake or estuary, each should have its own Tier 1 risk characterisation assessment carried out using the available water quality data to determine whether or not it is At Risk of not meeting its WFD objectives. For example, while a river water body may be At Risk of not meeting its own objectives because of high nitrogen or sediment, there may be sufficient dilution and capacity, and different trends in a receiving lake or transitional water body that indicate that the lake is Not At Risk.

If a receiving water body is At Risk, a Tier 2 risk characterisation is carried out to determine the susceptible areas and the potentially significant pressures, taking into account that they may be located within the sub-catchment of a different contributing water body. The monitoring data and the risk characterisation for the contributing water body catchment will therefore also be helpful. For example, a groundwater body may be delivering a significant portion of the flow to a linked river water body, and may have a mean nitrate level of 30 mg/l, which while less than the 37.5 mg/l threshold level for the groundwater status test, is still much higher than the nitrate level required to sustain the ecological water quality of the river at Good Status. In these instances, more stringent thresholds for the groundwater body must be set in accordance with Regulations 48-52. This essentially means a change to its status test threshold, and potentially the assessment of capacity and trends, and ultimately the risk characterisation. These sorts of integrated assessments for linked water bodies will not be achievable unless the unifying catchment or sub-catchment is adopted as the assessment unit.

4.4 Protected Areas

Protected areas are defined under both the Surface Water and Groundwater Regulations as ‘areas designated as requiring special protection under specific Community legislation for the protection of their surface water and groundwater, or for the conservation of habitats and species of European sites directly dependent on water and listed in the register established by the Agency in accordance with Article 8 of the 2003 Regulations. Under the WFD, Protected Areas include (Annex IV):

(i) areas designated for the abstraction of water intended for human consumption under Article 7;
(ii) areas designated for the protection of economically significant aquatic species. (For example, this may include waters previously designated under the Shellfish Waters Directive or the Freshwater Fish Directive);
(iii) bodies of water designated as recreational waters, including areas designated as bathing waters under the Bathing Waters Directive;
(iv) nutrient-sensitive areas, including areas designated as Vulnerable Zones under the Nitrates Directive and areas designated as Sensitive Areas under the Urban Waste Water Treatment Directive; and
(v) areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection, including relevant Natura 2000 sites under the Habitats Directive or the Birds Directive.

A register of Protected Areas must be established for each RBD (Article 6). Programmes for monitoring the status of the water body in which they are located must be established, and must be supplemented by any specific requirements of the legislation under which the protected areas were originally established (Article 8(1)(ii)). For each Protected Area, the relevant standards and objectives must be met by 2015 at the latest, unless otherwise specified in the legislation under which the Protected Area has been specified (Article 4(1)(c)).

It is apparent that some Protected areas are areas with boundaries that cut across the WFD water body boundaries (e.g. Bathing Waters, Shellfish Waters), and some have standards and tests that are in addition to the chemical, quantitative and ecological status tests appropriate for WFD water bodies (e.g. microbial and drinking water standards). The characterisation for water bodies that include these Protected Areas therefore needs to incorporate both the risk assessment appropriate for the water body(s), as well as an additional assessment that takes into account the objectives specific to that Protected Area type. In essence, this means that the water body simply needs to be assessed against one or more additional objectives specific to the Protected Area. The same Tier 1 matrix structure can be used for the additional assessment, i.e. using the status (or current condition), pressure, trend and capacity information, but it is applied to the indicator of relevance to the Protected Area, e.g. microbial quality. The resulting risk category is the least favourable of the two assessments, consistent with the 'one out, all out' policy. This allows for the assessments for the Protected Area, and the water body in which it is located, to be integrated.

4.5 Priority substances, priority hazardous substances and pollutants

The WFD objectives include requirements to reduce pollution from priority substances, and cease or phase out emissions, discharges and losses of priority hazardous substances, in surface waters (Article 4(1)(a)(iv)); and to prevent or limit entry of pollutants (as listed in Annex VIII) into groundwaters (Article 4(1)(b)(i)). These objectives are not explicitly included in the proposed characterisation structure above because the measures required to address the risk of not meeting them need to be directed towards managing the contaminants at source, before they gain entry to the water body. They are also required to be universally applied. Notwithstanding that, the characterisation structure will highlight those water bodies at highest risk of not meeting water quality objectives, which will serve as a prioritisation approach for targeting compliance checks against measures to achieve the priority substance objectives.

5 Conclusions

A new integrated approach to WFD characterisation has been developed that identifies water bodies that are At Risk of not meeting their WFD objectives so that they can be prioritised for monitoring and programmes of measures. The approach uses the available monitoring data, including status, trends and distance to threshold assessments, to identify the water bodies At Risk of not meeting their WFD objectives; and then seeks to identify the critical source areas and significant pressures causing the WFD failures in the At Risk water bodies. The framework presents characterisation as an ongoing process so that the monitoring and measures can always be targeted (and adjusted as necessary) towards the water bodies at greatest risk.

A three-tier risk characterisation approach has been developed so that the level of assessment effort is commensurate with the level of risk, and the expensive, resource intensive effort can be directed towards only those areas for which there is a reasonable degree of confidence in the risk characterisation. Tier 1 is largely a screening exercise that it should be possible to automate, and it is at this level that the reporting to the EU is carried out. Tiers 2 and 3 provide the required detail to enable specific measures to be identified and implemented.

The framework facilitates an integrated assessment of linked water bodies by taking a catchment approach, and builds on existing workflows and newly available modelling tools, datasets and IT infrastructure. It also encourages integration of Local Authority, RBD and other State Body data and expertise. Such an approach will assist in making the best use of Ireland's limited resources and will ensure that we can make substantial progress towards meeting the WFD objectives within our existing, and likely future, constraints.

6 Recommendations

A number of recommendations are made to help make further progress in developing characterisation and in the implementation of the WFD.

- Support should be provided for the continued refinement and development of the Catchment Characterisation Tool and the Catchment Modelling Tool, and their integration into WFD characterisation processes.
- The use of trends and distance to threshold assessments in the characterisation process is relatively new. Further research to review, develop and test relevant chemical parameters and biological quality elements would be useful.
- During the discussion sessions, some people felt that the term 'capacity' was synonymous with 'scope for development'. There was general agreement with the concept as a tool for prioritising action but there was some concern that the terminology might send out the wrong message. 'Capacity' is used by the Scottish EPA, but there may be other terms used in other countries, or elsewhere in the literature, that might be more appropriate. For now the terms distance to threshold and capacity are used interchangeably.
- Prioritising measures involves socio-economic and other factors across all levels of government and the community. A methodology should be drafted so that the scientific and political debate on how best to prioritise measures can be commenced.

- Implementing measures in excess of that which is already required under existing legislation, will likely be politically challenging and may mean additional funding and/or incentives is required. Possible funding streams and/or incentive schemes should be investigated.
- The three tiered approach integrates work being carried out in a number of different agencies at local and state levels. Discussions should be initiated with the relevant agencies on the practicalities of implementing and sharing the data required.
- A water body that has been designated as being At Risk and requires a Tier 3 assessment process should be selected to trial a pilot integrated catchment management project. The stakeholders should be fully involved with the problem, the issues and the solutions, so that appropriate measures can be selected and improvements can be made, and measured.

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