Caha Priority Area for Action

Desk Study

Disclaimer:

Although every effort has been made to ensure the accuracy of the material contained in this publication, complete accuracy cannot be guaranteed. The Local Authority Waters Programme (LAWPRO) nor the author(s) accept any responsibility whatsoever for loss or damage occasioned, or claimed to have been occasioned, in part or in full as a consequence of any person acting or refraining from acting, as a result of a matter contained in this publication.

 F02

Table of Contents

List of Figures

List of Tables

Acknowledgements

The authors would like to acknowledge the contribution of Cork County Council staff to this report and thank them for their support of the Local Authority Waters Programme. The Council has carried out a significant amount of work in Caha 020 and Coolkellure Lake in recent years.

Summary

The Caha Priority Area for Action includes two waterbodies: Caha 020 and Coolkellure lake. They are part of Bandon sub-catchment (20 6 Bandon_SC_010) in hydrometric area 20 (Bandon Ilen). There are three other waterbodies in the sub catchment: Caha 010 (High status), Bandon 010 (Good status), Bandon 020 (Good status). They are meeting their WFD objectives and are currently '*Not at Risk'.*

The Caha River rises in County Cork in the Shehy Mountains, flowing east and south joining the Bandon river (Bandon_020) about 4 km north of Dunmanway at Caha Bridge. Caha 020 is a high-status objective waterbody. It was at 'High Status' from 2006 to 2012 and dropped to 'Good status' in 2015. In 2018 the status remained at 'Good'. As such it is '*At risk*' of not meeting its objectives under the Water Framework Directive. It is also one of the 27 catchments included in the Freshwater Pearl Mussel Regulations (SI 269 of 2009). It is failing to meet the conservation objectives for Pearl Mussel under this legislation. A section of the main channel (approx. 3km) falls within the Bandon Special Area of Conservation (SAC).

It is not clear what the issue impacting Caha 020 is. Land use in the catchment consists of pasture and forestry. There is potential for sedimentation of the river substrate from recent forest clear-felling as well as historic quarries in the catchment. Both have been identified as potential significant pressures. Agriculture is primarily low intensity, but there are a few dairy farms in the area. The catchment is characterised by shallow soils, exposed bedrock and high rainfall. As such the potential for diffuse nutrient runoff is high in places. Local catchment assessment will focus on ruling in and out sections of the main channel and tributaries by taking kick samples (small stream impact score) and hydro-chemistry samples.

Coolkellure Lake is a 3.5-hectare (Type 7) lake, located in Coolkellure townland, close to the headwaters of Bandon_020. It is the drinking water source for Dunmanway (abstraction rate of 550 m^3/day). It is currently at 'Moderate' status. It has fluctuated between 'Good' and 'Moderate' status since 2007. Currently, the status (2013-2018) is being determined by total phosphorus. In 2010-2015, the moderate status was driven by the phytoplankton community/potential.

Ecological monitoring in Coolkellure lake indicates a nutrient issue in the lake. Macrophyte and phytoplankton communities both show enrichment. Forestry has been identified as a potential significant issue in the catchment. The lake is bounded by conifer plantation forestry that has been recently clear-felled. Given the proximity to the lake, steep slopes and peaty soils there is the potential for sediment and nutrient runoff to the lake as a result. Local catchment assessment will focus on the tributary streams to assess from where significant issues might be occurring.

1 Background

Table 1-1: Background information on the Caha PAA

Priority Area for Action	Catchment Number	Catchment Name	Sub catchment	Region	Local Authority
Caha	20	Bandon-Ilen	20_6 Bandon_SC_010	Southwest	Cork County Council

Priority Area for Action	No. of *At Risk* WBs	No. of *Review* WBs	No. of dRBMP Prioritised WBs	No of WBs for Status Improvement:		
				2021	2027	Beyond 2027
Caha	2	0	1	0	2	0

Reason for selection	• Failing to meet protected area objectives for Freshwater Pearl Mussel (19 of 27 catchments of S.I. 296 2009). • Bandon rivers trust in the area. • Deteriorated HES objective water body.

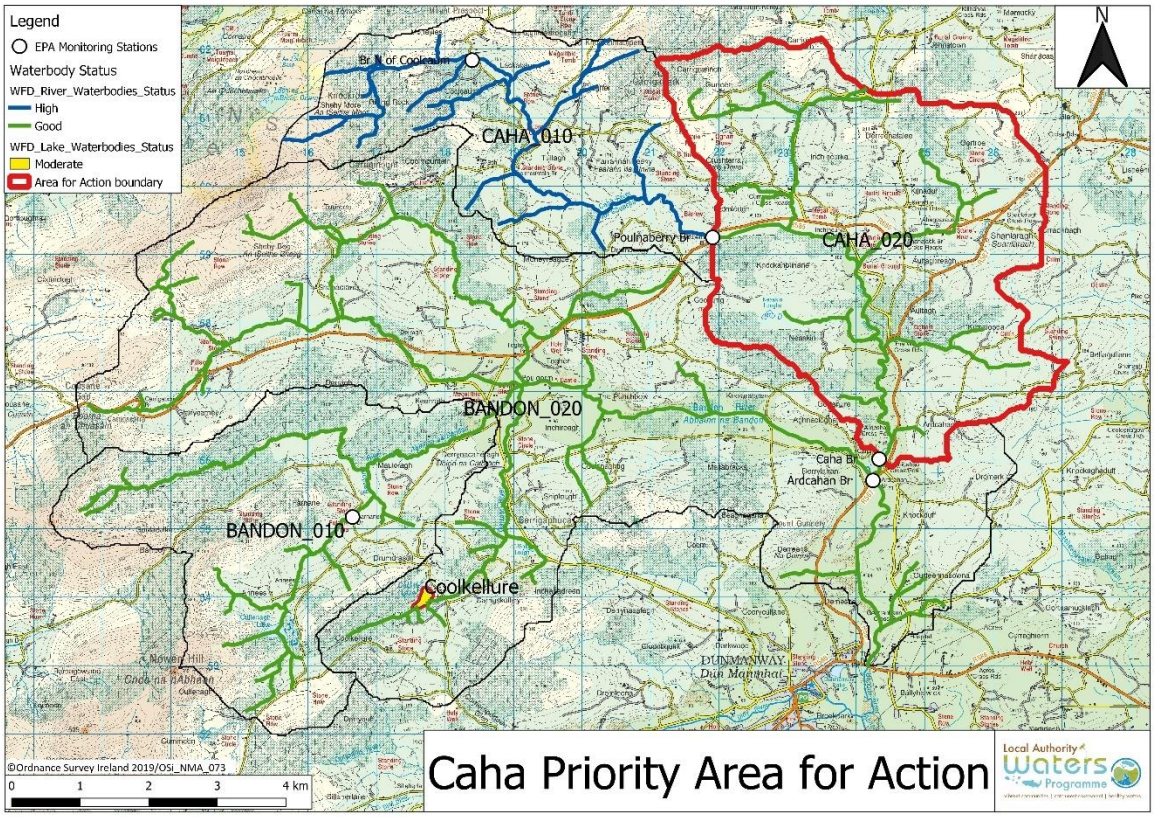


Figure 1-1: Caha Priority Area for Action Ecological Status (2018)

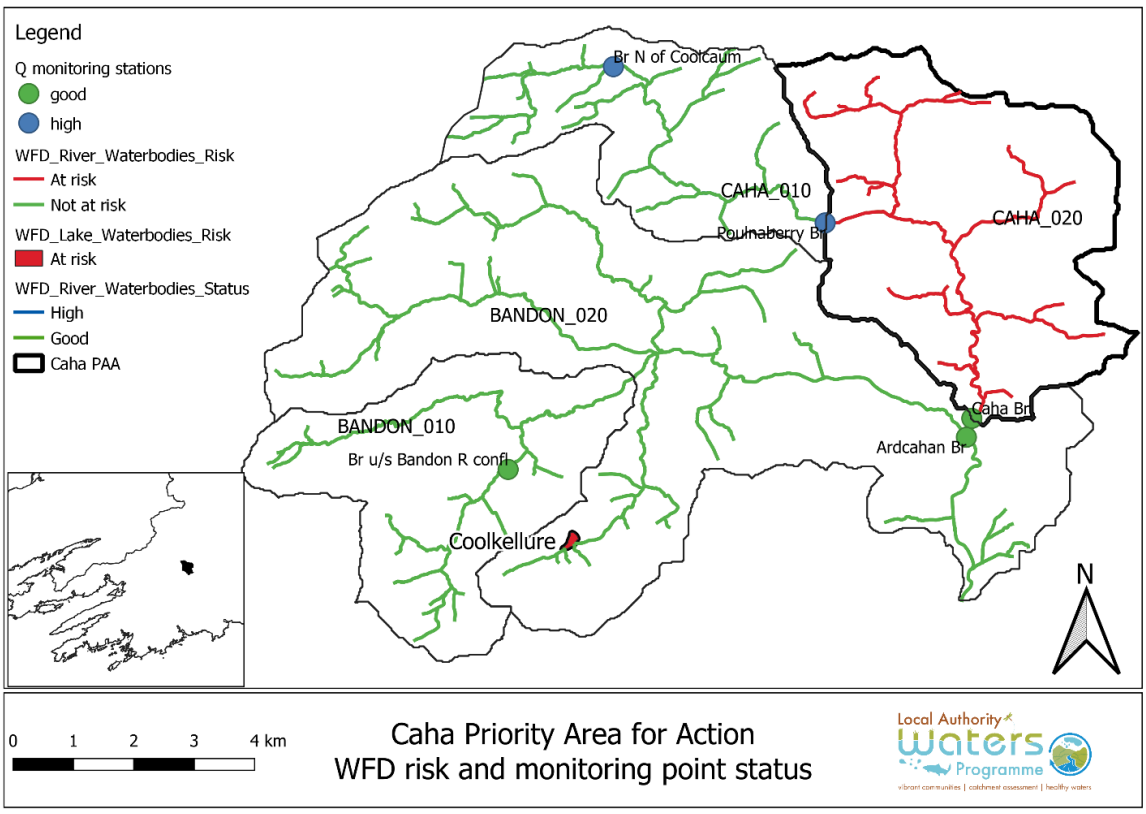


Figure 1-2: Caha Priority Area for Action WFD Risk Status (2015).

Table 1-2: Summary table of individual waterbodies within the Caha PAA

Water body Code	Water body Name	Risk *Use colour codes*	Obj.	Ecological Status				Pressures		
				2009	2012	2015	2018	Category	Subcategory	Sig? (Y/N)
IE_SW_20C010700	Caha 020	At Risk	High	High	High	Good	Good	Extractive Industry	Quarries	Y
								Forestry	Forestry	Y
IE_SW_20_153	Coolkellure Lake	At Risk	Good	Moderate	Good	Moderate	n/a	Forestry	Forestry	Y

EPA 2019

2 Receptor information

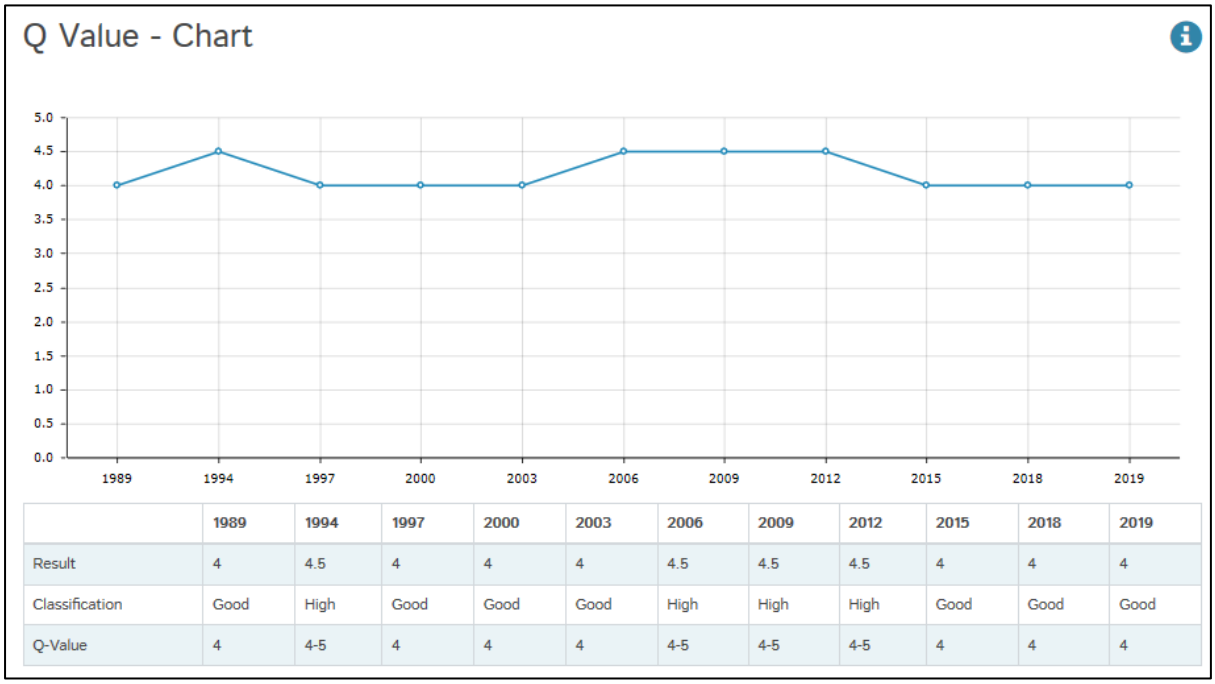
2.1 Overview table

Table 2-1: Receptor information for Caha PAA

		Figures Tables	Caha_010	Caha_020 (includes Cummernamart River)	Coolkellure Lake (on Bandon_020)	Bandon_020
Risk Category		Y	*Not at Risk*	*At Risk*	*At Risk*	*Not at Risk*
Biological Status	**2010-2015**	Y	High	Good	Moderate	Good
	2016-2018		High	Good	Moderate	Good
	trends in Q values **2016-2018 Q value data** **Fish status (where rel)**	Y	High (Q4-5) from 1994-2018, except in 2003 (Good) and 2009 (Good)	High (Q4-5) 2006-2012. Good (Q4) 2015-2018. (Fig. 2.1)	Moderate (2009) (Phytoplankton) Good (2012) Moderate (2015) (Phytoplankton)	Good (Q4) since 1989
Hydrochemistry Data						
Ortho-P (mg/l P)	**Baseline** **indicative quality** **Trends - significant?** **Dist to threshold**	Y	No data	No data	(2017) 0.027 mg/l total P (Fig. 2.2) (Moderate Quality) (Fig. 2-2) Increasing trend (2015-2019) Far	(2017) 0.025 mg/l Good No Far
NH4-N (mg/l N)	**Baseline** **indicative quality** **Trends - significant?** **Dist to threshold**	N	No data	No data	(2017) 0.046 mg/l NH4-N Good No Far	(2017) 0.030 mg/l NH4-N High No Near
TON (mg/l N)	**Baseline** **indicative quality** **Trends - significant?** **Dist to threshold**	N	No data	No data	(2017) 0.823 mg/l n/a n/a	(2012) 3.67 mg/l n/a n/a
Chlorophyll (µg/l)	**Baseline** **indicative quality** **Trends - significant?** **Dist to threshold**	Y	n/a	n/a	(2017) 9.053 µg/l (Fig. 2.2 below) Good/ Moderate No (fluctuates between High, Good and moderate) Near	n/a

	Figures Tables	Caha_010	Caha_020 (includes Cummernamart River)	Coolkellure Lake (on Bandon_020)	Bandon_020
Supporting Conditions **Chemical conditions?** **Oxygenation Conditions** **Acidification Conditions**	N	No data	No data	Supporting chemical conditions are indicative of Good or High Quality	No data
Hydromorphology					
RHAT score	N	No data	High (0.83)	n/a	No data
Evidence of Arterial drainage	N	None	None	None	None
Ecological Status (2010–2015)	Y	High	Good	Moderate	Good
Trends (2010-2015)	N	No change	Deteriorated	No change	No change
Protected Areas	Y		Bandon River SAC	Public drinking water supply for Dunmanway	Bandon River SAC
WFD Objective	N	High	High	Good	Good
EPA biologist notes (if any)			Only one sensitive taxon present. 15-minute search found no freshwater pearl mussels. Moderate siltation.	Ignore macrophyte score here because of local conditions (steep slope etc). Chlorophyll results indicate moderate status. EPA monitoring data indicates that the lake is stratified with extremely low dissolved oxygen levels (<0.5mg/l) reported within 4m of the lake surface during summer sampling.	
Significant issue/impact for receptor (e.g. PO_4)			Siltation, ortho-P	Total P, Chlorophyll A	

2.2 Q values in Caha 020



	1989	1994	1997	2000	2003	2006	2009	2012	2015	2018	2019
Result	4	4.5	4	4	4	4.5	4.5	4.5	4	4	4
Classification	Good	High	Good	Good	Good	High	High	High	Good	Good	Good
Q-Value	4	4-5	4	4	4	4-5	4-5	4-5	4	4	4

Figure 2-1: Caha 020 Q values at Caha Bridge EPA monitoring site EPA 2019

2.3 Hydrochemistry in Coolkellure lake

The ecological status of Coolkellure has been driven by Total P (2013-2018) and phytoplankton (2010-2015). Total Phosphorus has been increasing since 2012 and exceeds the EQS (0.025 mg/l). Chlorophyll-A has decreased in recent years and since 2014 has been indicative of High-Good conditions.

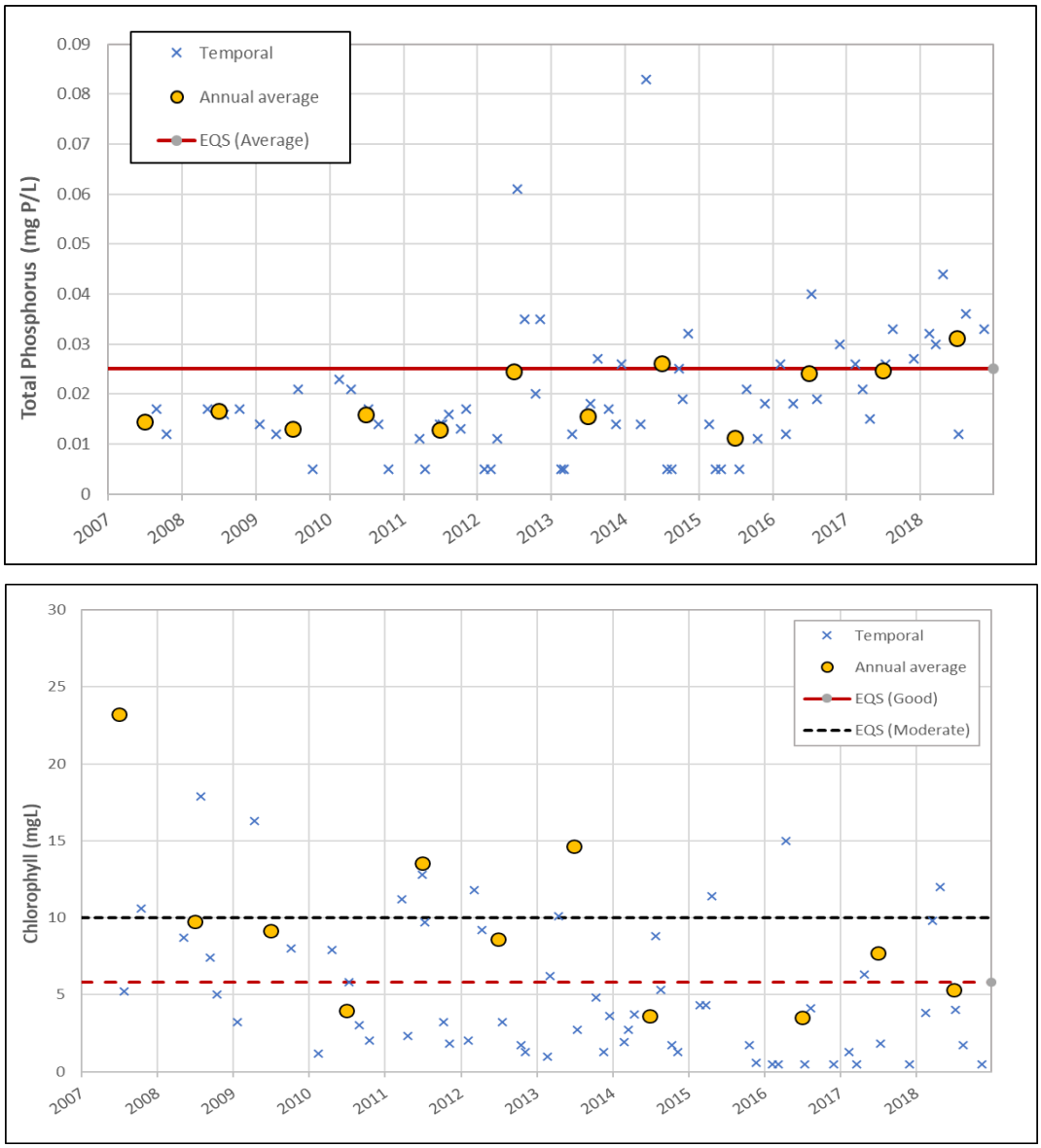


Figure 2-2: Observations of Total Phosphorus (top) and Chlorophyll (bottom) in Coolkellure lake. Note: some outliers in Chlorophyll not shown.

EPA 2019

2.4 Protected Areas

2.4.1 Bandon River SAC

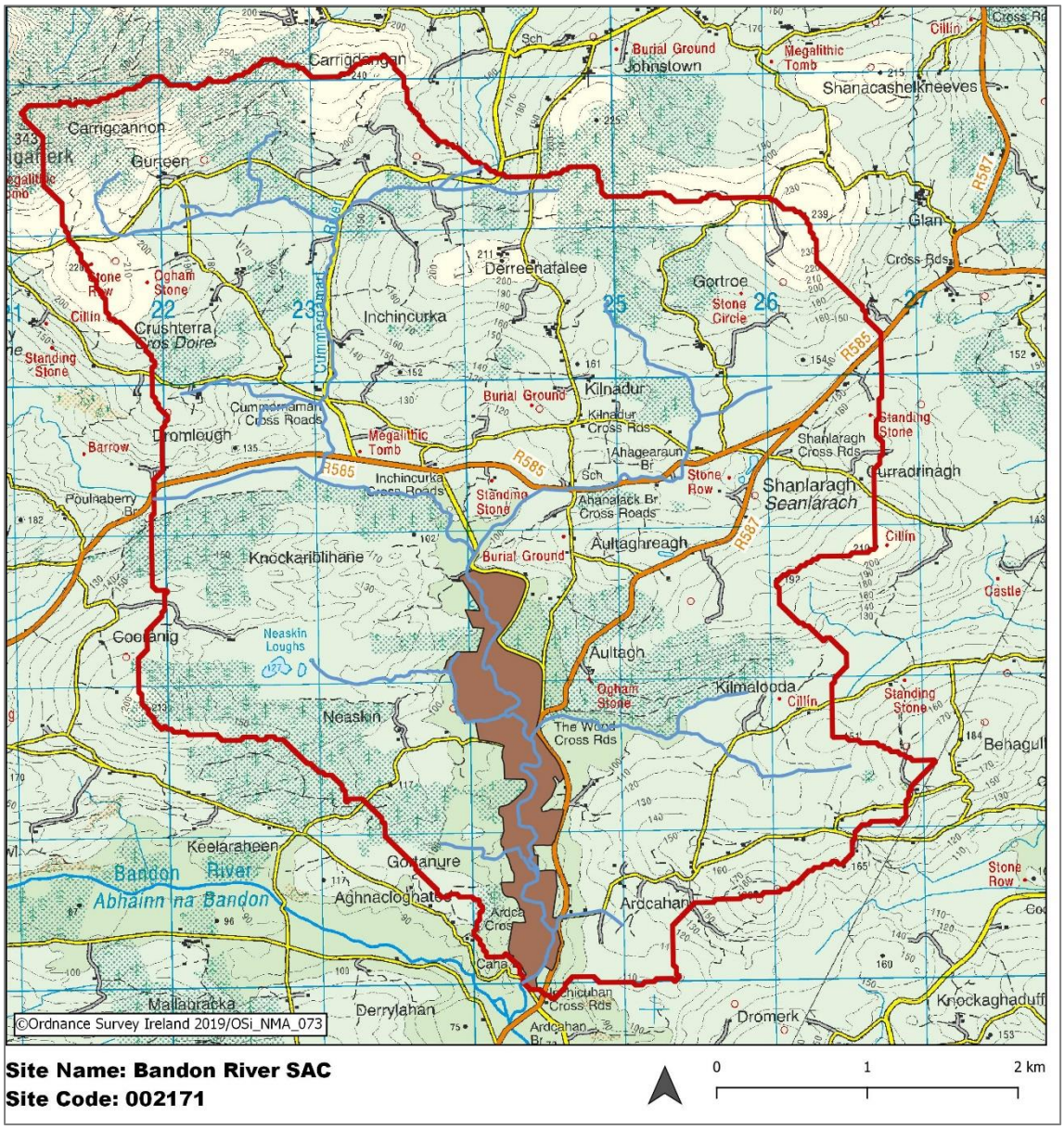


Figure 2-3: Bandon River SAC within Caha 020.

The Bandon River SAC consists of relatively short adjoining stretches of the Bandon and Caha Rivers. The site is a Special Area of Conservation (SAC) selected for the following habitats and/or species listed on Annex I / II of the E.U. Habitats Directive (* = priority; numbers in brackets are Natura 2000 codes):

[3260] Floating River Vegetation

[91E0] Alluvial Forests*

[1029] Freshwater Pearl Mussel (Margaritifera margaritifera)

[1096] Brook Lamprey (Lampetra planeri)

NPWS 2013

3 Significant pressures

3.1 Initial EPA characterisation

Table 3-1: Initial EPA characterisation

Water body Name	Id	Category	Subcategory	Name	Significant?	Pressure & Impact details
Caha 020	WBP0004983	Forestry	Forestry	n/a	Yes	Altered habitat due to Morphological changes
	WBP0004982	Extractive Industry	Quarries	n/a	Yes	Altered habitat due to Morphological changes
Coolkellure Lake	WBP0004980	Forestry	Forestry	n/a	Yes	Nutrient Pollution

EPA 2018

3.2 Conclusion on the Significant Pressures:

The pressures in both catchments relate to land use rather than point sources. Forestry and quarries have been identified as significant pressures in Caha 020. There have been recent felling operations and the poor drainage, peaty soils and high rainfall in the catchment mean that there is a risk of nutrient and sediment runoff to the river. There are two quarries that are no longer operational. Both could have been a source of sediment to the river in the past. Farming is not intensive—with only a handful dairy farms in the area. There are few other pressures in the catchment. Overall, it is not possible to conclude on the significant pressures as the significant issue (siltation, nutrients) in the river is not known.

Nutrient enrichment by phosphorus is the issue in Coolkellure lake. This could have arisen due to phosphorus runoff from recent clear-felling around the lake as well as loss of peaty sediment into the lake. Agriculture may also be a significant pressure on Coolkellure Lake from poorly draining soils on one side of the lake.

4 Pathways information (diffuse pollution)

4.1 Caha 020

Caha 020 can be divided into compartments based on soil type (Table 3-1). The geology of the catchment is entirely Old Red Sandstone and acts as a poor or locally important aquifer only. Soils are thin with depth to bedrock less than 3m almost across the entire catchment (Appendix A). The soil types acidic mineral – either shallow well-draining or peaty poorly draining. There are also localised areas of peat and alluvial soil along the river (Fig. 4-1). Large parts of the catchment are under forestry or scrub. The high-risk areas for diffuse P runoff are on those poorly draining soils in agriculture (Fig. 4-2).

Table 4-1: Caha 020 pathways conceptual model

	Map	Caha 020			
factor	**Y/N**	**Compartment 1**	**Compartment 2**	**Compartment 3**	**Compartment 4**
Aquifer type	N	Ll (locally important) and Pl (poor aquifer)			
Topography	N	100m to 240m with rocky outcrops and exposed bedrock throughout			
Bedrock unit	N	Devonian Old Red Sandstone			
GWB	N	Bandon GWB			
Gwb flowpath	N	Flow occurs along fractures, joints and major faults. Flows in the aquifer are generally concentrated in a thin zone at the top of the rock, although deeper groundwater flows along faults and major fractures			
Subsoil type	Y	Primarily bedrock outcrop or subcrop and Devonian sandstone till. Some pockets of peat, alluvium and gravel.			
Subsoil permeability	Y	Depth to bedrock <3m in almost the whole catchment, a few pockets of moderate and high permeability subsoil			
Groundwater vulnerability	Y	X, Extreme and High			
Soil type	Y	Poorly draining peaty acid mineral soils	Shallow and deep well drained mineral soils	Blanket peat	Alluvial
Soil drainage	Y	poorly draining	well-draining	poorly draining	poorly draining
Po4 susceptibility (surface)	N	high	moderate to low	high	high
No3 susceptibility (surface)	N	low	high to very high	low	low
No3 susceptibility (sub surface)	N	very low			
Po4 PIP (Surface water)	Y	High in agricultural areas (low in of forestry and scrub)	moderate to low	high	high
No3 pip (Surface water)	N	low	high to very high	low	low
No3 pip (ground water)	N	very low			
likely main pathways	N	surface runoff and land drains, bedrock outcrops	shallow g/w flow in subsoil	surface runoff and drains, bedrock outcrops	
likely CSAs	N	near watercourse in areas of improved land	well-draining hill slopes improved for agriculture	near watercourse in areas of improved land	

From *Desk Studies for Areas for Action, EPA Recommendations. Version 3, January 2019*

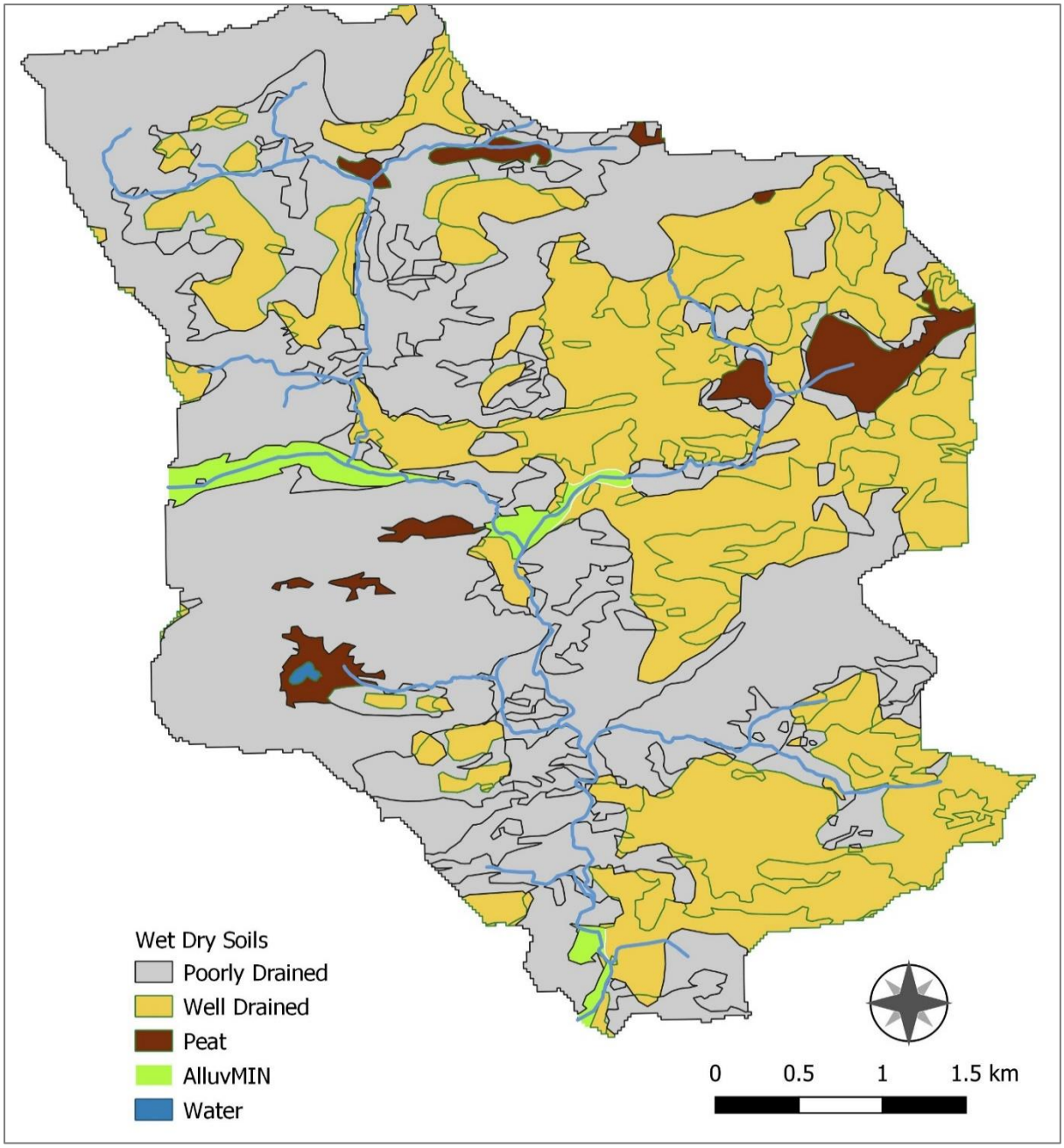


Figure 4-1: Soil drainage class in Caha 020 (source: Teagasc/EPA)

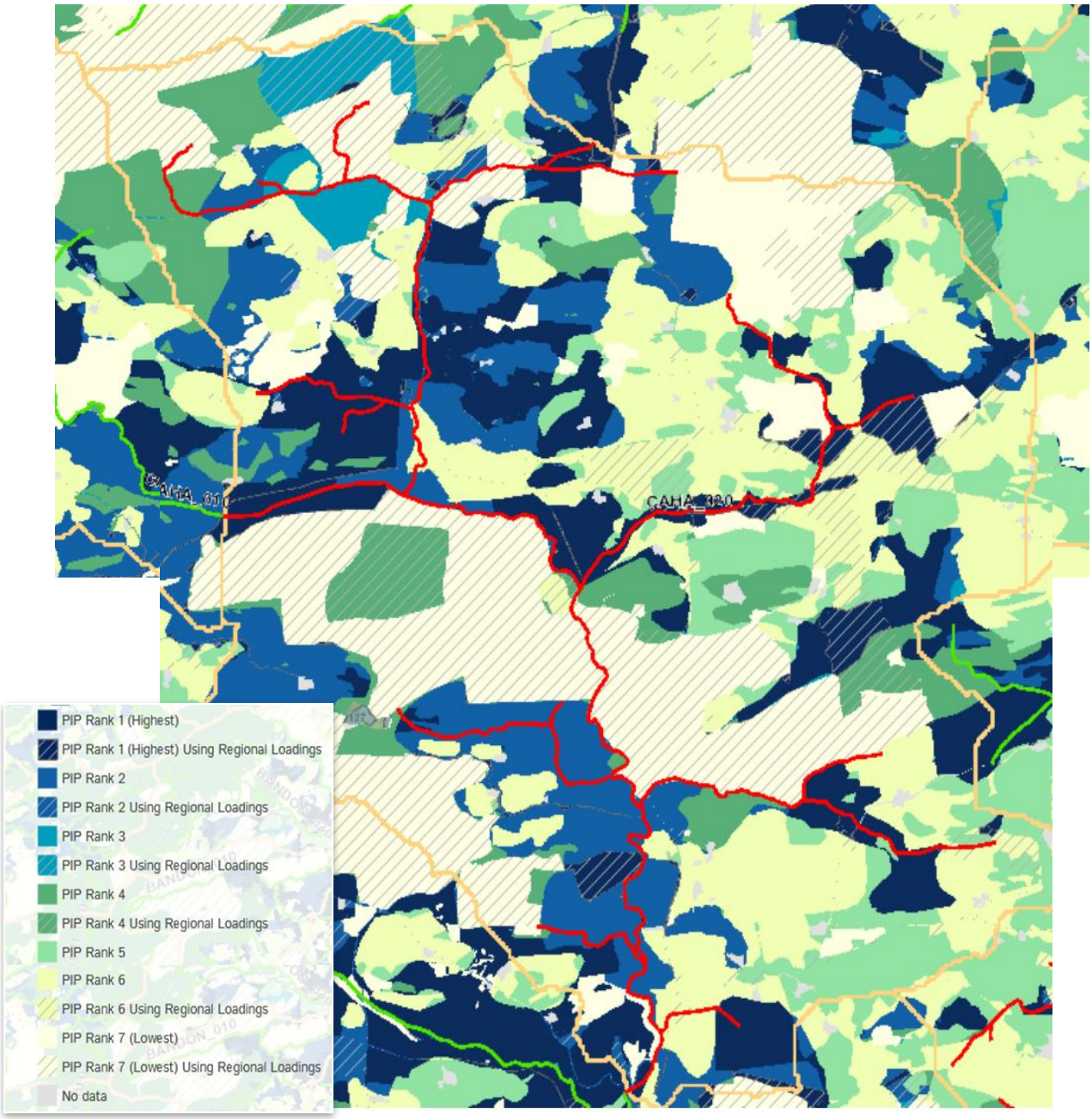


Figure 4-2: Surface water receptor phosphorus pollutant impact potential (PIP) map. EPA 2018

4.2 Coolkellure lake

Pathways for diffuse runoff can be divided into three compartments in the Coolkellure lake basin (Table 4-2). The north and west side of the lake is bounded by a steep rock outcrop – soils are thin and primarily of peat (compartment 1) (Fig. 4-3). On the southern side – soils are freely draining and underlain by sandstone till and gravel in places (compartment 2). The risk of diffuse P runoff here is low (Fig. 4-4). On the south-eastern side (compartment 3) soils are poorly draining and represent the greatest risk for P diffuse runoff.

Table 4-2: Coolkellure lake pathways conceptual model

	Map	Coolkellure lake		
factor	**Y/N**	**Compartment 1**	**Compartment 2**	**Compartment 3**
Aquifer type	N	Pl: Poor aquifer which is generally unproductive except for local zone		
Topography	N	Rocky escarpment (240 m) on west side, gradual slope on east and south rising steeply to 250m		
Bedrock unit	N	Devonian Old Red Sandstone		
GWB	N	Bandon GWB		
Gwb flowpath	N	Flow occurs along fractures, joints and major faults. Flows in the aquifer are generally concentrated in a thin zone at the top of the rock, although deeper groundwater flows along faults and major fractures		
Subsoil type	Y	n/a depth to bedrock <3m	Devonian sandstone till	Devonian sandstone gravel and till
Subsoil permeability	Y	n/a depth to bedrock <3m	Moderate	Moderate
Groundwater vulnerability	Y	X, Extreme and High	Moderate	Moderate
Soil type	Y	Shallow peat/rock	Acid Mineral deep well drained soils	Acid mineral poorly draining soils
Po4 susceptibility (surface)	N	n/a	low	high
No3 susceptibility (surface)	N	low	moderate to high	low
No3 susceptibility (sub surface)	N	low		
Po4 PIP (Surface water)	Y	high	high	moderate to low
No3 pip (Surface water)	N	low	low	high
No3 pip (ground water)	N	low		
likely main pathways	N	surface runoff from rock	shallow groundwater	near surface flow overland or in drains
likely CSAs	N	felled areas on lake boundary	well drained soils and subsoils in agricultural use	waterlogged soils with direct connection to lake via drains

From *Desk Studies for Areas for Action, EPA Recommendations. Version 3, January 2019*

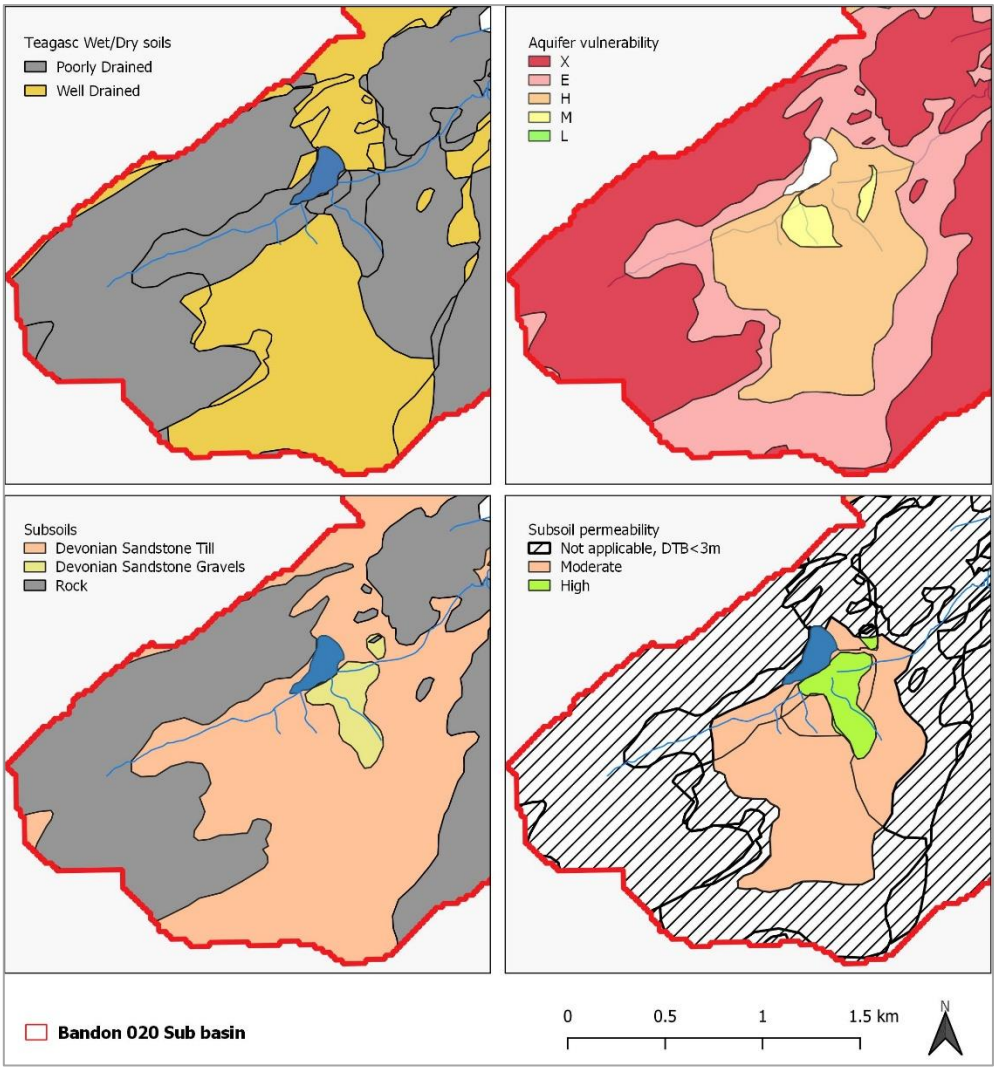


Figure 4-3: Geophysical setting for Coolkellure lake catchment EPA 2018

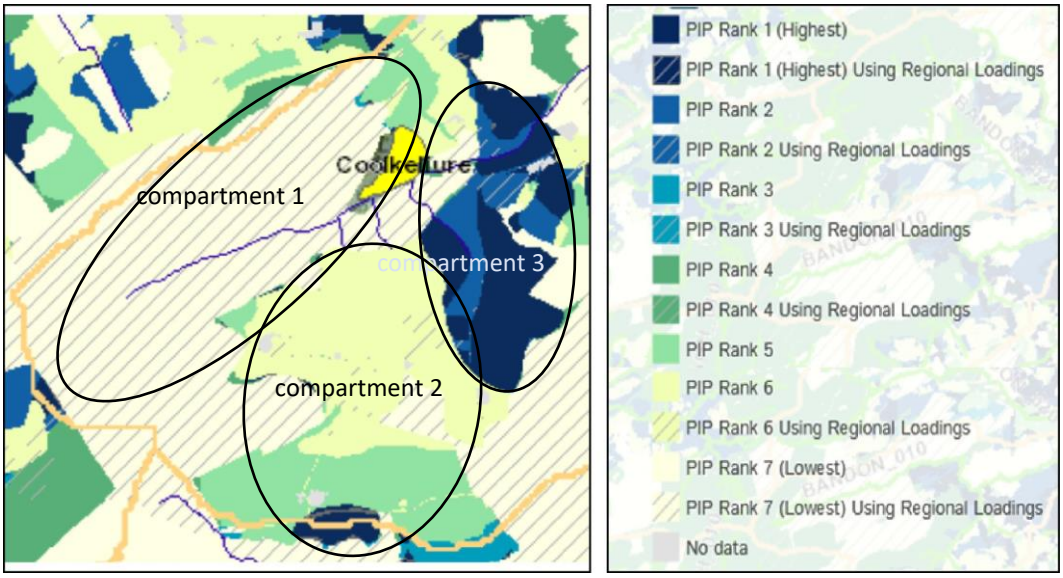


Figure 4-4: Conceptual model for diffuse nutrient pathways in Coolkellure lake EPA 2018

5 Interim conclusions on the PAA

The Caha Priority Area for Action includes two waterbodies: Caha 020 and Coolkellure lake (in Bandon 020). They are part of Bandon sub-catchment (20 6 Bandon_SC_010) in Hydrometric Area 20 (Bandon Ilen).

Caha 020

- Deteriorated in ecological status from 'High' to 'Good' in 2015. Remained at 'Good' in 2018.
- High status objective waterbody '*At Risk*' of not meeting its WFD objectives.
- Freshwater Pearl Mussel catchment not meeting its objectives under SI 296 (2009)
- Ecological status is determined by macro invertebrate Q value at Caha bridge.
- No Hydrochemistry; however, similar waterbodies (e.g. Bandon 020) have low nutrient concentrations
- Significant cannot be determined without hydrochemical data
- Significant pressures from initial characterisation are Quarries and Forestry (felling)
- Pathways for diffuse phosphorus runoff include poorly draining mineral soils in agricultural use. However, most of the farms are extensive and lowly stocked.
- Shallow soil and near surface bedrock result in rapid runoff and risk of bank erosion.

Coolkellure lake

- Coolkellure Lake is a 3.5-hectare (Type 7) lake, located in Coolkellure townland, close to the headwaters of Bandon_020.
- Currently at 'Moderate' status (2015). It has fluctuated between 'Good' and 'Moderate' status in recent years.
- The status is determined by the biological quality element of phytoplankton community/potential, which indicates a nutrient issue in the lake.
- The concentration of Total Phosphorus has been increasing in the lake in recent years (2016-2018).
- It is the drinking water source for Dunmanway (abstraction rate of 550m3/day).
- Significant pressure is forestry. The conifer plantation surrounding the lake was felled in recent years.
- Steep slopes, near surface bedrock and peaty soils increase the potential for sediment and nutrient runoff to the lake as a result of clearfelling.
- Local catchment assessment will initially focus on inflow streams to establish if forestry is still a pressure or if other pressures e.g. agriculture are significant.
- More in depth assessment of lake turnover and sediment bound phosphorus maybe required to address legacy inputs.

6 Workplan

6.1 EPA further characterisation actions

WB Name	Id	Action	Responsible Organisation	Further Characterisation Action details
Caha 020	FC002798	IA8 High status RWB pressures	Local Authority Waters Programme (LAWPRO)	Focus on sources of sediment from forestry and quarries.
Coolkellure lake	FC002799	IA1 Provision of Information	Environmental Protection Agency	EPA to address felling practices and maintenance of adequate buffer strips with Forest Service.
	FC002800	IA9 Lake pressures	Local Authority Waters Programme (LAWPRO)	Confirm that forestry is the significant pressure and report this back to the Forest Service, via the EPA.

EPA 2018

6.2 Additional information requirements

- Felling records needed for Coolkellure lake and Caha_020
- Additional information from Cork Co Co on quarry discharges in Caha 020

6.3 Field Assessment

Caha 020

- SSIS and physico chemical sampling at points outlined in Fig. 6-1
- Assess potential sediment runoff from point sources at quarries and forest clear-felling
- Otherwise focus on diffuse nutrient runoff from high pip areas

Coolkellure Lake

- Check land use to the north of the catchment to confirm whether there is commercial forestry here. Felling records are also important.
- Undertake SSIS on each of the inflow streams flowing into the lake for sediment and nutrient issues (Fig. 6-2). Nutrient monitoring may be required where SSIS results indicate an impact.

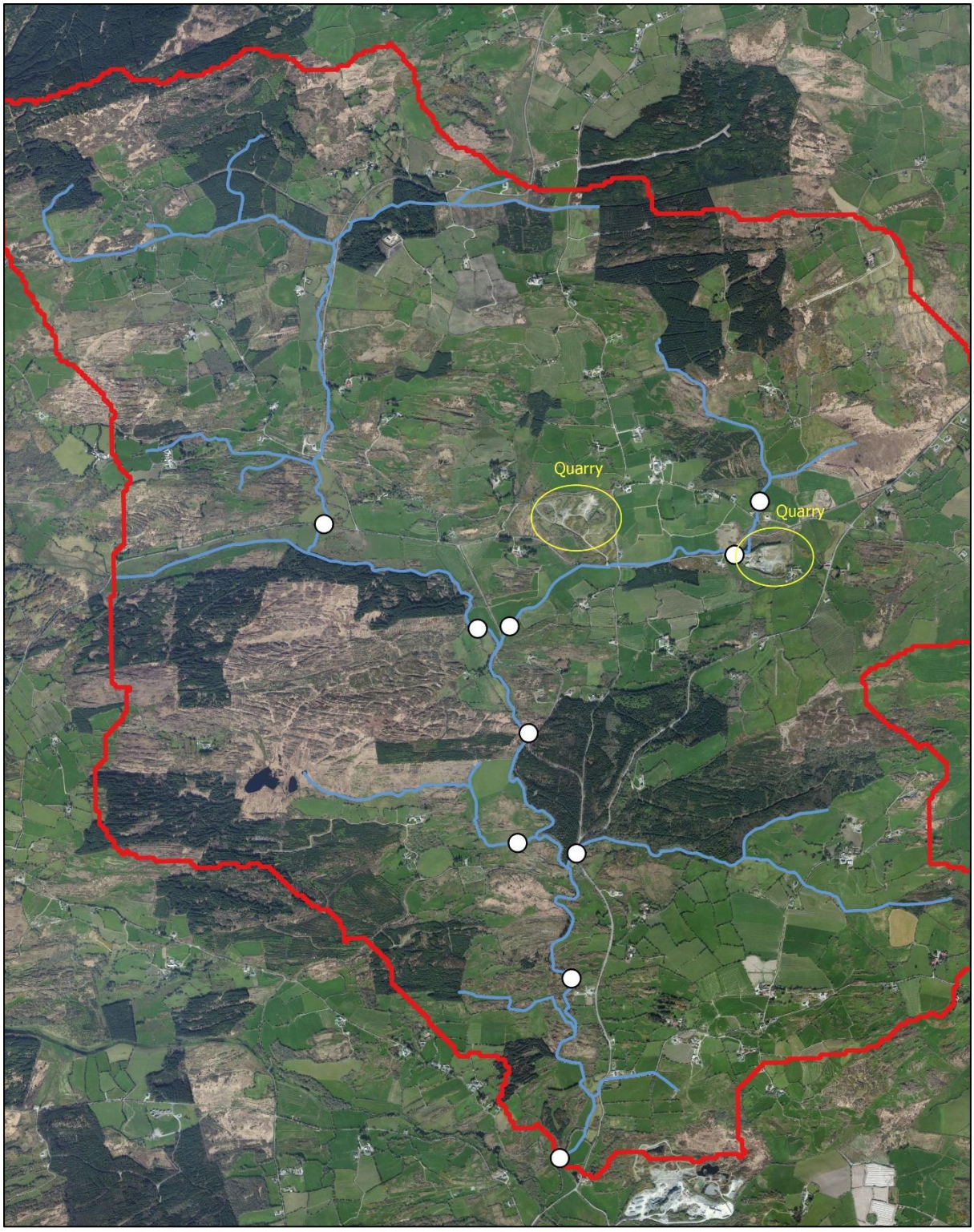


Figure 6-1: Sampling points for SSIS in Caha 020.

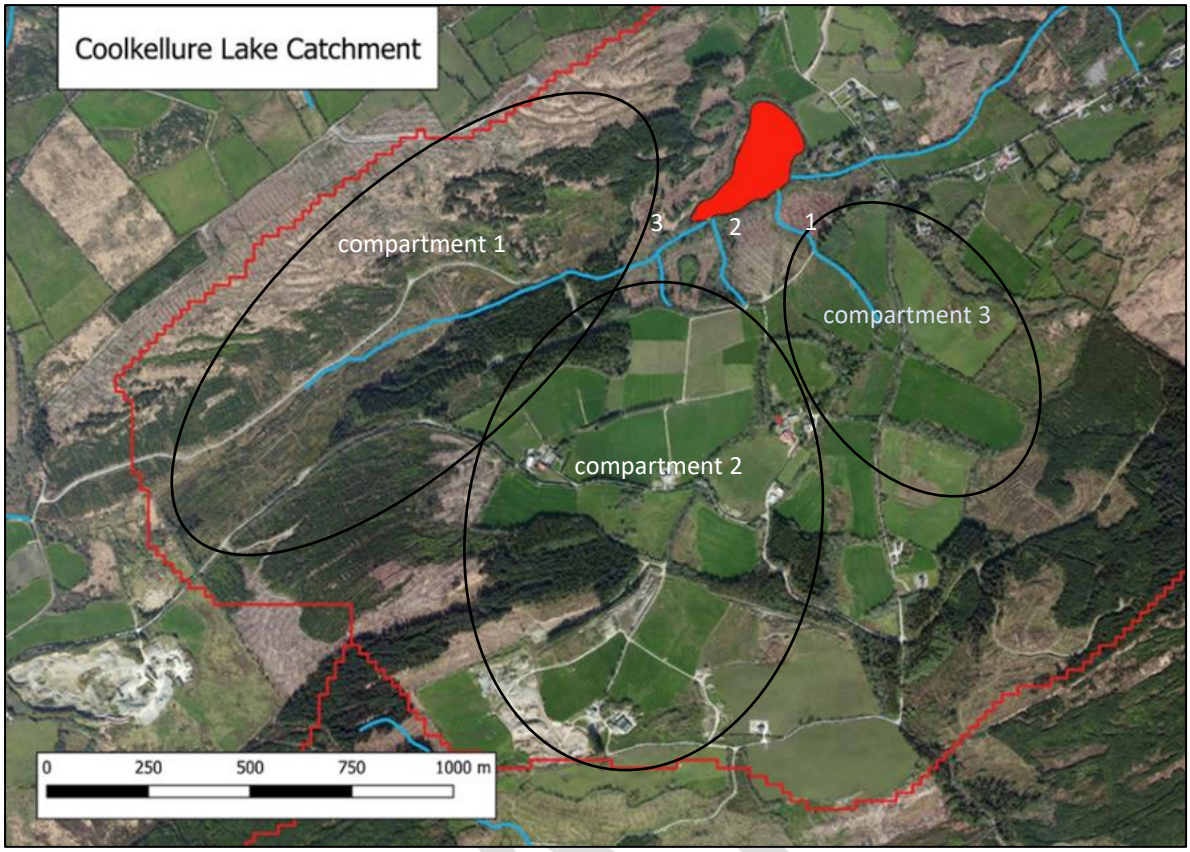


Figure 6-2: Inflow streams (1 to 3) for SSIS as part of local catchment assessment.

7 Review of possible mitigation options

Possible mitigation options include interpreting nutrient and sediment pathways to watercourses. Given the high rainfall and surface driven flow paths, this would involve buffer margins along waterways and restoring/enhancing retention within the catchment through wet grassland and peat habitat management and/or the use of alluvial/riparian woodland.

8 Communications

A public meeting was held in Dunmanway on 6th December 2018. Thirty three people attended the meeting, in addition to LAWPRO and ASSAP staff. Attendees were interested in the type of monitoring that is undertaken, including the EPA WFD monitoring programme. Questions were asked about sediment, where it arises, how it travels and how it impacts the freshwater pearl mussel. Windfarms as a pressure were also discussed, as was forestry and appropriate setback distances. Questions were asked about agriculture, what types of measures would be proposed and how these can be funded.

Appendix A: Geophysical characteristics of Caha 020 catchment

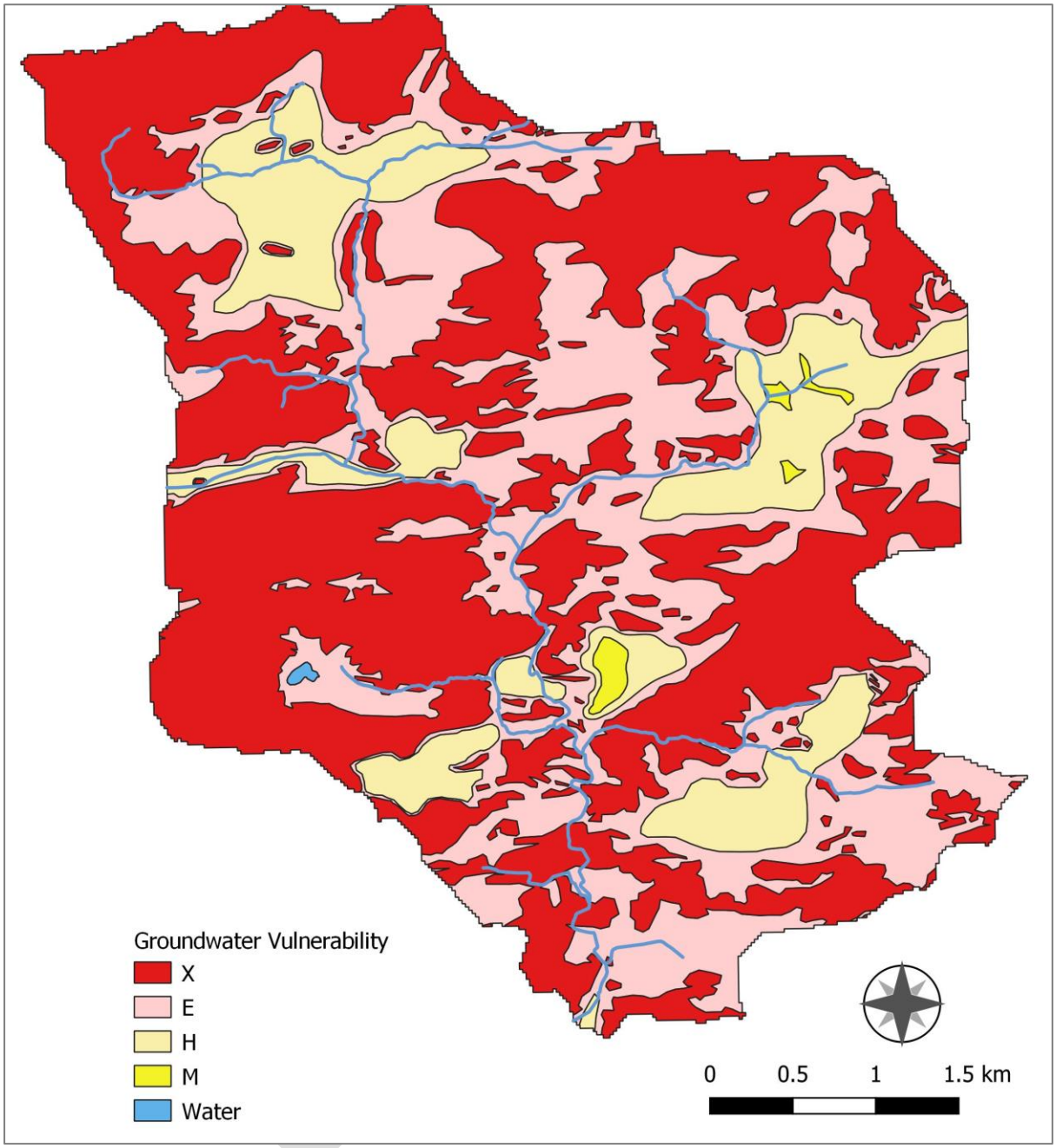


Figure A-1: Groundwater vulnerability (GSI)

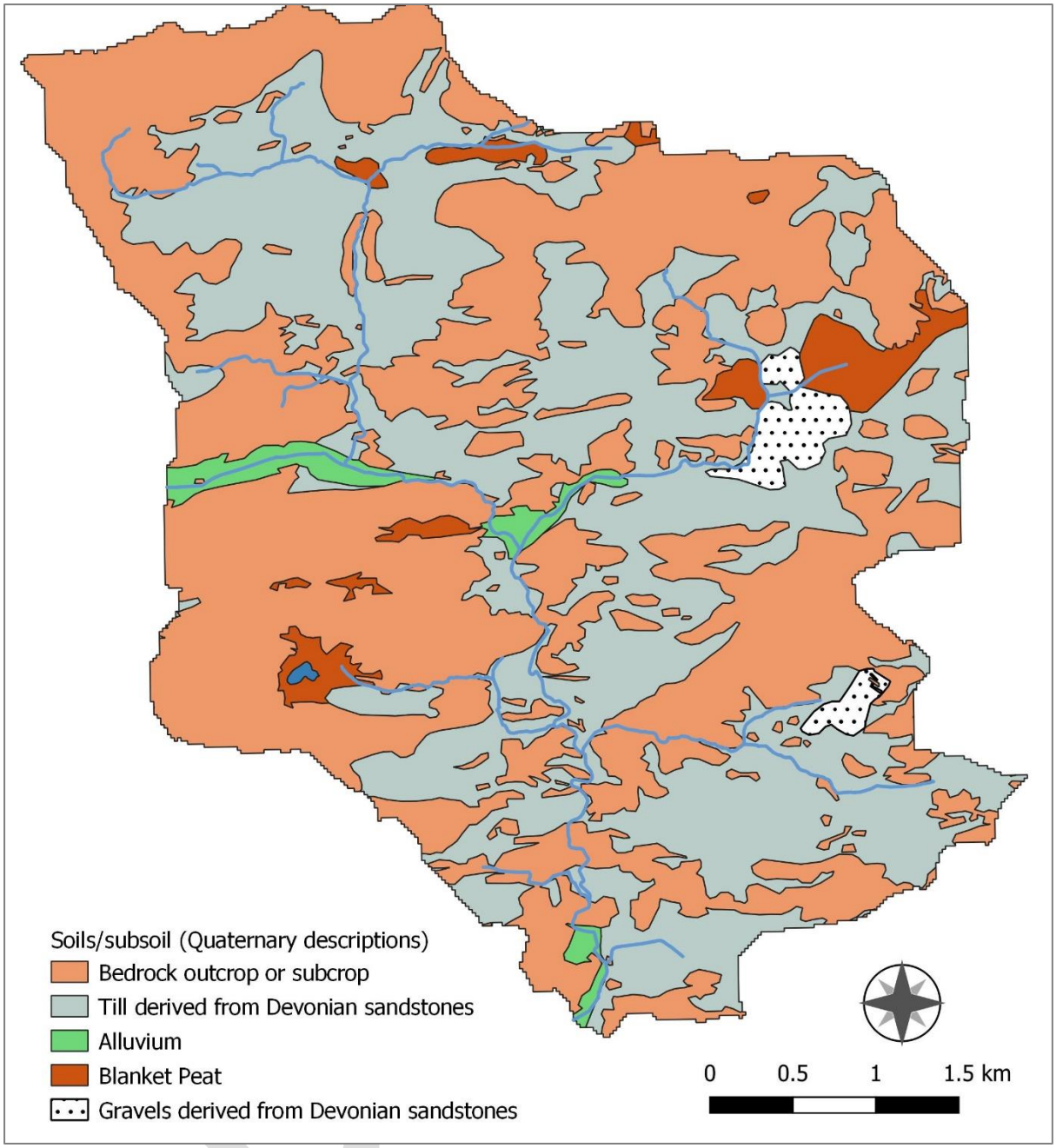


Figure A-2: Subsoils (Teagasc/EPA)

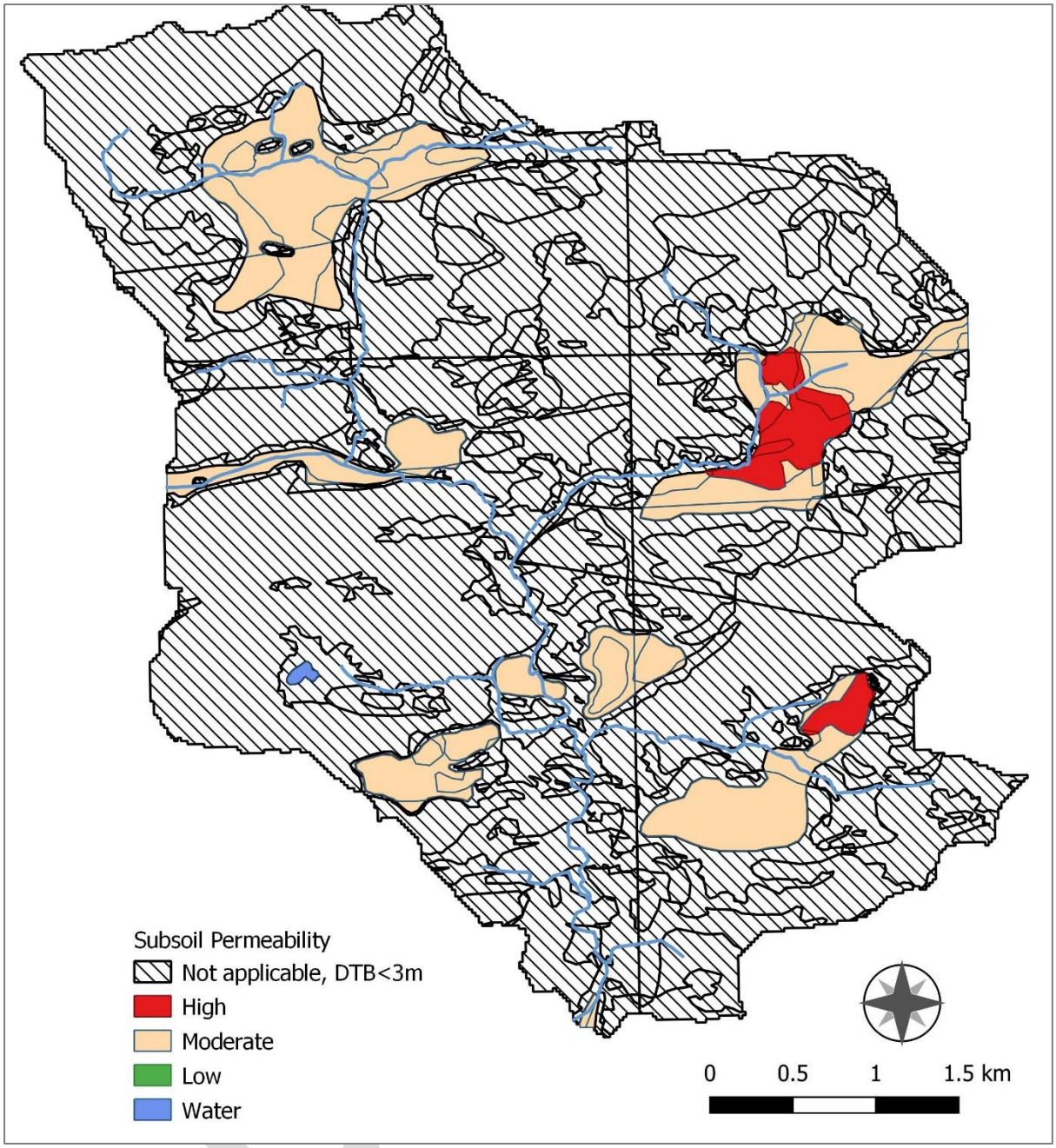


Figure A-3: Subsoil permeability (GSI)

Appendix B: Coolkellure lake hydrology and hydromorphology

- Lake hydraulic residence time is calculated by dividing lake volume by Q50 (50 percentile inflow to the lake).
- Lake volume was calculated from lake area and mean lake depth. Lake area is 3.58 hectares. Mean lake depth is 5m, therefore lake volume is 179,000m3. Mean depth and bathymetry information were provided by the EPA (see bathymetry map below).
- Estimated Q50 inflow to the lake of 0.066m3/second (this excludes groundwater inputs). (CDM, 2009).
- Using the Q50 hydraulic input (0.066m3/sec) from the CDM report, a theoretical lake residence time of 31 days is obtained. The actual residence time will be increased slightly due to the drinking water abstraction (<10% of Q50 inflow) and may be reduced slightly due to groundwater inputs.
- EPA ecological monitoring indicates that the lake is often anoxic at depth suggesting that stratification occurs. This would mean that residence time is shorter for water moving through the upper strata of the system.

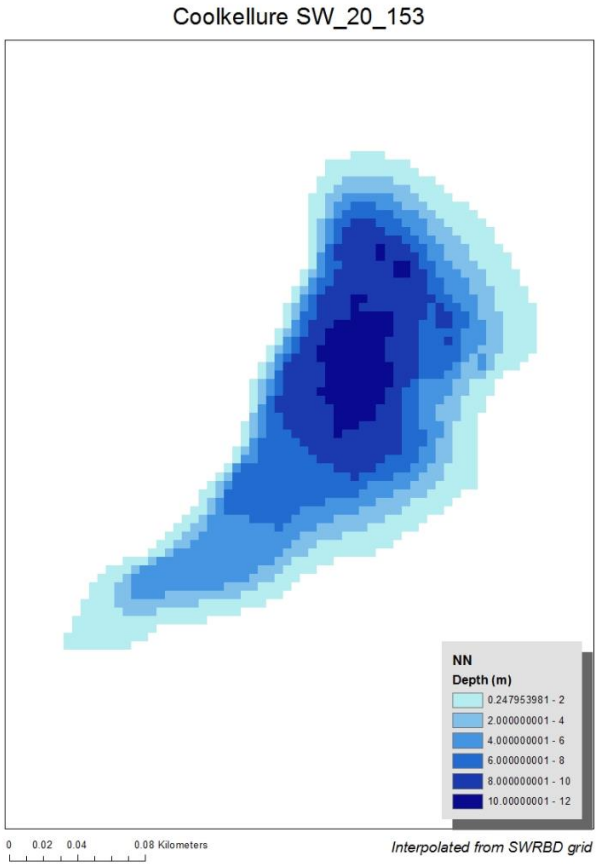


Figure B-1: Coolkellure lake bathymetry (EPA)

Information from the older OSI maps indicates that the lake may have been deepened in the past. It now covers a smaller area than was shown on the old 6" maps and an adjacent much smaller waterbody appears to have been drained into the lake (see Figure B-2 below).

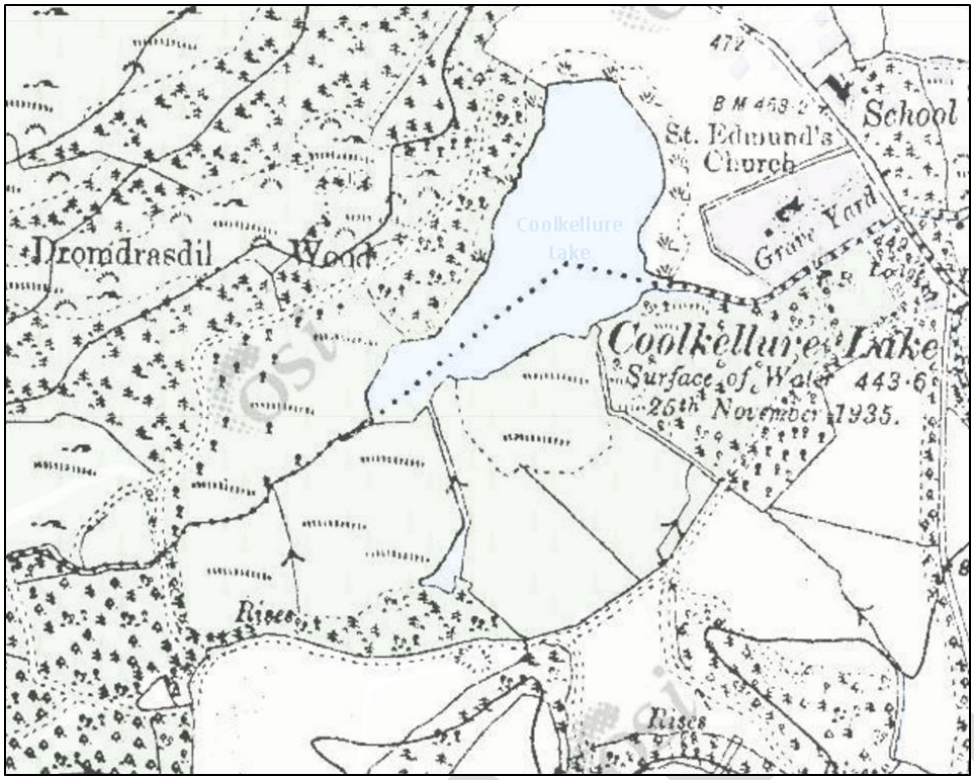


Figure B-2: OSI 6" map, www.osi.ie accessed 30th January 2019

Appendix C: Coolkellure lake seasonal hydrochemistry

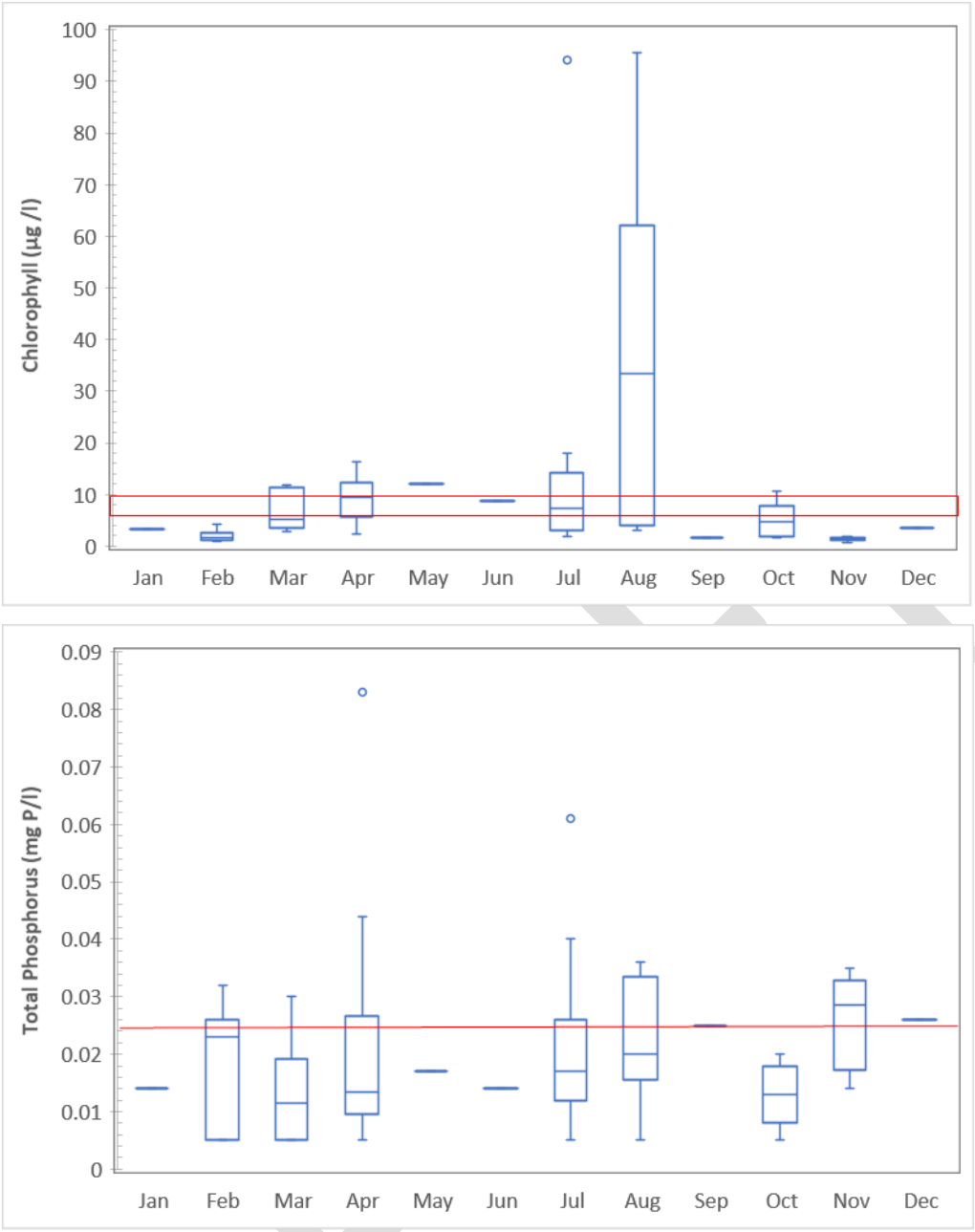


Figure C-1: Chlorophyll and total phosphorus concentrations by month in Coolkellure lake. Red lines indicate threshold between 'good' and 'moderate' status