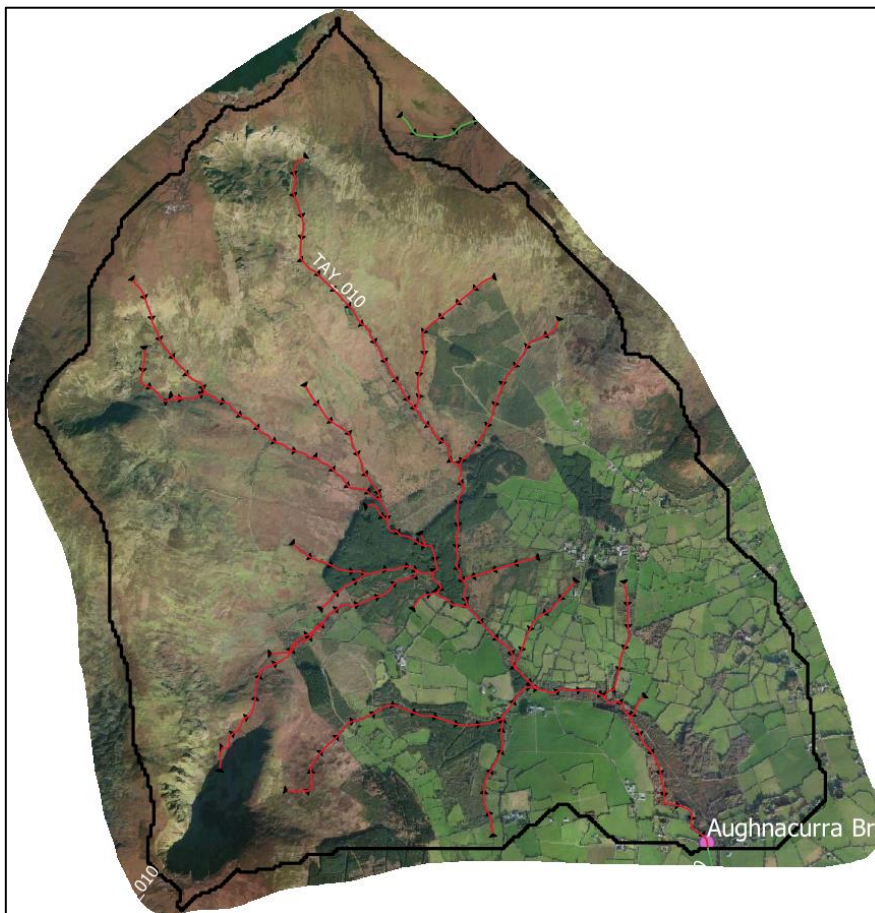


Tay


Priority Area for Action Desk Study (AFA0171)

Philip Murphy



Document Control Sheet

LA Waters Programme Office	Clonmel
Document Title	Tay Priority Area for Action Desk Study
Document No.	South East Rp AFA0171_F01

Date	Version	Author	Reviewer
30/10/2018	F01	Philip Murphy	Ruth Hennessy 

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. All or part of this publication may be reproduced without further permission, provided the source is acknowledged

Contents

1	Tay background.....	1
1.1	Reasons for Selection.....	1
2	Receptor Information and Assessment	1
2.1	Tay_010.....	1
3	Significant Pressures	6
3.1	Tay_010.....	6
4	Pathway Information and Analysis	9
4.1	Overview of pathway information.....	9
4.2	Pathway analysis.....	9
4.2.1	Aquifers and bedrock.....	9
4.2.2	Karst features and/or sand and gravel aquifers	9
4.2.3	Soil & subsoil	9
4.2.4	Pathways.....	9
5	Interim Conclusion.....	12
5.1	Tay_010.....	12
6	Work Plan.....	13
6.1	Sampling plan.....	13
7	Review of Mitigation Options	16
7.1	Suggestions pre-fieldwork	16
8	Cushcam background.....	17
8.1	Reasons for Selection.....	17
9	Receptor Information and Assessment	18
9.1	Cushcam_010.....	19
9.1.1	Hydrochemistry data.....	19
9.1.2	Hydromorphology.....	19
9.1.3	Protected areas.....	19
10	Significant Pressures	20
10.1	Cushcam_010.....	20
10.1.1	Agriculture.....	20
10.1.2	Forestry	20
11	Pathway Information and Analysis	23
11.1	Overview of pathway information.....	23
11.2	Pathway analysis.....	23
11.2.1	Aquifers and bedrock.....	23
11.2.2	Karst features and/or sand and gravel aquifers	23
11.2.3	Soil & subsoil	23
11.2.4	Pathways.....	24
12	Interim Conclusions on the Cushcam waterbody	27
12.1	Cushcam_010.....	27
13	Work Plan.....	28

14	Review of Mitigation Options	29
14.1	Suggestions pre-fieldwork	29
15	Appendices.....	29
15.1	Additional information.....	29

List of Figures

Figure 2-1	Monitoring station – Aughnacurra Br within the Tay PAA.	1
Figure 2-2	Status details Tay_010	3
Figure 2-3	Q-Value graph for Aughnacurra Br monitoring point – Tay_010	3
Figure 2-4	-Phosphate data for Aughnacurra Br monitoring point – Tay_010	4
Figure 2-5	- Nitrate data for Aughnacurra Br monitoring point – Tay_010	4
Figure 2-6	- Ammonia data for Aughnacurra Br monitoring point – Tay_010.....	5
Figure 2-7	- Biological Oxygen Demand (BOD) for Aughnacurra Br monitoring point – Tay_010.....	5
Figure 3-1	- Private Forestry distribution within Tay PAA	7
Figure 3-2	- Picture Provided by Inland Fisheries Ireland: Showing One of a number of streams which represents the headwaters of the Tay River in a Coillte site, on peat soils, which are “tunnelled” because no riparian buffer zone was incorporated.....	7
Figure 3-3	PIP maps Phosphate to surface receptor within the Tay PAA.....	8
Figure 3-4	- PIP maps Nitrate to surface receptor within the Tay PAA.....	8
Figure 4-1	- Aquifer map Tay_010	11
Figure 4-2	- Map of well drained and poorly drained soils within Tay PAA.....	11
Figure 6-1	Map of suggested sampling locations given in Work Plan.	15
Figure 9-1	Cushcam_010 monitoring station – 2 nd Br u/s from coast on.	18
Figure 9-2	Cushcam_010 - Waterbody status.....	18
Figure 9-3	Cushcam_010 – Protected areas	19
Figure 9-4	Cushcam_010 Protected areas - Bathing waters.....	19
Figure 10-1	Cushcam_010 - Forested areas.....	21
Figure 10-2	Cushcam_010 - PIP Nitrate to SW	22
Figure 10-3	Cushcam_010 - PIP Phosphate to SW.....	22
Figure 11-1	- Aquifer map for Cushcam_010 catchment.....	26
Figure 11-2	- Map of soils within Cushcam_010 catchment.....	26

List of Tables

Table 1-1	Summary table of waterbodies within the Tay PAA	1
Table 2-1	Summary table of waterbody results.....	2
Table 3-1	Significant pressures Tay_10.....	6
Table 4-1	Summary table of pathway analysis	10
Table 6-1	Stop locations and associated coordinates.....	14
Table 6-2	Factors to be aware of during fieldwork.....	15
Table 8-1	Summary table of waterbodies within the Cushcam_010	17
Table 3-1	Significant pressures Cushcam_010.....	20
Table 4-1	Summary table of pathway analysis	25

Acknowledgements

The authors would like to acknowledge the contribution of the relevant agencies who have carried out a significant amount of work in the catchment in recent years and their support of the Local Authority Waters Programme.

Data attribution

The following data sources were consulted in the preparation of this report:

Catchment boundaries, waterbodies and areas for action: EPA (2018)

Bedrock Unit: GSI (2008)

Aquifer Category: GSI (2015)

Groundwater body: EPA Catchments Unit (2018)

Soils & Subsoils Maps: Teagasc (2015)

IFS Soils: EPA (2006)

Susceptibility and Pollution Impact Potential Maps: EPA (2018)

WFD waterbody status: EPA (2018)

SAC and NHA boundaries: NPWS (2018)

1 Tay background

The Tay priority area for action (PAA) comprises of two waterbodies: Tay_010 and Cushcam_010. Tay_010 is an *At Risk* headwater situated near Kilrossanty and Lemybrien Co. Waterford. Cushcam_010 is located south of the Tay, it is not hydrologically connected to the Tay and is a coastal stream discharging to Dungarvan Bay at the eastern end of Clonea strand.

1.1 Reasons for Selection

Regional workshops were held in Roscrea on 6-9 June 2017 and were attended by representatives of local authorities (Kilkenny, Tipperary, Waterford City and County, Kildare, Laois, Offaly, Carlow, Wexford & Wicklow), and other agencies (Bord Iascaigh Mhara, DHPCLG, EPA, National Dairy Sustainability Forum, National Federation for Group Water Schemes, Sea Fisheries Protection Authority, Waterways Ireland, LAWCO, Irish Water, IFI, Forest Service, Coillte, NPWS, Teagasc, GSI, DAFM, Marine Institute and EPA). Based on the draft River Basin Management Plan priorities, a set of agreed principles and the priorities of the workshop attendees, 34 areas were recommended for action in the South East region and the Tay was selected for the following reasons

- The Tay PAA was selected for the following reason:
 - One deteriorated High Ecological Status objective water body
- The initial characterisation recommended the following actions be taken;
 - Field assessment by WC&CC to assess the pressures that are impacting on the High Status of this water body with emphasis on Forestry and also to include agriculture (in particular, farmyards) as part of the river walk if forestry is not deemed to be the impacting pressure.
 - Two areas appeared to have been felled, one adjacent to the monitoring location and one further upstream.

Note 1: Fresh Water Pearl Mussel were identified in this waterbody in the past. Their current numbers in Tay_010 is unknown.

Table 1-1 Summary table of waterbodies within the Tay PAA

WB Code & WB Name	Risk & Status of Obj.	2010	2013	2016	Pressure Category (Pressure Sub-Category) Significant Pressure	Action & Local Authority
IE_SE_17 T010050 & Tay_10	<i>At Risk</i> & High-Status Objective	High 4.5	Good 4	Good 4	Agriculture (Agriculture) Significant – No & Forestry (Forestry) Significant – Yes & Agriculture (Farmyards) Significant – Yes	FC000996: IA8* High status RWB pressures & Waterford City & County Council

*Investigative Assessment 8: Stream (catchment) walk along high ecological status objective rivers

2 Receptor Information and Assessment

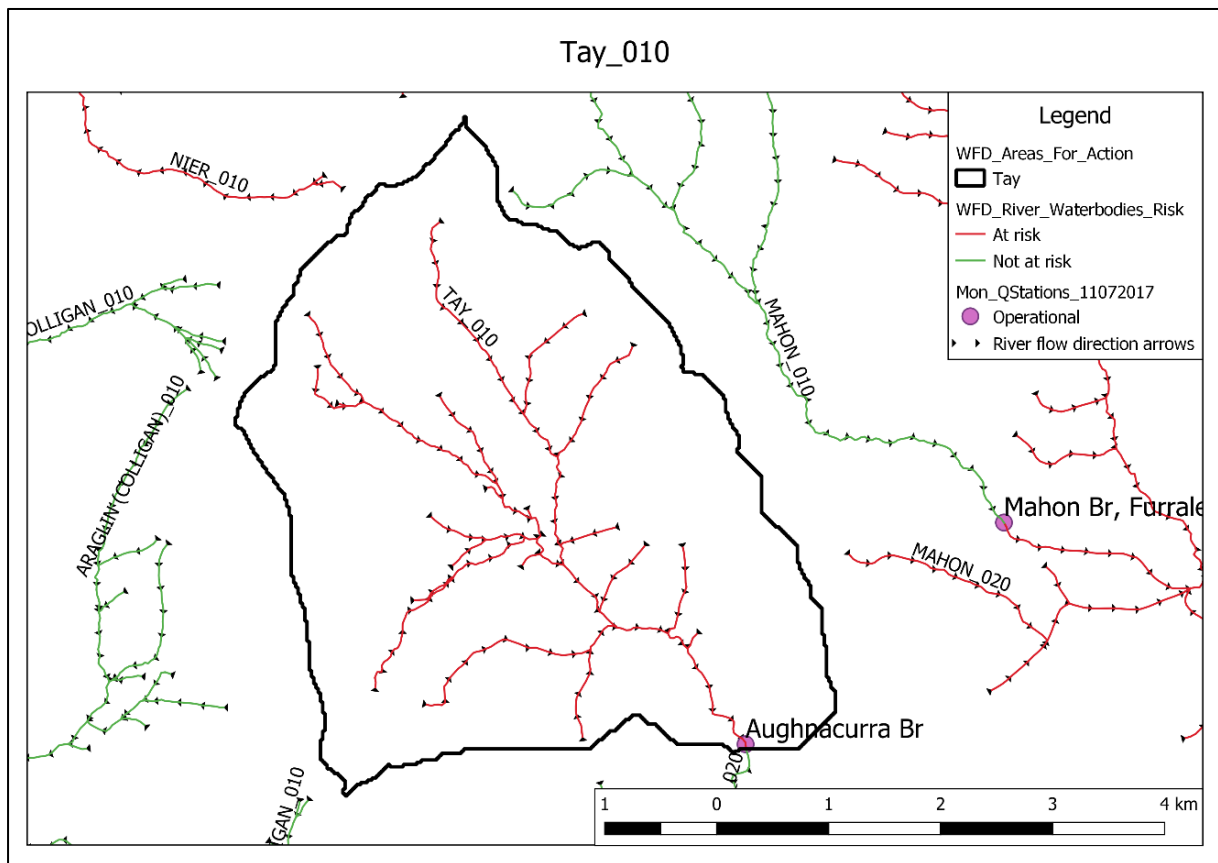


Figure 2-1 Monitoring station – Aughnacurra Br within the Tay PAA.

2.1 Tay_010

- Phosphate levels for the Tay (0.014 mg/l, baseline 2014) are below the High status Environmental Quality Standard (EQS) threshold (0.025mg/l) (Figure 2-4).
- Nitrate levels (0.848 mg/l baseline 2014) are below the High status EQS threshold (1.8mg/l) (Figure 2-5).
- Ammonia levels (0.020 mg/l baseline 2014) are below the High status EQS threshold (0.040 mg/l) (Figure 2-6).
- Results for Biological Oxygen Demand (BOD) are shown in Figure 2-7.
- The Tay_010 is monitored at the Aughnacurra Br monitoring point. Ecological status is Good (Figure 2-3) and is classified as *At Risk* because the environmental objective for this water body is High Status.
- It has one receiving surface waterbody the river Tay_020 which is *Not at Risk*.
- The Q-value was High (4-5) in 2010, Good (4) in 2013 and Good (4) in 2016 (Figure 2-3).
- Table 2-1 summarises the receptor assessment details. In conclusion, there was no evidence of a significant nutrient issue. As a result, potential impacts from the selected significant pressures should be assessed in the local catchment assessment (LCA).

Table 2-1 Summary table of waterbody results

Tay_010	Fig. ID	Monitoring results
Risk Category	Table 1-1	<i>At Risk</i>
Biological Status	Figure 2-3	Good
Monitoring Station(s) with Q-Values		Aughnacurra Br
2010-2012 Status		High
Trends in Q value since 2009		Declining. (High in 2007 & 2010. Good in 2013)
2016-2018 Q value data		Good in 2016 - Q4
Hydrochemistry Data		
Monitoring Station(s) with data		RS17T010050: Aughnacurra Br
Existing	Figure 2-6 Figure 2-4 Figure 2-5 Figure 2-7	Ammonia, Ortho-Phosphate, Total Oxidised Nitrogen, Biological Oxygen Demand (BOD)
New		N/A
Trends in PO₄, NH₃ and NO₃		
In App (until 2015)		PO₄ : Upwards NH₃ : Upwards NO₃ : Downwards
All available data		N/A
Other water quality data	Figure 2-7	BOD: Range: 0.500 to 2.9 mg/l. Highest in 2012, 2015, 2017.
2014 Baseline Concentration		PO₄ : 0.014 mg/l NH₃ : 0.020 mg/l NO₃ : 0.848 mg/l
Distance to threshold		PO₄ : Far, NH₃ : Far, NO₃ : Far
Supporting Conditions		
Chemistry		Pass
Oxygenation		Pass
Acidification		Pass
Hydro-morphology		
RHAT Score		N/A
Evidence of arterial drainage		N/A
Ecological Status (2010-2015)		
Trends 2010-2015		Good
Protected Areas		No
WFD Objective		High-Status Objective
EPA biologist notes (if any)		Satisfactory at all three stations surveyed. Remaining Good ecological quality at the uppermost station (0100) where previously High. Returning to High quality at the middle station (0250) and maintaining Good ecological quality at the lowermost station at Stradbally Bridge (0400).

Status Iterations SW 2010-2015

Ecological Status or Potential	Good	
Biological Status or Potential	Good	
Invertebrate Status or Potential	Good	
Supporting Chemistry Conditions	Pass	
General Conditions	Pass	
Oxygenation Conditions	Pass	
Dissolved Oxygen (% Sat)	Pass	
Other determinand for oxygenation conditions	High	
Acidification Conditions	Pass	
pH	Pass	
Nutrient Conditions	Pass	
Nitrogen Conditions	High	
Nitrate	High	
Ammonium	High	
Phosphorous Conditions	High	
Orthophosphate	High	

Figure 2-2 Status details Tay_010

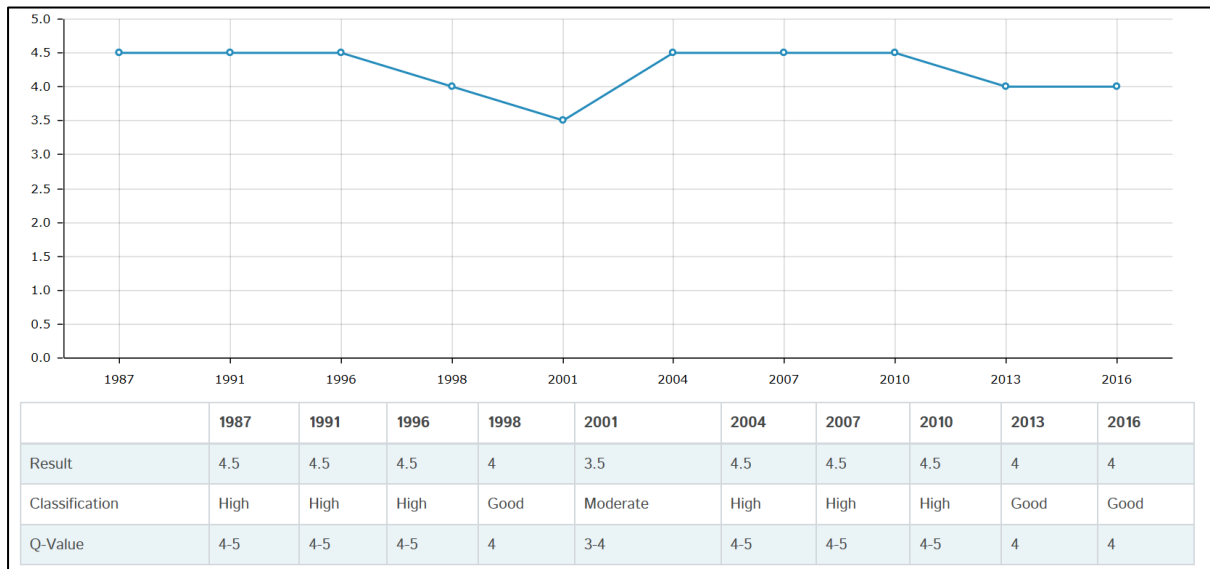


Figure 2-3 Q-Value graph for Aughnacurra Br monitoring point – Tay_010

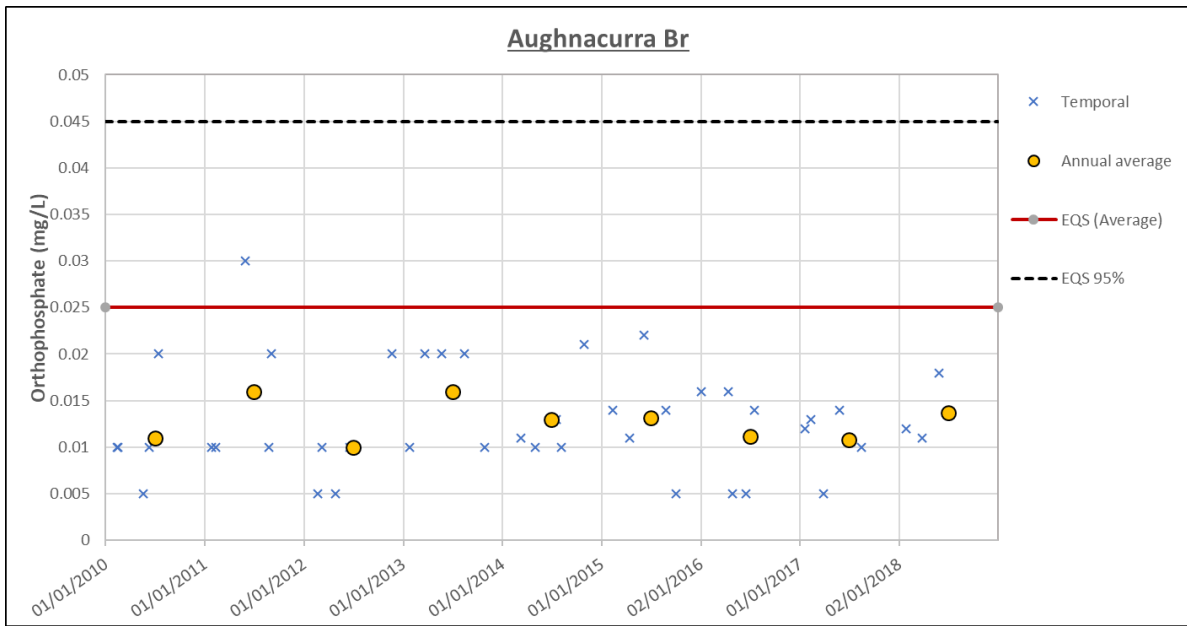


Figure 2-4 -Phosphate data for Aughnacurra Br monitoring point – Tay_010

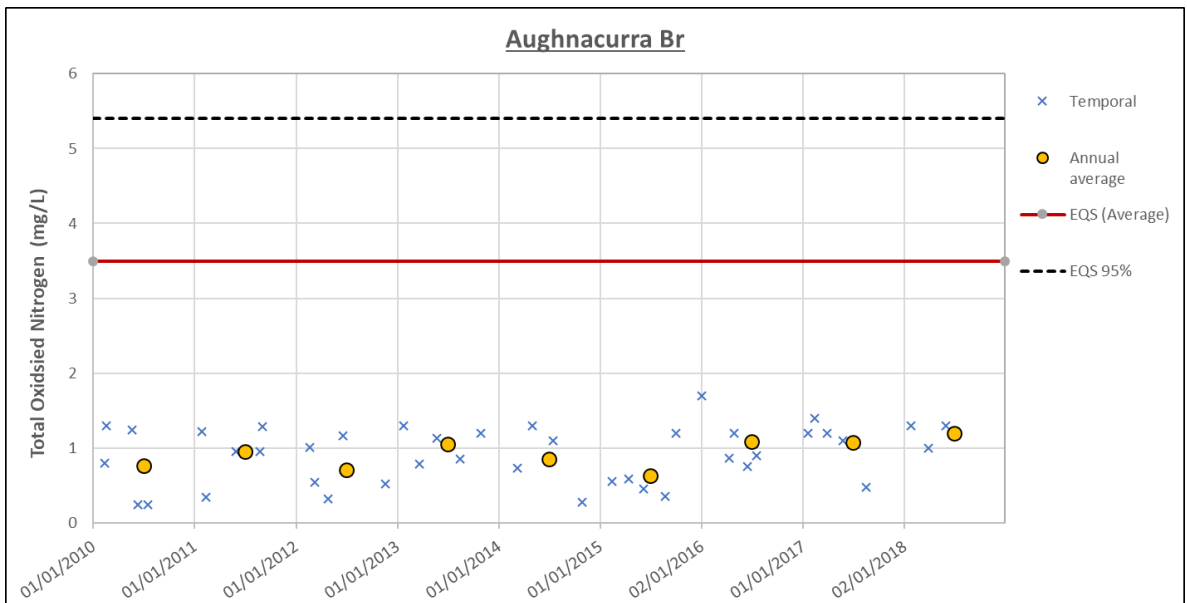


Figure 2-5 - Nitrate data for Aughnacurra Br monitoring point – Tay_010

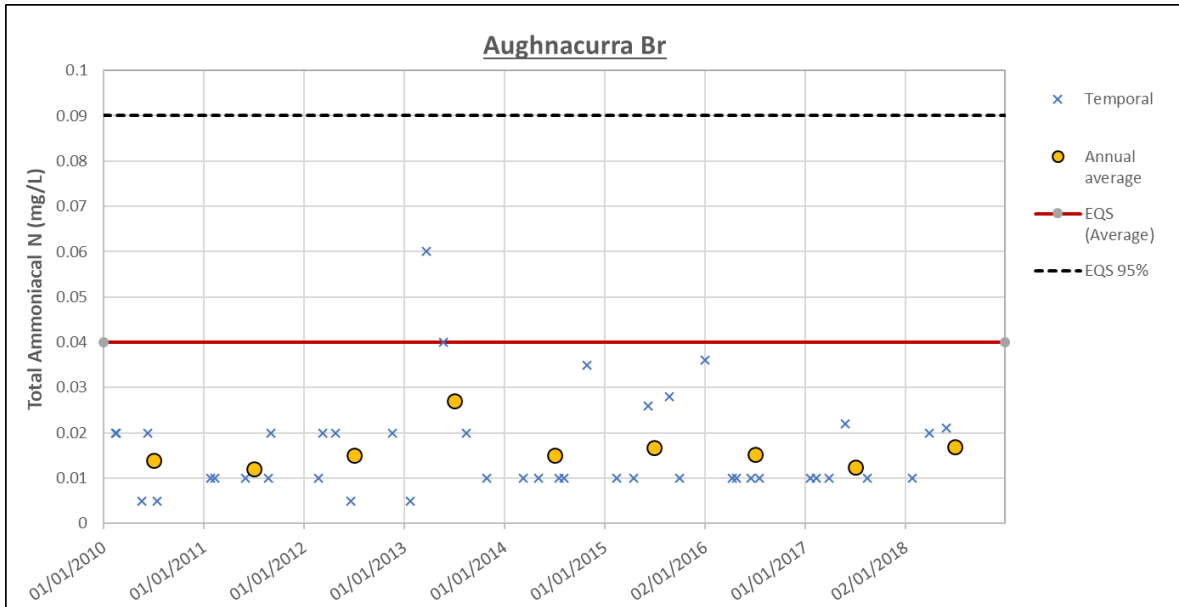


Figure 2-6 - Ammonia data for Aughnacurra Br monitoring point – Tay_010

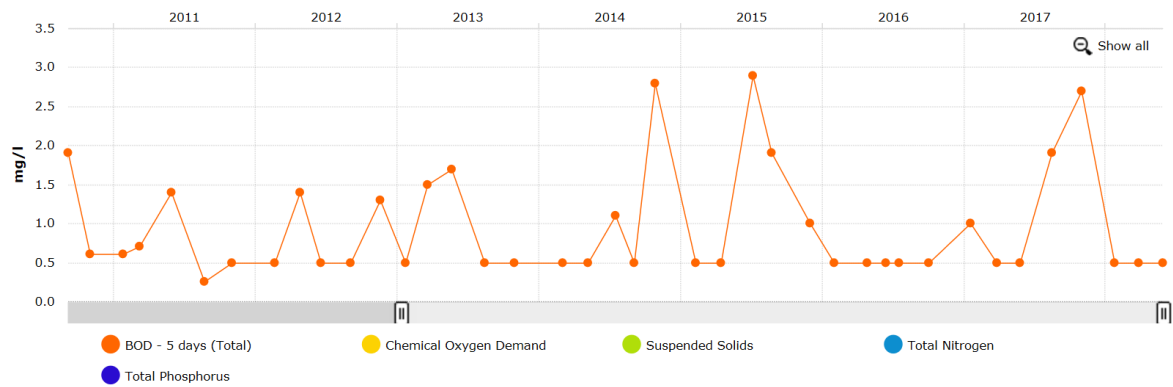


Figure 2-7 - Biological Oxygen Demand (BOD) for Aughnacurra Br monitoring point – Tay_010

3 Significant Pressures

Table 3-1 Significant pressures Tay_10

Waterbody	Pressure Category	Sub-category	Significant Pressure	Impact
Tay_10	Agriculture	Agriculture	No	n/a
	Forestry	Forestry	Yes	Altered habitat due to Morphological changes
	Agriculture	Farmyards	Yes	Organic Pollution

3.1 Tay_010

- As nutrients levels were not significant in the receptor (Table 2-1), the significant pressures (Table 3-1) identified in the initial characterisation will be used to guide the work plan for the LCA.
- The significant pressures identified are forestry and agricultural and the potential impacts are altered habitat due to morphological changes and organic pollution respectively.
- Initial characterisations indicate that emphasis should be put on investigating forest pressure and it was noted that areas near the monitoring point and upstream were felled in recent years. It was also noted that farmyard pressures should also be investigated if forestry is not deemed to be impacting.
- For forestry pressure & altered habitat:
 - Inland Fisheries Ireland provided a picture showing a lack of buffer on a forest stand in Tay_010 (Figure 3-2).
 - At the community meeting a landowner stated that a pink dye from forestry activities discoloured part of the Tay which flowed through a local farmer’s land. It was also highlighted at the meeting that forestry roads redirected the flow of the stream.
 - Private forest stands in the PAA are shown in Figure 3-1.
 - Information requests from the relevant agencies on harvesting events and other non-private forestry stands should be carried out.
 - Sediment from forestry operations may be the impact from morphological changes.
 - Other factors that may alter habitat include; forest roadways, bad practice felling and extraction, bad practice afforestation.
- For farmyard pressure & organic pollution:
 - Farmyards may be identified during the catchment walks and, high PIP areas, shown in Figure 3-3 and Figure 3-4, can be used to identify areas where the risk of phosphorus loss or Nitrate loss to surface water is greatest for example.
 - Other factors to look out for during the catchment assessment are dairy washing management, silage effluent, effluent breakout, slurry and manure storage, outwintering, farm roadways, slurry spreading.
 - Some of these factors can be point or diffuse sources and this must be considered during the catchment assessment.
- Within the context of the significant pressures that have been identified, it is possible that these pressures could lead to sediment from forestry (hydro morphological activities) and nutrient run off from farm yards.
- In conclusion of the significant pressure’s analysis, potential pathways for sediment and nutrient runoff that could enable the source and receptor to be connected should be identified.

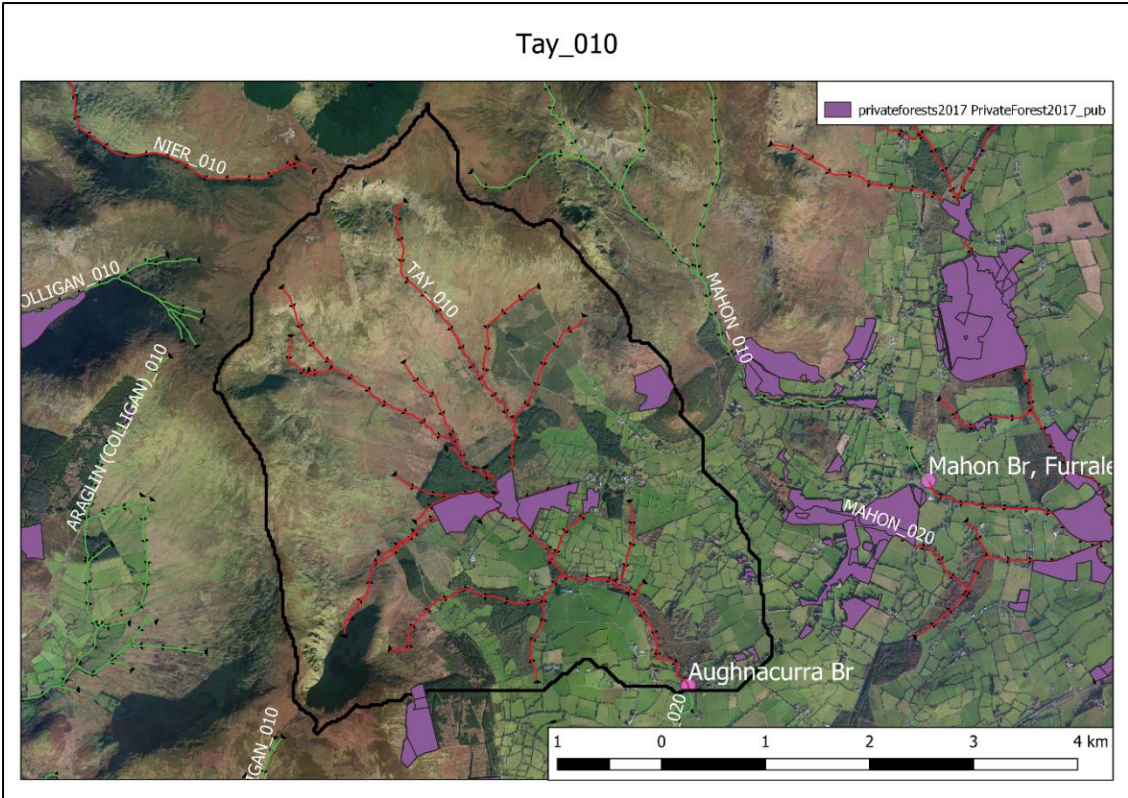


Figure 3-1 - Private Forestry distribution within Tay PAA



Figure 3-2 - Picture Provided by Inland Fisheries Ireland: Showing One of a number of streams which represents the headwaters of the Tay River in a Coillte site, on peat soils, which are “tunnelled” because no riparian buffer zone was incorporated.

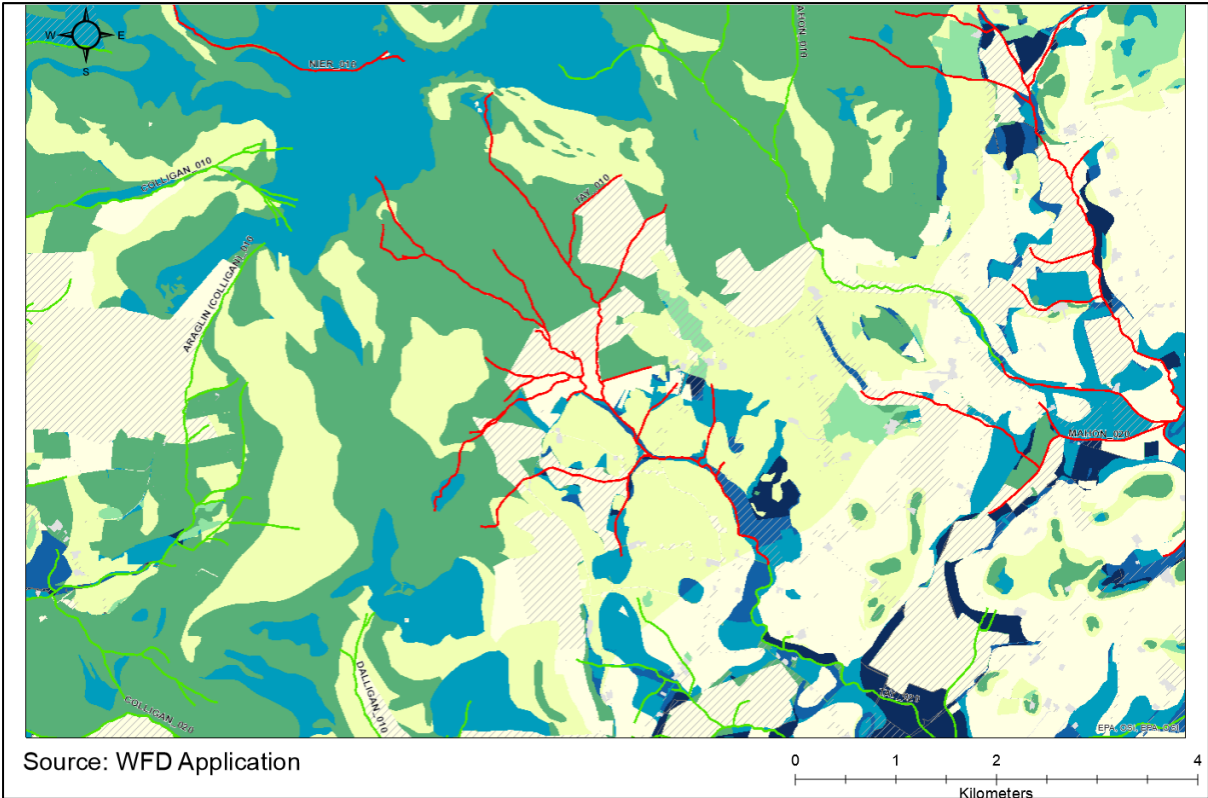


Figure 3-3 PIP maps Phosphate to surface receptor within the Tay PAA

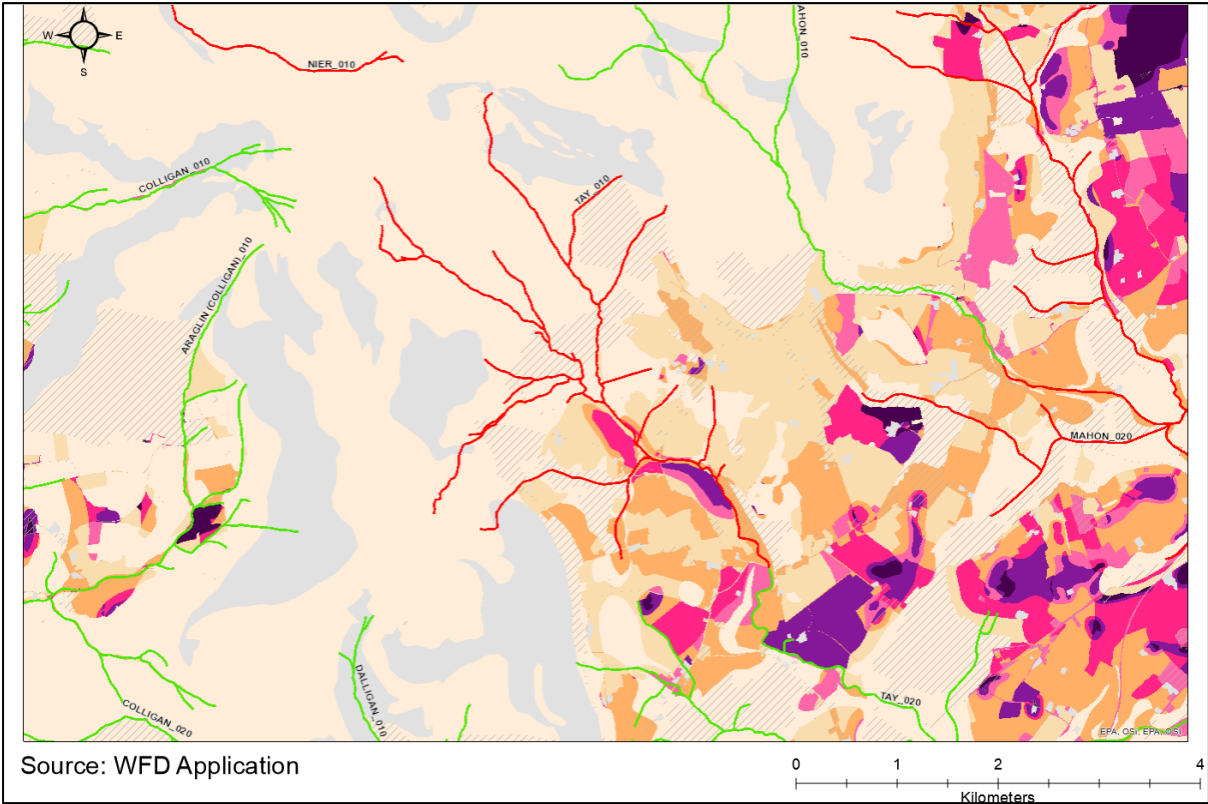


Figure 3-4 - PIP maps Nitrate to surface receptor within the Tay PAA

4 Pathway Information and Analysis

4.1 Overview of pathway information

- In relation to the potential issues associated with the significant pressures for this PAA (sediment and nutrient runoff) a pathway analysis was carried out to identify the most likely flows that would allow the source pressure to be connected to the receptor. A summary of the pathway analysis is shown in Table 4-1.

4.2 Pathway analysis

4.2.1 Aquifers and bedrock

- The Tay_010 catchment is predominately underlain by a moderately productive aquifer (Figure 4-1). According to GSI, the characteristic flow for this aquifer type is as follows: *“Some recharge in the upper, more fractured/weathered zone is likely to flow along the relatively short flow paths and rapidly discharge to streams, small springs and seeps. Groundwater discharge to streams (‘baseflow’) can significantly decrease in the drier summer months”*.
- There is also a small area of fissured bedrock at the bottom of the catchment where the monitoring point Augnacurra Br is located (Figure 4-1). According to GSI the characteristic flow for this aquifer type is as follows: *“There is likely to be substantial groundwater discharge to surface waters (‘baseflow’) and large (>2,000 m³/d), dependable springs may be associated with these aquifers”*.
- Devonian Old Red Sandstones was the main bedrock type and Ordovician Volcanic bedrock was found at the bottom of the catchment.

4.2.2 Karst features and/or sand and gravel aquifers

- No karst features or sand and gravels aquifers were identified for this catchment.

4.2.3 Soil & subsoil

- At higher elevations, in the upper areas of the catchment, there is little or no soil cover. Rock is very close to the surface and soil depth is small. There are small areas of peat soil and well-drained soil overlaying these rocky areas (Figure 4-2).
- The central and lower area of the catchment is made up of both well and poorly drained soils (Figure 4-2). These are both overlaying moderately permeably subsoils.

4.2.4 Pathways

- There are two main compartments;
 - Compartment 1: Ll - Locally Important – Moderately productive only in local zones (< 40 m³/d)
 - Compartment 2: Rf – Regionally important – Fissured bedrock. Likely substantial groundwater discharge to surface water (baseflow) and large (>2,000m³/d).
- Soil type differences are the distinguishing feature for sub compartments.
 - Sub compartment 1A: Where there are poorly drained soils or peat, it is likely that the main flow is via overland.
 - Sub compartment 1B: Flow is most likely via subsurface flow in the transition zone (where the bedrock and aquifer meet) on the well drained soil areas or where soil layer is thin.
 - Sub compartment 2A: Where well drained soils are over the fissured bedrock aquifer, groundwater flow is the most likely pathway, however, this is in a very small, potentially insubstantial area of the catchment.

- In conclusion, there wasn't any significant nutrient issue in the receptor, but sediment and nutrient run off are the likely pollutant sources from the significant pressures. The main pathway for sediment is potentially via overland flow on peat or poorly drained soils, or for example from bank erosion due to changes to the bank. The main pathway for nutrient run-off is via overland flow on poorly drained soils also. However, point source pollution from yards would bypass any pathways, this should be considered in the LCA.

Table 4-1 Summary table of pathway analysis – Tay_01

Factors			
Compartment	Compartment 1		Compartment 2
Aquifer (transmissivity)	LI - Locally Important – Moderately productive only in local zones (< 40 m ³ /d)		Rf – Regionally important – Fissured bedrock. Likely substantial groundwater discharge to surface water (baseflow) and large (>2,000m ³ /d).
Bedrock	Devonian Old Red Sandstones		Ordovician Volcanic
Sub-compartment	1A	1B	2A
Soil wet/dry	Peat Poorly drained	Thin soil layers Rocky outcrops Well drained	Well drained
Sub-soil	Rock and Till derived chiefly from Devonian sandstones	Till or scree	Till derived chiefly from Devonian sandstones
Sub-soil permeability	Moderate	Moderate	Moderate
GW vulnerability	X, E, H and M	X, E and H	H
Karst features ○ Tracing	None	None	None
Hydrology • Drainage density • Arterial	N/A	N/A	N/A
Susceptibility • PO4 to near • NO3 sub • NO3 near	Moderate Very low Moderate	Low Very low Moderate	Very low Very low Low
Likely main flow pathways	Overland	Transition zone	Groundwater flow
Possible CSA	Forestry sediment runoff on peat or poorly drained soils Farm yard runoff on poorly drained soils	N/A	N/A

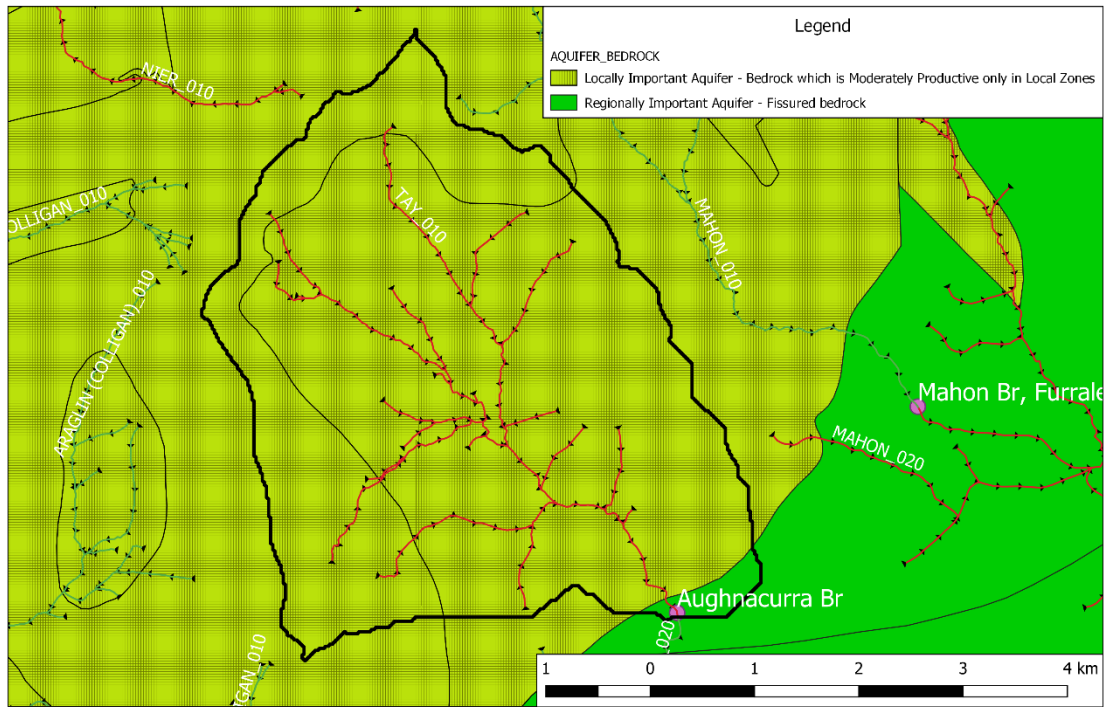


Figure 4-1 - Aquifer map Tay_010

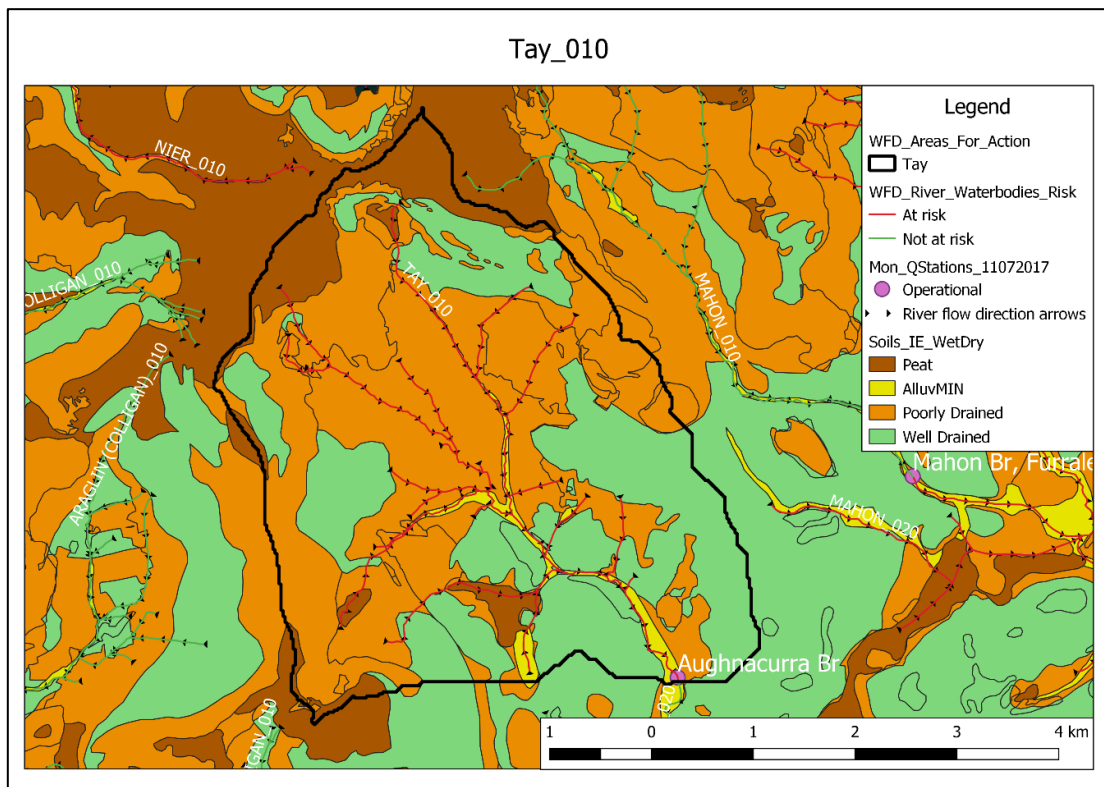


Figure 4-2 - Map of well drained and poorly drained soils within Tay PAA

5 Interim Conclusion

5.1 Tay_010

- The Tay_010 is a High Status Objective waterbody and it is *At Risk*. It was selected because it had one deteriorated High Ecological Status objective water body. An IA8 (stream/catchment walk along high ecological status objective rivers) was assigned to it. The Q value trends showed that the status was Good (4) in 2016, when it was last surveyed. In 2010 the status was Good (4) and in 2011 the status was High (4.5).
- Receptor assessment of nutrient data available at the Aughnacurra Br monitoring point indicated that levels were below the EQS threshold for High status waterbodies for phosphate, nitrate and ammonia. As a result, there isn't any significant nutrient issue in the receptor, and it is the biological assessment that has determined the Q4 status. Consequently, it is considered that intermittent sediment and nutrient run-off are the likely pollutant sources from the significant pressures present in the water body and that the intermittent nature of them may be impacting on the river ecology. The main pathways are overland flow, sub surface transition zone flow and groundwater flow. For sediment, overland flow on peat or poorly drained soils, or for example from bank erosion due to changes to the bank are the likely pathways. For nutrient run off, overland flow on poorly drained soils are the most likely pathways. However, point source pollution from yards would bypass any pathways.
- Overall, the Tay_010 is in Good status currently, but because it was High status previously and as a High status objective, this waterbody will be sensitive to even small amounts of pollutants from issues such as sediment and organics. The field investigation should therefore be sensitive enough to find evidence of small amounts of pollutants and not rule out anything that may be a small impact. As a High status objective this waterbody it will require the implementation of measures to protect the waterbody, LCA will ensure measures are developed and targeted appropriately.

6 Work Plan

The Tay_010 is a High Status objective waterbody and will require appropriate measures to be implemented to achieve or maintain this status. Measures will need to be specific to the task of protecting the waterbody from existing pressures as well as maintaining this protection into the future. The sampling/work plan below aims to gather evidence relating to the pressures that were identified in this waterbody.

Forestry pressure

Investigate the forested areas which can be delineated from the maps above (Figure 3-1). Communication should be made with forest related agencies such as Forest services, Coillte and private forest owners to set up a plan that will protect this waterbody from the forestry pressures mentioned above. Information relating to past or future felling or thinning events would be informative for understanding how forestry pressures may have caused an impact in the past and planning how to prevent these happening in the future.

Agricultural pressure

Investigate the agricultural areas which can be delineated from the maps above (Figure 3-3, Figure 3-4). Communication should be made with agricultural agencies that are working in this area such as Teagasc ASSAP (Agricultural Sustainability Support and Advisory Programme), private advisors or farmer discussion groups to develop appropriate measures that will protect the waterbody from organic pollutants. A survey by ASSAP of the farms in the high PIP areas will aim to identify sources of point or diffuse sources.

6.1 Sampling plan

There are only two sampling points accessible from the roadways (First & Second Investigation). A third sampling point (Third Investigation) is only accessible via forestry roads which may require permission from forestry owners or agencies. Note also that the river is currently in Good Status, so the field work test results may reflect this. Sampling locations and map are shown in Table 6-1 and Figure 6-1 and factors to look out for during the LCA are shown in Table 6-2.

Monitoring point: 52.1870018,-7.5330246

First Investigation: 52.195355,-7.5528342

This is the most accessible sampling point from a roadway other than the monitoring point. An investigation at this point will only indicate whether two tributaries in the south of the PAA are contributing to pollution issues. Aim to gather evidence of sediment issues in the water here. Make observations of recent forest felling. Carry out an SSIS (Small Stream Impact Score) but be mindful of the presence of fresh water pearl mussel.

Second Investigation: 52.1964505,-7.5486883

The stream here may be relatively inaccessible. Note that this location is downstream of the tributaries that were tested in the First Investigation and so results from that test will be helpful for here. This second investigation will help decide if the pollution issue is occurring between here and the monitoring point south of here. It might be likely as there has been forest felling near this stretch of water according to the Further Characterisation comments. Carry out an SSIS. And test the usual field parameters (conductivity, DO, pH, temperature).

In the case that the pollution issue is still not found and therefore occurring upstream, then it will be necessary to carry out the Third Investigation.

Third Investigation: 52.2116012,-7.5451426

These coordinates are only to the entranceway to the forest access paths. Use this road to get to **Point A** (52.209093,-7.557214). Gather evidence of sediment issues and if they are found they are occurring upstream of this. Move upstream to **Point B** (52.213808,-7.561824) and **Point C** (52.213292,-7.554403) only if necessary. If no sediment issue is found on this branch of tributaries, then move along the roadway of **Point A** to get to **Point D** (52.207252, -7.562591).

Note that the flow rate may be very low at Point B, C and D. They may not be worth sampling. Making an observation at these points would be useful however.

Table 6-1 Stop locations and associated coordinates.

Name	Coordiantes
Monitoring Point	52.1870018,-7.5330246
First Investigation	52.195355,-7.5528342
Second Investigation	52.1964505,-7.5486883
Third Investigation	52.2116012,-7.5451426
Forestry access 2	52.1954148,-7.552953
Point A	52.209093,-7.557214
Point C	52.213292,-7.554403
Point B	52.213808,-7.561824
Point D	52.207252, -7.562591

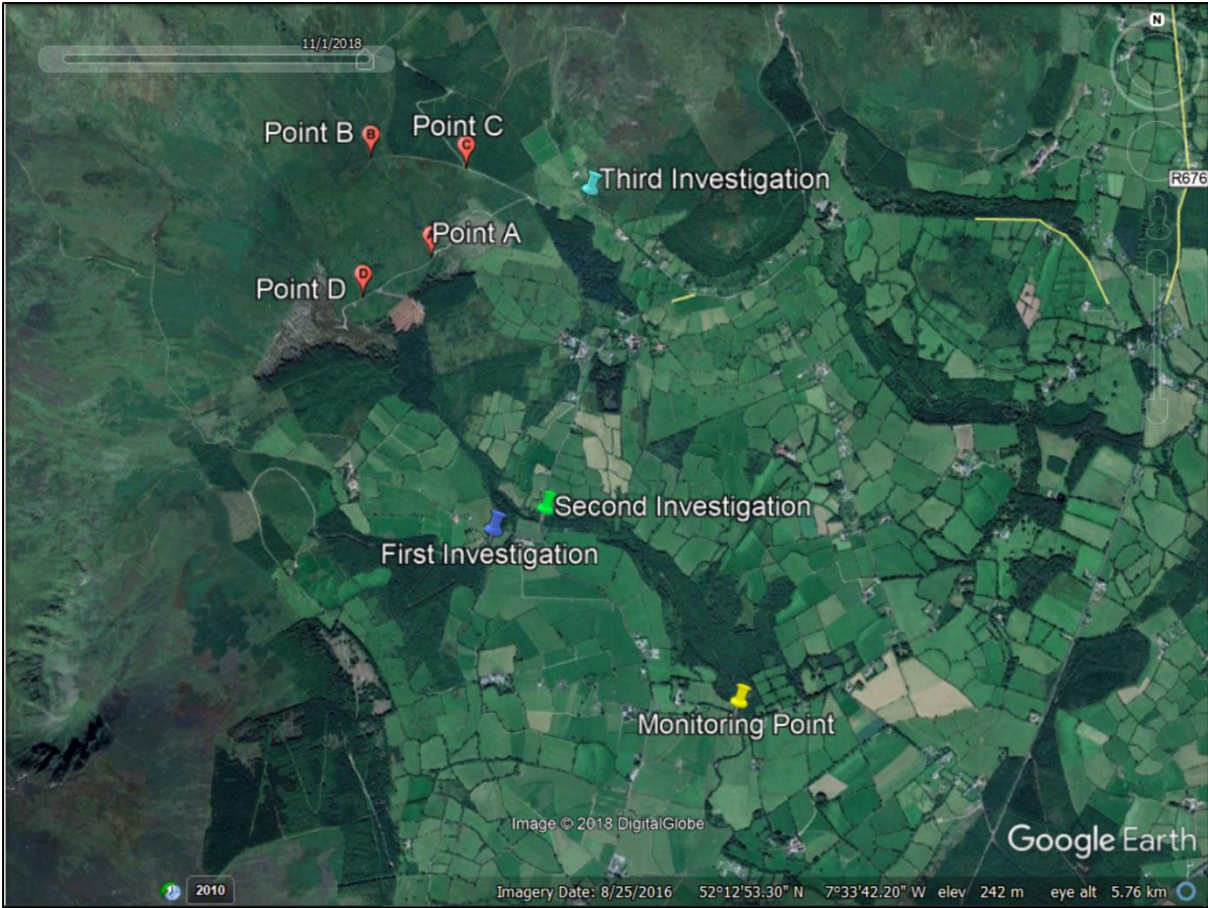


Figure 6-1 Map of suggested sampling locations given in Work Plan.

Table 6-2 Factors to be aware of during fieldwork

Sediment issues – What’s likely in this PAA
<ul style="list-style-type: none"> ○ Land drainage ○ Cattle poaching & cattle access along banks ○ Forestry planting and clear felling ○ Construction of dwellings of buildings along banks ○ Barriers to water flow ○ Potentially other sediment related risks
Tips
<ul style="list-style-type: none"> ○ Determine what is natural sediment and unnatural sediment levels – what is the baseline sediment over time ○ Freshwater Pearl Mussel have a zero-tolerance policy for artificially elevated levels of siltation in their habitat
Measurements
<ul style="list-style-type: none"> ○ Observations ○ Turbidity ○ Suspended concentration/total suspended solids

7 Review of Mitigation Options

7.1 Suggestions pre-fieldwork

- Catchment wide farmer discussion group. Provide advice on clean farmyards and soil type differences between fields. Measures may include GAP regulations compliance review and targeted advisory relating to infrastructure and organic manure handling.
- Speak with forest owners to identify past and future harvest events. Consider placing preventative measures in place for future forest clear felling. Measures may include; appropriate set back distances, silt traps and appropriate crossing points.

Cushcam (Tay PAA) (AFA0171)

8 Cushcam background

Cushcam_010 is located south of the Tay, it is not hydrologically connected to the Tay and is a coastal stream discharging to Dungarvan Bay at the eastern side of Clonea strand. Cushcam_010 is an *Unassigned* waterbody. The receiving surface waterbody is the Dungarvan Harbour (IE_SE_140_0000) which is currently at High status (SW 2013-2018).

8.1 Reasons for Selection

Regional workshops were held in Roscrea on 6-9 June 2017 and were attended by representatives of local authorities (Kilkenny, Tipperary, Waterford City and County, Kildare, Laois, Offaly, Carlow, Wexford & Wicklow), and other agencies (Bord Iascaigh Mhara, DHPCLG, EPA, National Dairy Sustainability Forum, National Federation for Group Water Schemes, Sea Fisheries Protection Authority, Waterways Ireland, LAWCO, Irish Water, IFI, Forest Service, Coillte, NPWS, Teagasc, GSI, DAFM, Marine Institute and EPA). Based on the draft River Basin Management Plan priorities, a set of agreed principles and the priorities of the workshop attendees, 34 areas were recommended for action in the South East region. Cushcam was selected for the following reasons:

- Discharges into popular bathing area (Stradbally)
- Discharges into an important sea bass fishery

Note 2: Discussion with IFI (Inland Fisheries Ireland) indicates that the Cushcam_010 is hydrologically connected to the Deelish stream_010 which is part of the Colligan and Bricky PAA. This information will have to be confirmed with fieldwork.

Table 8-1 Summary table of waterbodies within the Cuschcam_010

<u>WB Code</u> & <u>WB Name</u>	<u>Risk</u> & <u>Status of</u> <u>Obj.</u>	<u>2010</u>	<u>2013</u>	<u>2016</u>	<u>Pressure Category</u> (<u>Pressure Sub-</u> <u>Category</u>) <u>Significant Pressure</u>	<u>Action</u> & <u>Local</u> <u>Authority</u>
IE_SE_17C390620& CUSHCAM_010	<i>Review</i> (<i>Unassigned</i>) & Good Status	Unassigned			Agriculture (Pasture) Significant – Yes & Forestry (Clear- felling) Significant – No	FC000143: IA3 Determination of Water Quality & Local Authority Waters Programme

9 Receptor Information and Assessment

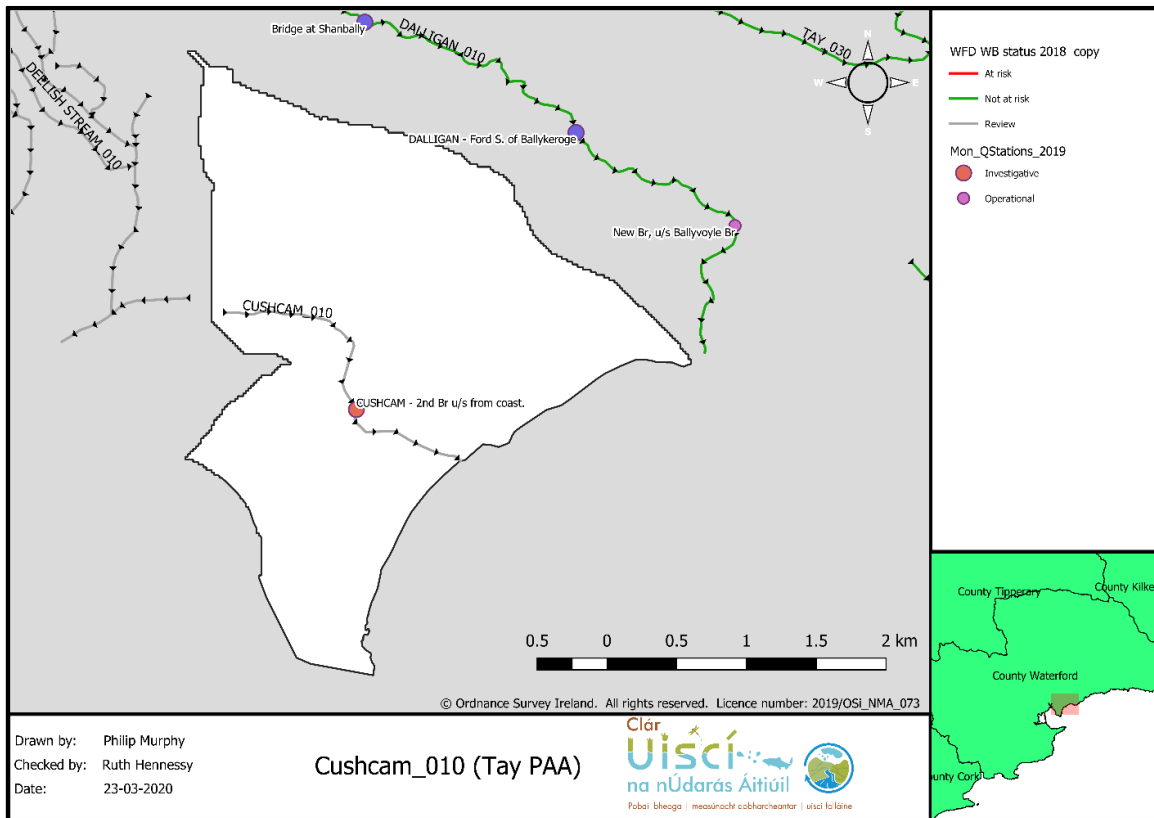


Figure 9-1 Cuschcam_010 monitoring station – 2nd Br u/s from coast on.

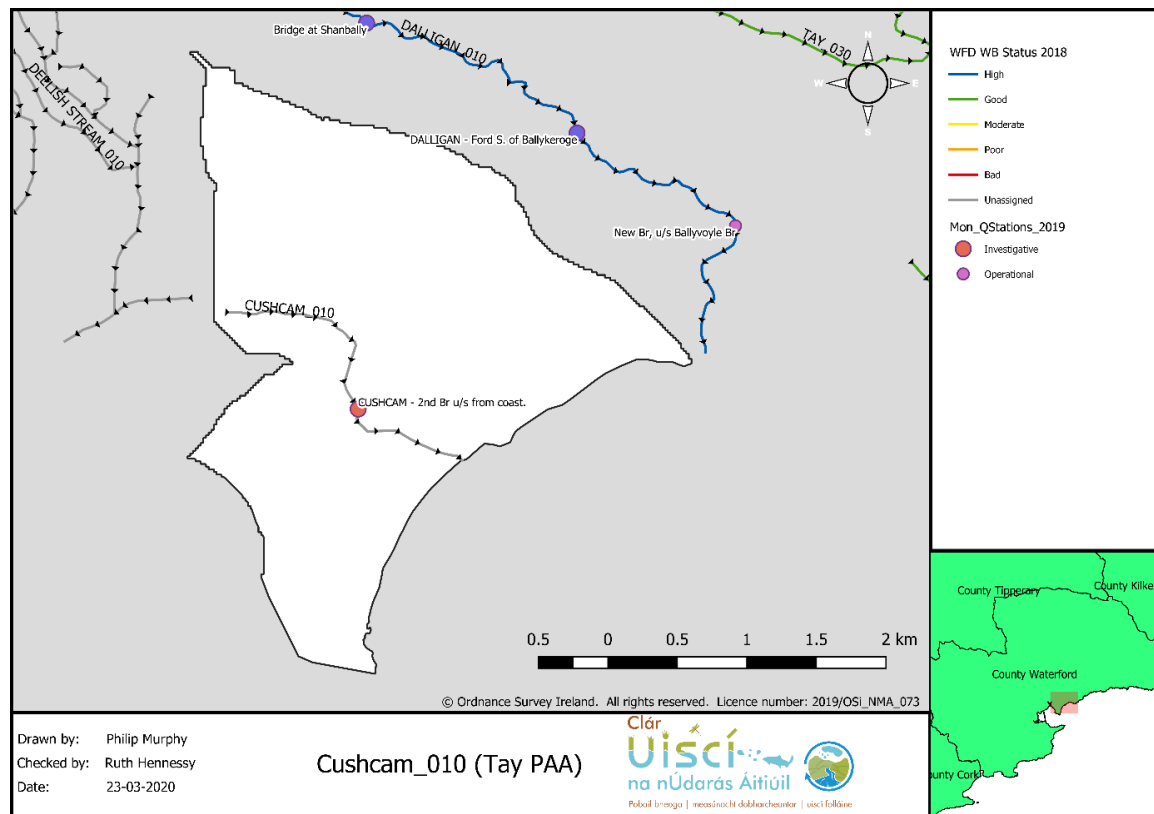


Figure 9-2 Cuschcam_010 - Waterbody status

9.1 Cushcam_010

9.1.1 Hydrochemistry data

There is no receptor monitoring data or status details available for the Cushcam_010 waterbody.

9.1.2 Hydromorphology

There is no hydromorphological or RHAT score data available for the Cushcam_010 waterbody.

9.1.3 Protected areas

The Dungarvan (Drinking Water – IEPA1 SE G 052) is a protected area connected to the Cushcam_010 waterbody (Figure 9-3). There is also a bathing area (Figure 9-4).

Code	Name	Type	Other ID	Association Type	Water Qualifying Interest
IEPA1 SE G 052	Dungarvan	Drinking Water		Within Protected Area	Not Applicable

Figure 9-3 Cushcam_010 – Protected areas

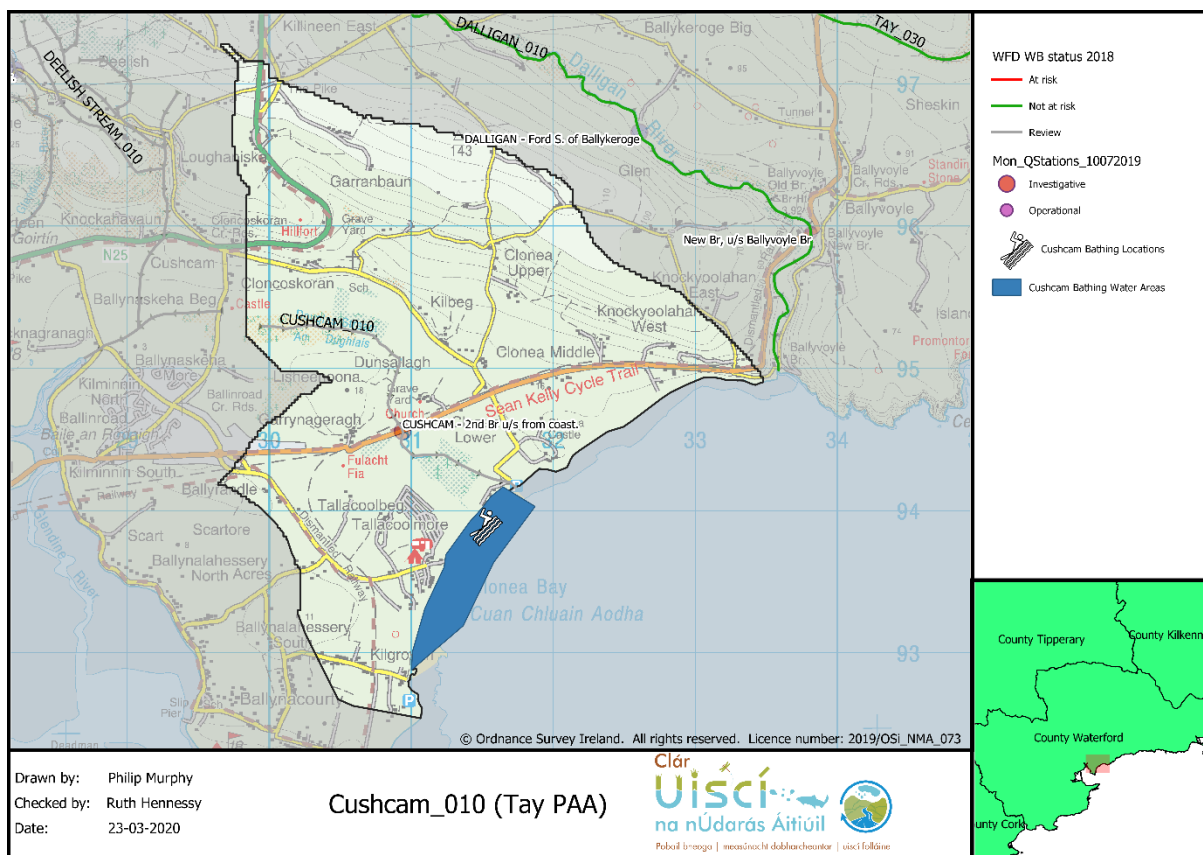


Figure 9-4 Cushcam_010 Protected areas - Bathing waters

10 Significant Pressures

Table 10-1 Significant pressures Cushcam_010

Waterbody	Pressure Category	Sub-category	Significant Pressure	Impact
Cushcam_010	Agriculture	Pasture	Yes	Nutrient pollution
	Forestry	Clear-felling	No	N/A

10.1 Cushcam_010

10.1.1 Agriculture

As there is no nutrient information available for the waterbody, both pollution impact potential maps (PIP) for nitrate and phosphorous are shown – Figure 10-2 and Figure 10-3. The highest risk areas for Nitrate to surface water are the immediate area surrounding the monitoring station (Cushcam 2nd Br u/s from coast), as well as a small area north west of the monitoring station and a larger area to the north east (Figure 10-2). The highest risk areas for Phosphate to surface water is the immediate area north and south of the monitoring station (Figure 10-3).

10.1.2 Forestry

Although clear felling from forestry wasn't indicated as a significant pressure, it was noted that there was clear felling event in the initial characterisation which may have deteriorated the quality of the waterbody incidentally. It is shown in Figure 10-1 that there are only private forestry stands in the Cushcam_010 sub-basin, and the main risk areas are immediately south of the monitoring station and also north west of the station, both areas are adjacent to the waterbody.

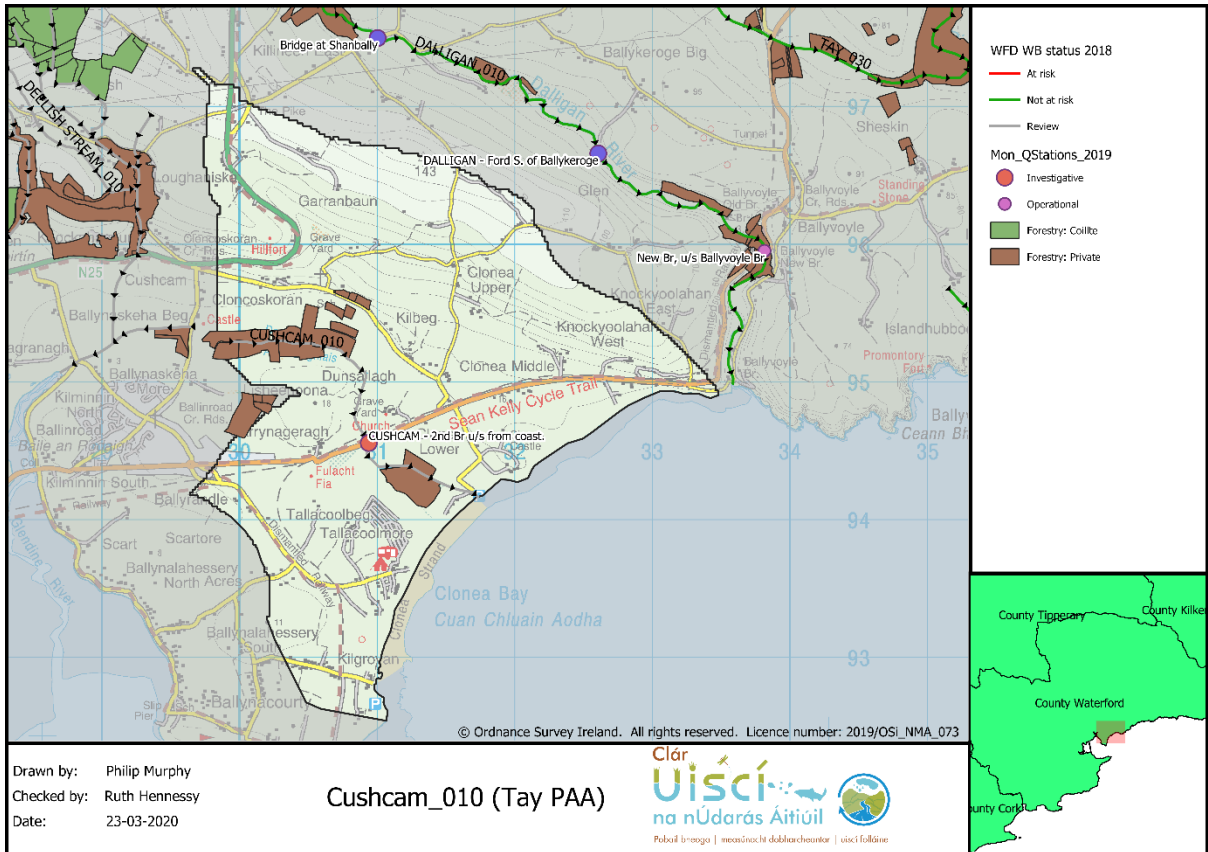


Figure 10-1 Cushcam_010 - Forested areas

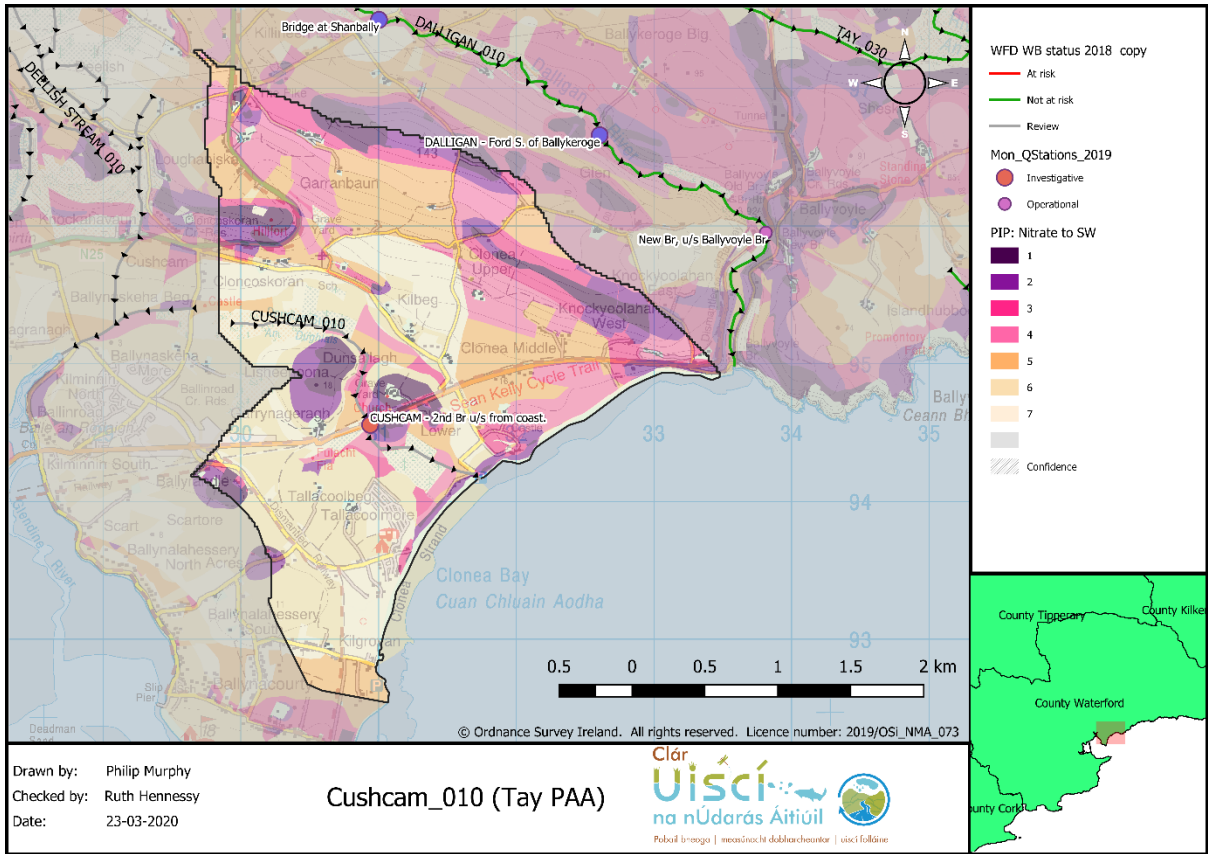


Figure 10-2 Cushcam_010 - PIP Nitrate to SW

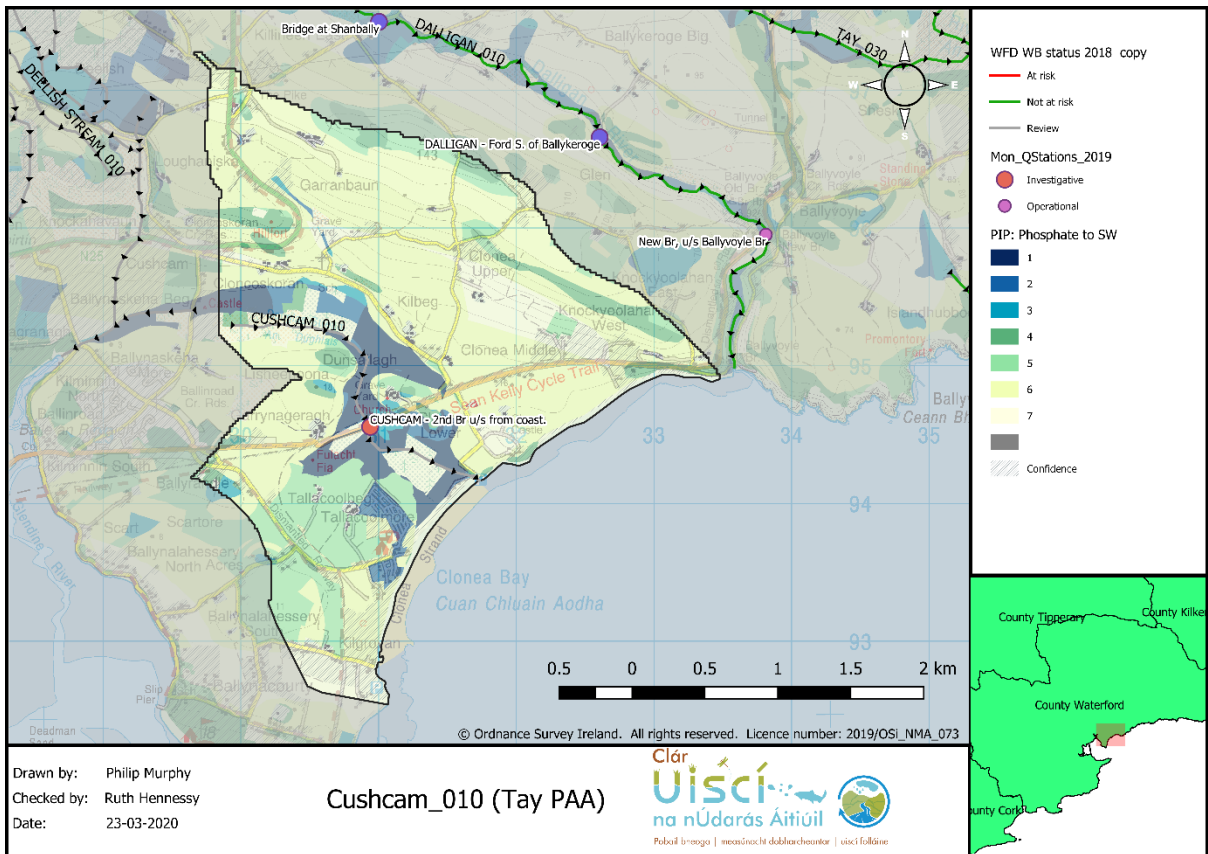


Figure 10-3 Cushcam_010 - PIP Phosphate to SW

11 Pathway Information and Analysis

11.1 Overview of pathway information

- In relation to the potential issues associated with the significant pressures for this PAA (sediment from clear felling and nutrient runoff from agriculture) a pathway analysis was carried out to identify the most likely flows that would allow the source pressure to be connected to the receptor. A summary of the pathway analysis is shown in Table 11-1.

11.2 Pathway analysis

11.2.1 Aquifers and bedrock

- The Cushcam_010 southern portion of the catchment is predominately underlain (~45% of the total area) by a regionally important aquifer (Rkd) (Figure 11-1). According to Geological Survey Ireland (GSI), the characteristic flow for this aquifer type is as follows: *“most flow [is likely] occurring through the more permeable solutionally-enlarged interconnected fissure conduit zones, which may be several kilometres long. Furthermore, as it is karstified, “karstification frequently results in the uneven distribution of permeability through the rock and the development of distinctive karst landforms at the surface (e.g. swallow holes, caves, dry valleys), some of which provide direct access for recharge/surface water to enter the aquifer”*. The bedrock is Dinantian Pure Unbedded Limestone.
- There are two individual sections of locally important aquifer (Li) (~ 40% of the area). This aquifer is described as an *“aquifer with a limited and relatively poorly connected network of fractures, fissures and joints, giving a low permeability which tends to decrease with depth”*. For this aquifer, *“the lack of connection between limited fissures results in relatively poor aquifer storage and flow paths that may only extend to a few 100 meters”* and *“some recharge in the upper more fractured weathered zone is likely to flow along the relatively short flow paths and rapidly discharge to streams small springs and seeps”*. The bedrock is Dinantian Lower Impure Limestone and Devonian Old Red Sandstone.
- There is a smaller area of regionally important aquifer (~15% of the area). This is described as having *“good aquifer storage and groundwater flow paths that can be up to several kilometres in length. There is likely a substantial groundwater discharge to surface waters (baseflow) and large dependable springs may be associated with these aquifers”*. The bedrock is Devonian Kiltorcan type sandstone.

11.2.2 Karst features and/or sand and gravel aquifers

- A karst spring feature is located in the middle of the catchment. It is likely that there are other karst features and preferential pathways due to the characteristics of the aquifers described above.

11.2.3 Soil & subsoil

- Almost the entire catchment area is well drained soil, however the area immediately surrounding the main channel is alluvium soil (Figure 11-2).
- Subsoils range from low to moderate permeability (TDSs).

11.2.4 Pathways

- There are two main compartments.
 - Compartment 1: LI - Locally Important – Moderately productive only in local zones (< 40 m³/d), short flow paths.
 - Compartment 2: Rk & Rf – Regionally important – Karstified or Fissured bedrock. Likely substantial groundwater discharge to surface water (baseflow) and large (>2,000m³/d), long flow paths.
- Soil type differences are the distinguishing feature for sub compartments.
 - Sub compartment 1A: Where there are alluvium soils, it is likely that the main flow is via downward movement through the soil profile i.e. leaching, however, it is expected that the water table is close to the surface in these areas so there is a risk of overland flow also.
 - Sub compartment 1B: Flow is most likely via subsurface flow in the transition zone (where the bedrock and aquifer meet) on the well drained soil areas.
 - Sub compartment 2A: Where well drained soils are over the fissured bedrock aquifer, groundwater flow to surface water is the most likely pathway.
- A summary of the pathway analysis is described in Table 11-1. In conclusion, the shortest pathway to surface water is most likely well drained or alluvium soils on top of the LI aquifer, via the transition zone. However, alluvium soils adjacent to the waterbody may be a source of overland flow to surface water also.
- As this is an unassigned waterbody, there wasn't any indication of the significant nutrient issue in the receptor, but sediment and nutrient run off are the likely pollutant sources from the pressure's forestry and agriculture, although only agriculture was significant. The main pathway for sediment is potentially via overland flow on alluvium soils or, for example from bank erosion due to hydromorphological changes in forested areas. The main pathway for nutrient run-off is via leaching on well drained soils. However, as the area is karstified, there may be preferential or direct flow paths such as swallow holes that by-pass the attenuation features of the soil for example. This should be considered in the LCA.

Table 11-1 Summary table of pathway analysis – Cushcam_010

Factors			
Compartment	Compartment 1		Compartment 2
Aquifer (transmissivity)	LI - Locally Important – Moderately productive only in local zones (< 40 m ³ /d)		Rk and Rf – Regionally important – Karsified and/or Fissured bedrock. Likely substantial groundwater discharge to surface water (baseflow) and large (>2,000m ³ /d).
Bedrock	Devonian Old Red Sandstones		Ordovician Volcanic
Sub-compartment	1A	1B	2A
Soil wet/dry	Alluvium	Well drained	Well drained
Sub-soil	Alluvium	Till derived chiefly from Devonian sandstones	Till derived chiefly from Devonian sandstones
Sub-soil permeability	Low	Moderate	Moderate
GW vulnerability	Predominantly L & M	Predominantly L & M	Predominantly L & M
Karst features ○ Tracing	None	Karst spring	None
Hydrology • Drainage density • Arterial	N/A	N/A	N/A
Susceptibility • PO4 to near • NO3 sub • NO3 near	Predominately low	Predominately low	Predominately low
Likely main flow pathways	Groundwater flow	Transition zone	Groundwater flow
Possible CSA	N/A – no significant issue	N/A – no significant issue	N/A – no significant issue

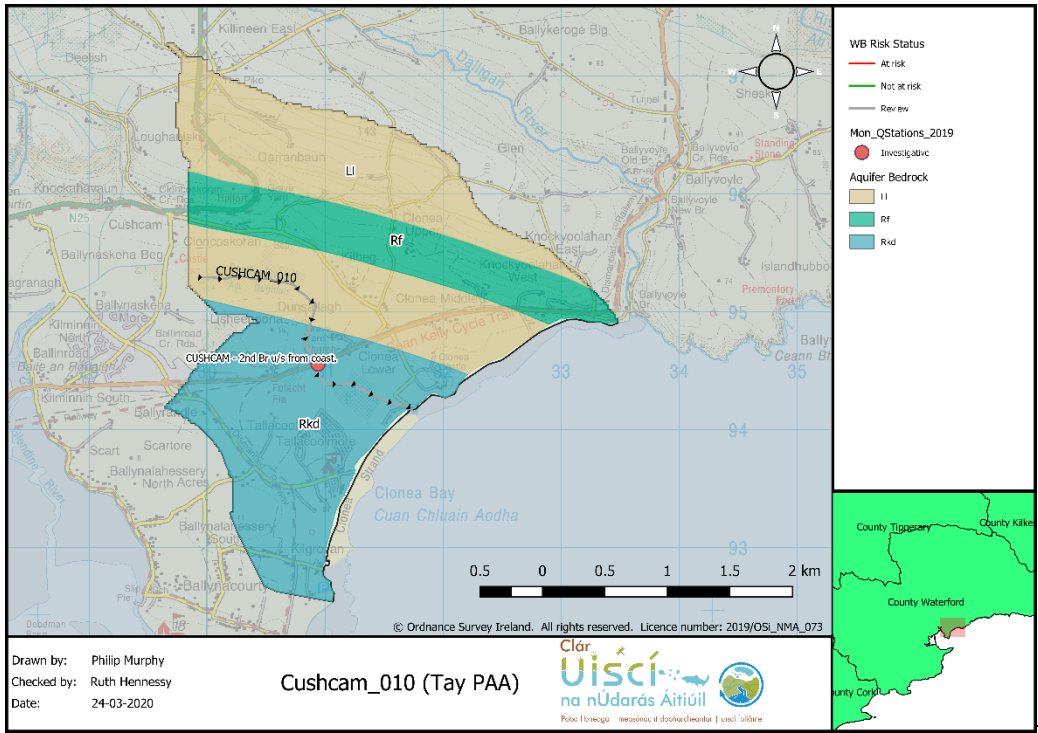


Figure 11-1 - Aquifer map for Cushcam_010 catchment

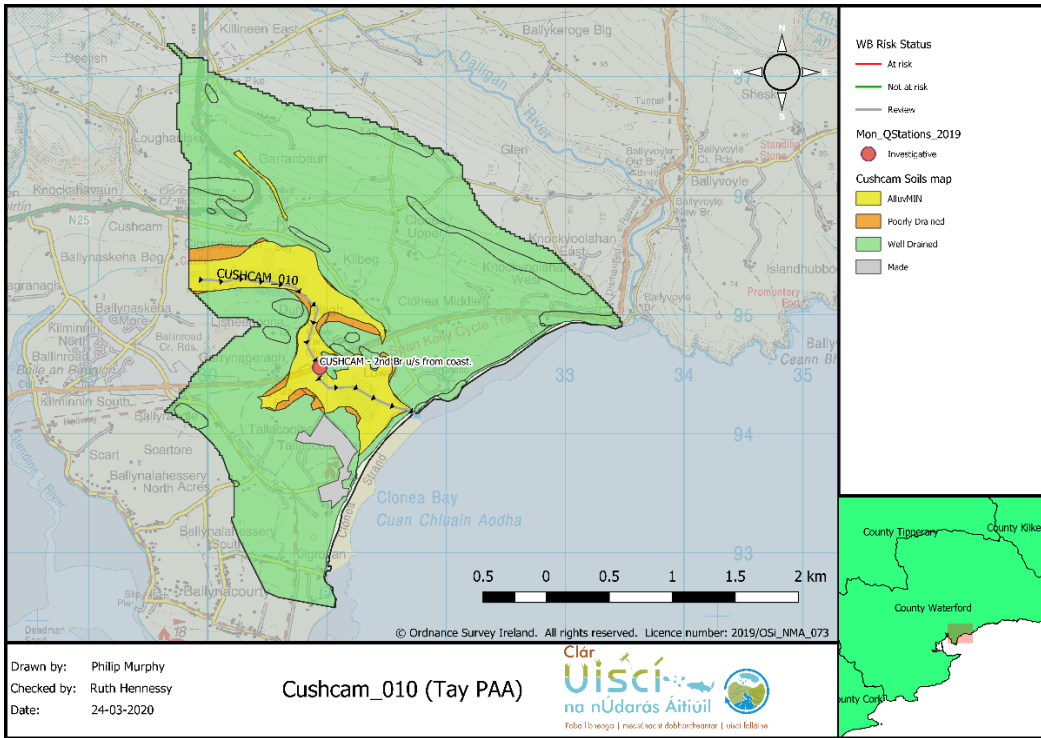


Figure 11-2 - Map of soils within Cushcam_010 catchment

12 Interim Conclusions on the Cushcam waterbody

12.1 Cushcam_010

- The Cushcam_010 is part of the Tay PAA however it is not hydrologically connected. Instead, this waterbody is located south of the Tay and is a coastal stream discharging to Dungarvan Bay at the eastern end of Clonea strand.
- Cushcam was selected for the following reasons:
 - Discharges into popular bathing area (Stradbally)
 - Discharges into an important sea bass fishery
- The receiving surface waterbody is the Dungarvan Harbour (IE_SE_140_0000) which is currently at High status (SW 2013-2018).
- Cushcam_010 is an *Unassigned* waterbody. Note: Discussion with IFI (Inland Fisheries Ireland) indicates that the Cushcam_010 is hydrologically connected to the Deelish stream_010 which is part of the Colligan and Bricky PAA. This information will have to be confirmed with fieldwork.
- There is no receptor monitoring data or status details available for the Cushcam_010 waterbody.
- There is no hydromorphological or RHAT score data available for the Cushcam_010 waterbody.
- The Dungarvan (Drinking Water – IEPA1 SE G 052) is a protected area connected to the Cushcam_010 waterbody. The waterbody discharges into a bathing area (Figure 9-4).
- The significant pressures are agriculture and forestry but only agriculture was deemed significant in the initial characterisation process.
- The main flow pathway was via the transition zone on well drained soils over Li aquifers, or where alluvium soils have become overland flow pathways via a rising water table.

13 Work Plan

This waterbody is an IA3 Determination of Water Quality (unassigned waterbody). The further characterisation actions details contain the following information: *Complete SSRS and collect water quality sample at catchment outlet. If SSRS result is pass, no further work is required. If SSRS result is a fail, a local catchment assessment will need to be completed. This will include catchment walks, collection of field chemistry, using field chemistry to guide water quality and SSRS sample location. Be aware of brackish boundary where necessary.*

Firstly, fieldwork should be carried out to gather evidence that the Cushcam_010 is hydrologically connected to the Deelish stream_010. If the connection is confirmed, then the pressures on the Deelish stream should be considered as pressures on the Cushcam_010 also. If not, then the focus can remain on the pressures identified in the catchment area of the Cushcam waterbody.

Secondly, according to the Ecology Working Group Briefing Note No. 3, the following actions should be carried out for unassigned waterbodies:

A SSIS survey should be undertaken in at least two seasons, one of which must be summer (June to September). If the SSIS indicates there is a significant impact, then it should be assumed that the waterbody is At Risk of not achieving its status objective and local catchment assessment should be progressed as in other catchments that are failing to meet their status objectives.

If the SSIS indicates that the waterbody is “probably not significantly impacted” then if the community present meets the requirements of the status objective of the waterbody or contact the EPA and request that a Q value assessment is carried out.

If the community present does not meet the requirements of the status objective of the waterbody then then it should be assumed that the waterbody is At Risk of not achieving its status objective and local catchment assessment should be progressed as in other catchments that are failing to meet their status objectives.

In conclusion, the initial actions should include water samples in the winter and summer season, and additionally, SSIS carried out in both seasons. With this information it can then be decided if a full scale local catchment assessment is required or not.

14 Review of Mitigation Options

14.1 Suggestions pre-fieldwork

- Catchment wide farmer discussion group. Provide advice on clean farmyards and soil type differences between fields. Measures may include Good Agricultural Practices (GAP) regulations compliance review and targeted advisory relating to infrastructure and organic manure handling.
- Speak with forest owners to identify past and future harvest events. Consider placing preventative measures in place for future forest clear felling. Measures may include; appropriate set back distances, silt traps and appropriate crossing points.

15 Appendices

15.1 Additional information

A meeting with Waterford County Council brought up the point that public interest may be in the Mahon which is adjacent to the Tay PAA. Part of the Mahon is *At Risk* but it was not selected as a PAA. It should be sought out as to why the Mahon wasn't selected as a PAA. The Mahon has been added as an PAA for 2021 since this meeting.

A survey report by RPS of Fresh Water Pearl Mussel on the Tay was passed to the Catchment Assessment Team after the meeting with Waterford County Council environmental officer. The report was published in 2000. Results for the Tay were as follows: "*Margaritifera* occur along about 4km of river and the minimum total population is probably in the region of 300". The report concludes that the Tay Freshwater Pearl Mussel population are at a critically low level. The Mahon has a small population also. Inland Fisheries Ireland (IFI) also provided information to the Assessment Team: A recent IFI inspection of a number of proposed felling sites in the headwaters of the Tay highlighted underlying soil conditions, many of which fulfil a number of the criteria for sites deemed not suitable for afforestation under the afforestation scheme, as laid out in the Dept. of Agriculture Working document Land Types for Afforestation published in 2016. Of serious concern to IFI was the extreme "tunnelling" effect of the forestry at numerous locations, where no buffer zone was left between watercourses and the planting of coniferous trees. Also, of concern was the fact that replanting on recently felled sites did not include riparian buffer zones as required in the Forest Service guidelines, while a bridge on a forestry access road over the upper reaches of the Tay was acting as a complete barrier to the free passage of fish. IFI have concerns relating to the use of heavy machinery on such sensitive sites with potential for serious soil erosion, exacerbating run-off of suspended solids and nutrients during felling operations.