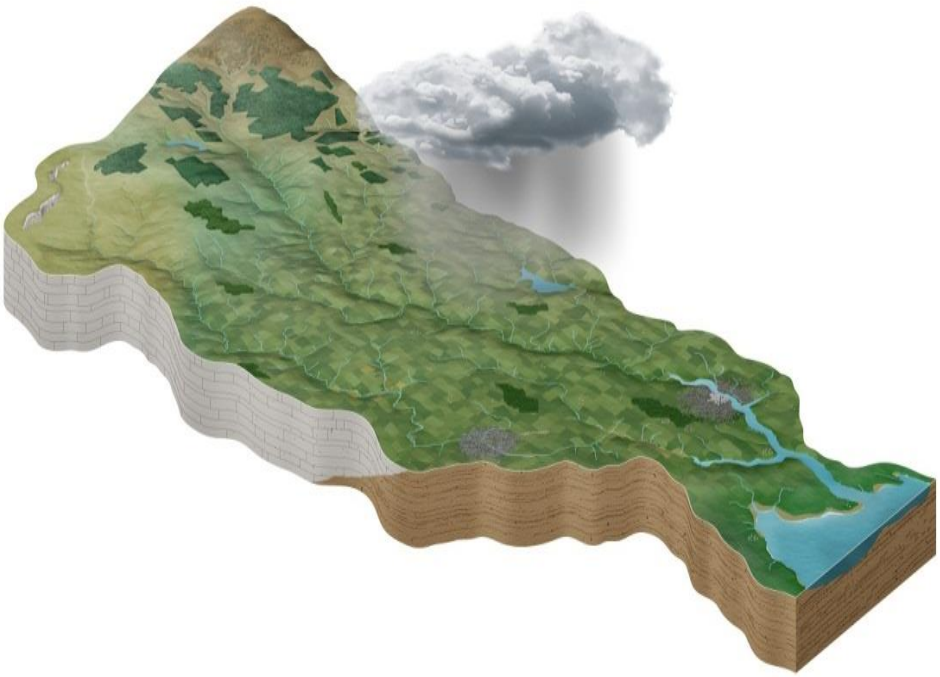
Lower Shannon (Brosna)
Catchment Assessment 2010-2015
(HA 25A)



Catchment Science & Management Unit

Environmental Protection Agency

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Preface

This document provides a summary of the characterisation outcomes for the water resources of the Lower Shannon (Brosna) Catchment, which have been compiled and assessed by the EPA, with the assistance of local authorities and RPS consultants. The information presented includes status and risk categories of all water bodies, details on protected areas, significant issues, significant pressures, load reduction assessments, recommendations on future investigative assessments, areas for actions and environmental objectives. The characterisation assessments are based on information available to the end of 2015. Additional, more detailed characterisation information is available to public bodies on the EPA WFD Application via the EDEN portal, and more widely on the catchments.ie website. The purpose of this document is to provide an overview of the situation in the catchment and help inform further action and analysis of appropriate measures and management strategies.

This document is supported by, and can be read in conjunction with, a series of other documents which provide explanations of the elements it contains:

1. An explanatory document setting out the full characterisation process, including water body, subcatchment and catchment characterisation.
2. A published paper on Source Load Apportionment Modelling, which can be accessed at: http://www.jstor.org/stable/10.3318/bioe.2016.22
3. A published paper on the role of pathways in transferring nutrients to streams and the relevance to water quality management strategies, which can be accessed at: http://www.jstor.org/stable/pdf/10.3318/bioe.2016.19.pdf
4. An article on Investigative Assessments which can be accessed at: https://www.catchments.ie/download/catchments-newsletter-sharing-science-stories-june-2016/

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1 Introduction

This catchment covers an area of 1,248km² and is characterised by relatively flat topography with extensive areas of boglands in the low-lying areas. Most the catchment is underlain by impure limestones with some purer karstified limestones located in an area extending from Tyrrellspass to Kilcormac. There are extensive sand and gravel deposits (mainly eskers) running through the catchment in an east-west direction in north Offaly and south Westmeath, and in isolated pockets in the south of the catchment that form productive groundwater aquifers. The southern tip of the catchment comprising part of the Slieve bloom Mountains is underlain by red sandstones.

The Brosna rises at the northern end of Lough Owel. This stream experiences flow reversal under high water conditions and over the catchment boundary to Lough Iron in the Inny system. Usually, however, it flows into Lough Owel and then flows out of the southern end of the Lough through an ill-defined channel.

The main feeder channel for the Royal Canal also flows out of Lough Owel at this point and a significant volume of water is removed from the system via this route. The Brosna then flows southwest through Mullingar and into the northern end of Lough Ennell. The catchment around Lough Ennell is drained by several small streams which flow into the Lough along is length.

The Brosna then leaves the southern end of Ennell after which it is joined by several tributaries including Monaghanstown River, and Gageborough River. The Brosna continues past Ballycumber and is then joined by the Clodiagh (Tullamore) River from the eastbefore flowing west where it is joined by several smaller rivers and streams flowing including the Pollagh and Boora Streams. The Brosna makes its way through Ferbane and onward to Shannon Harbour where it joins the main channel of the River Shannon. An arterial drainage scheme was completed on the River Brosna by the OPW between 1948 and 1955 and flood relief works were completed around Tullamore during 2013.

The Lower Shannon (Brosna) catchment comprises 12 subcatchments with 60 river water bodies, four lakes and 18 groundwater bodies. There are no transitional or coastal water bodies. (Table 1, Figure 1).

Table 1. List of subcatchments in the Lower Shannon (Brosna) catchment

Subcatchment ID	Subcatchment Name
25A_12	Silver[Kilcormac]_SC_010
25A_4	Tullamore_SC_010
25A_3	Silver[Tullamore]_SC_010
25A_6	Clodiagh [Tullamore]_SC_010
25A_9	Brosna_SC_030
25A_5	Brosna_SC_040
25A_2	Brosna_SC_050
25A_8	Brosna_SC_060
25A_11	Brosna_SC_070
25A_1	Brosna_SC_080
25A_7	Brosna_SC_020
25A_10	Brosna_SC_010

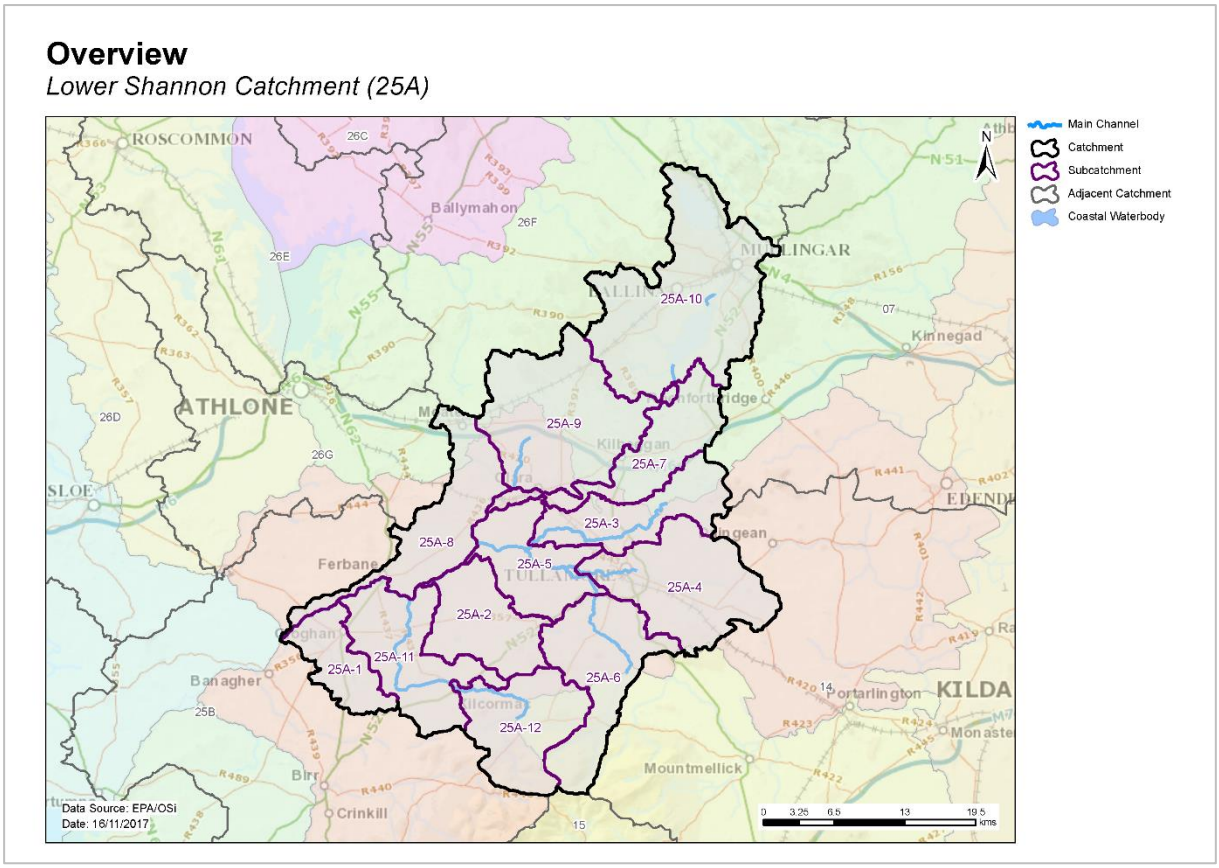

Figure 1. Subcatchments in the Lower Shannon (Brosna) catchment

2 Water body status and risk of not meeting environmental objectives

2.1 Surface water ecological status

- There were 21 (33%) river and lake water bodies at Good or High status, and 26 (41%) at less than Good status in 2015 (Table 2, Figure 2). Seventeen (27%) river and lakes water bodies are unassigned.
- One surface water body has a high status environmental objective (Gorragh_010). In 2015, this river water body was at High status (Figure 3, Appendix 1).
- The change in numbers of water bodies at each status class in 2007-09 and 2010-15 are shown in Figures 4 (rivers) and 5 (lakes).
- Since 2007-09 when WFD monitoring began, seventeen water bodies have improved and three rivers have deteriorated (Figure 6).
- The variation in nutrient concentrations and loads in the Brosna main channel is illustrated in Appendix 2.

Table 2. Summary of surface water body status and risk categories

	Number of water bodies	2010-15 Status						Risk Categories		
		High	Good	Mod	Poor	Bad	Unassigned	*Not at Risk*	*Review*	*At Risk*
Rivers	60	2	17	22	4	0	15	19	15	26
Lakes	4	0	2	0	0	0	2	2	2	0

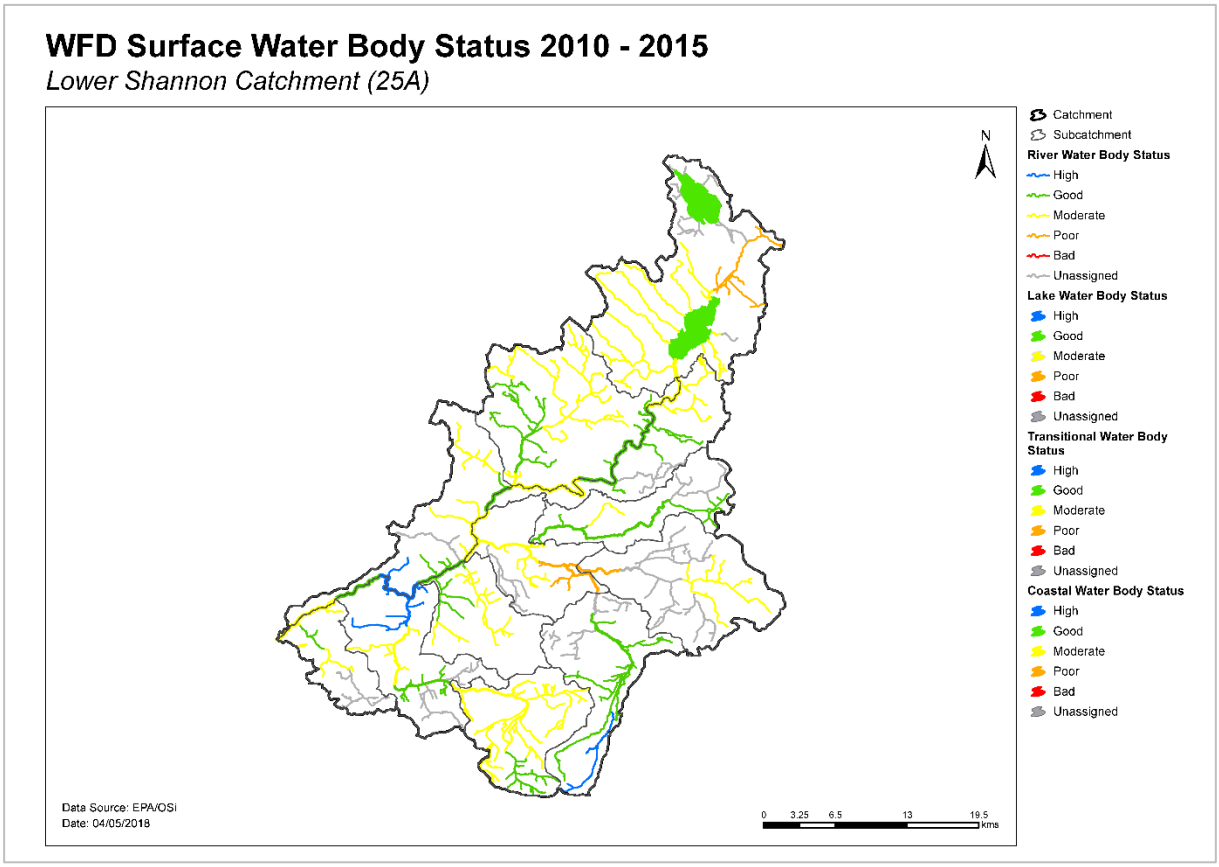

Figure 2. Surface water body ecological status

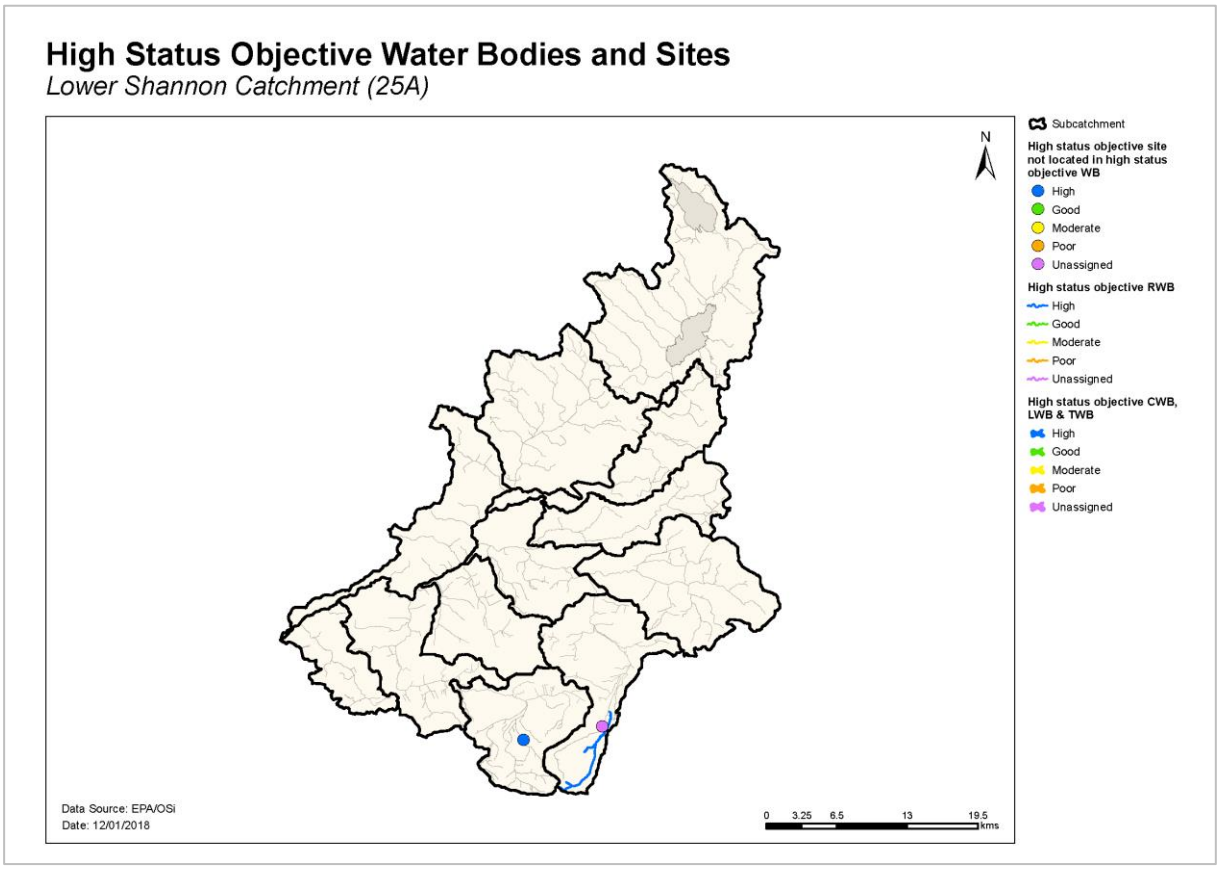

Figure 3. High ecological status objective water bodies and sites

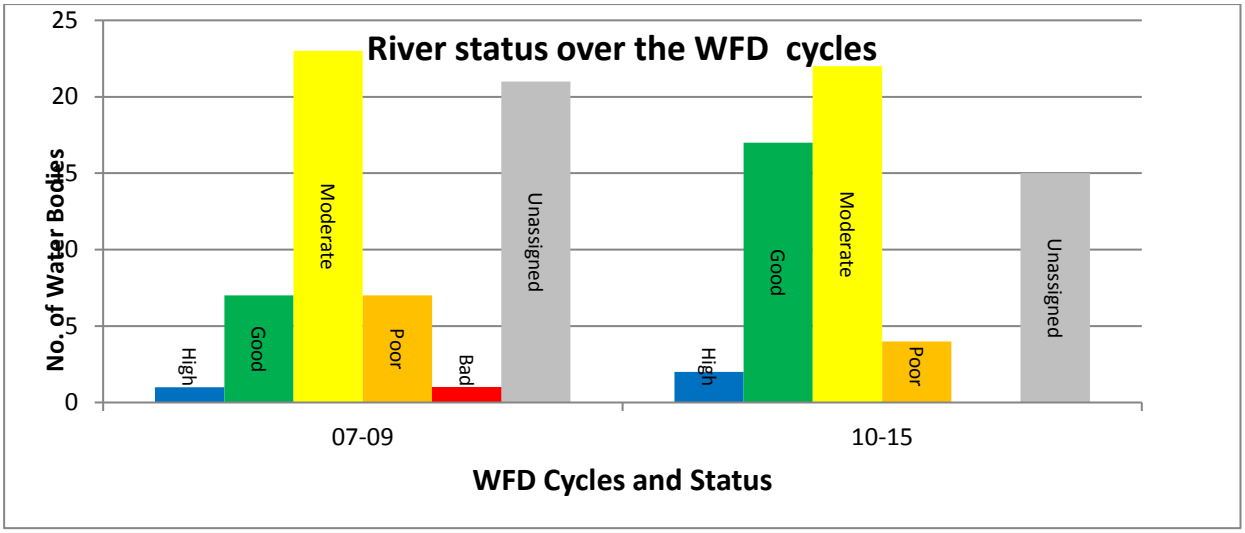

Figure 4. Number of rivers at each status class in 2007-09 and 2010-15

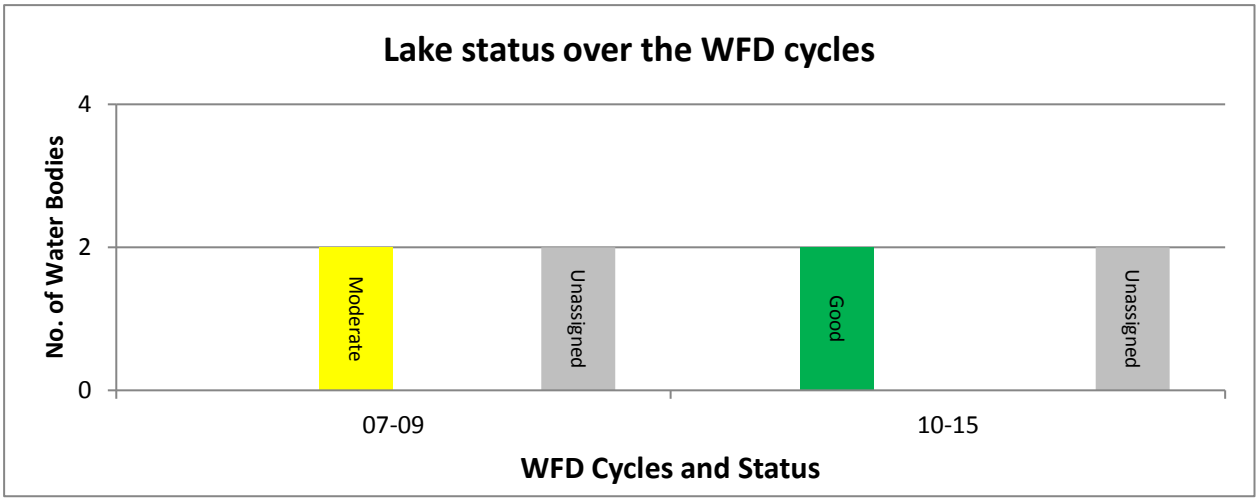

Figure 5. Number of lakes at each status class in 2007-09 and 2010-15

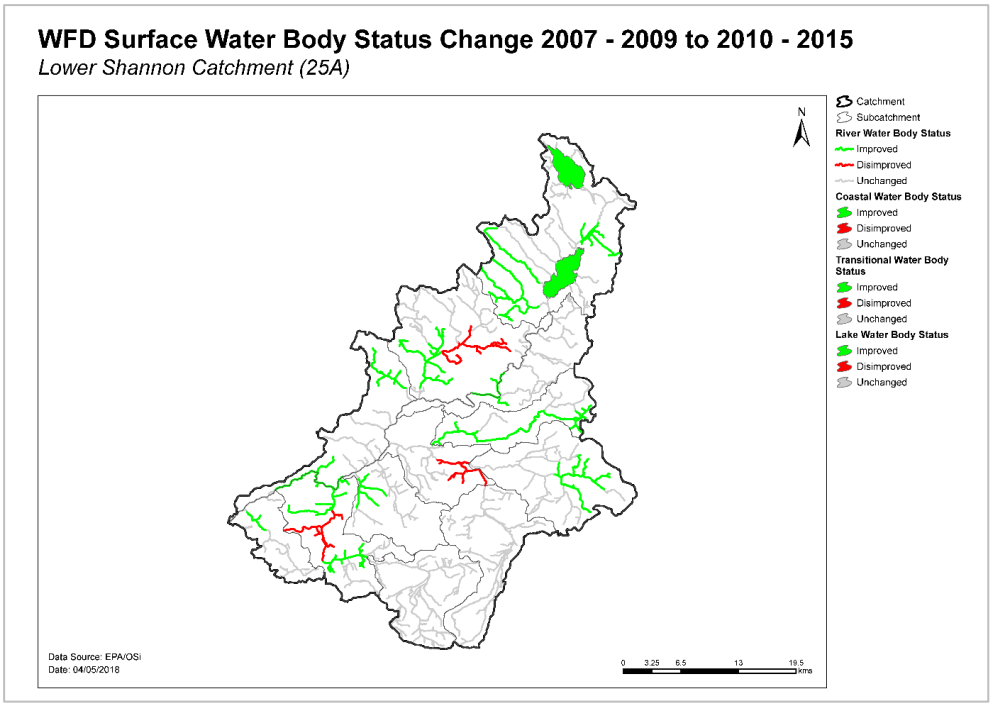

Figure 6. Surface water body status changes from 2007-09 to 2010-15.

2.2 Groundwater status

- Eighteen groundwater bodies were at Good status in 2015 (Table 3, Figure 7).
- One groundwater body, GWDTE-Clara Bog (SAC000572), is Poor status due to marginal drainage of the bog.

Table 3. Summary of groundwater body water body status and risk categories

	Number of water bodies	2010-15 Status		Risk Categories		
		Good	Poor	*Not at Risk*	*Review*	*At Risk*
Groundwater	18	17	1	7	10	1

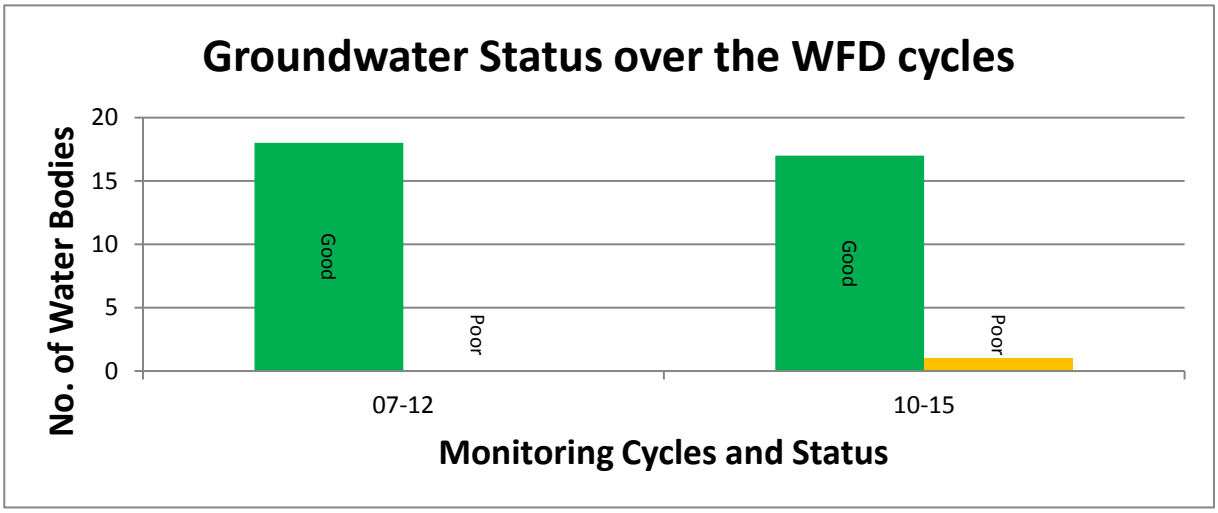

Figure 6(a). Number of groundwater bodies at each status class in 2007-09 and 2010-15

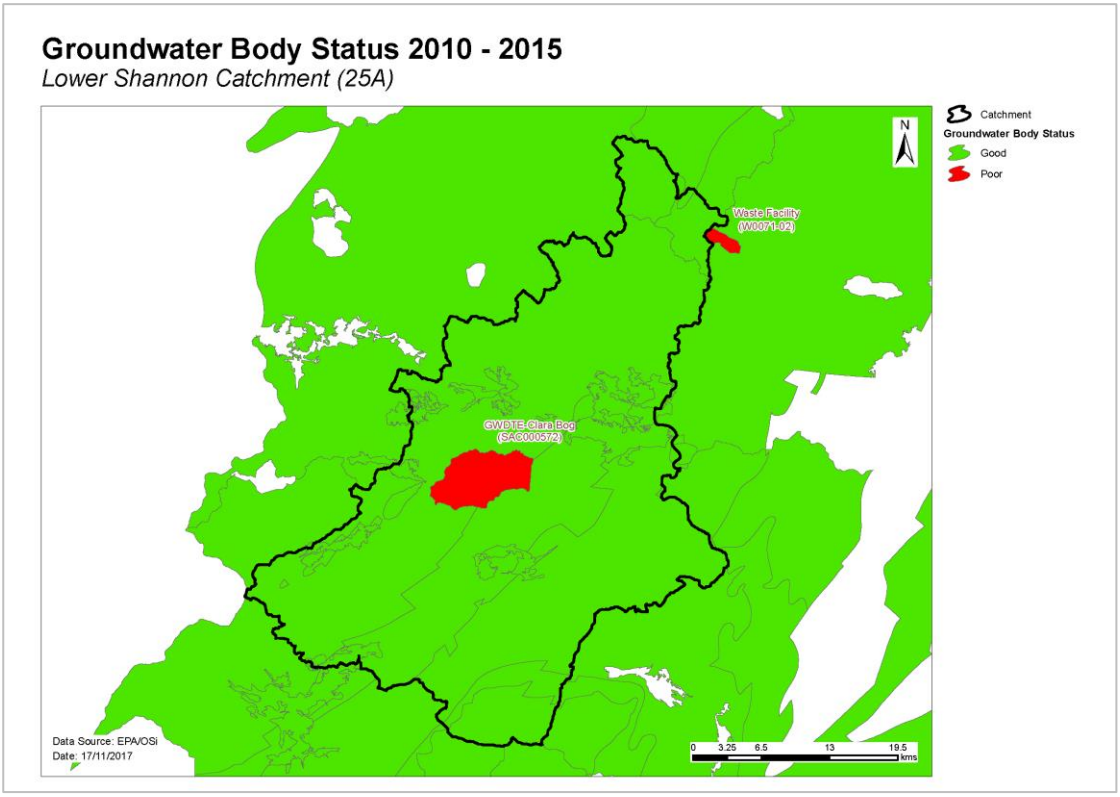

Figure 7. Groundwater body status 2010-15

2.3 Risk of not meeting surface water environmental objectives

2.3.1 Rivers and lakes

- There are 19 river water bodies and two lake water bodies *Not at Risk* (Figure 8, Table 2) which require no additional investigative assessment or measures to be applied, other than those measures that are already in place.
- There are 15 river water bodies and two lake water bodies in *Review*. This applies to 15 water bodies where more information is required and two water bodies where measures have recently been implemented and improvements have not yet been realised.
- Twenty-six river water bodies in the catchment are *At Risk* of not meeting their water quality objectives. Measures will be needed in these water bodies to improve the water quality outcomes. Summary information for the *At Risk* water bodies is given in Appendix 3. There are no lake water bodies *At Risk,* in the catchment.

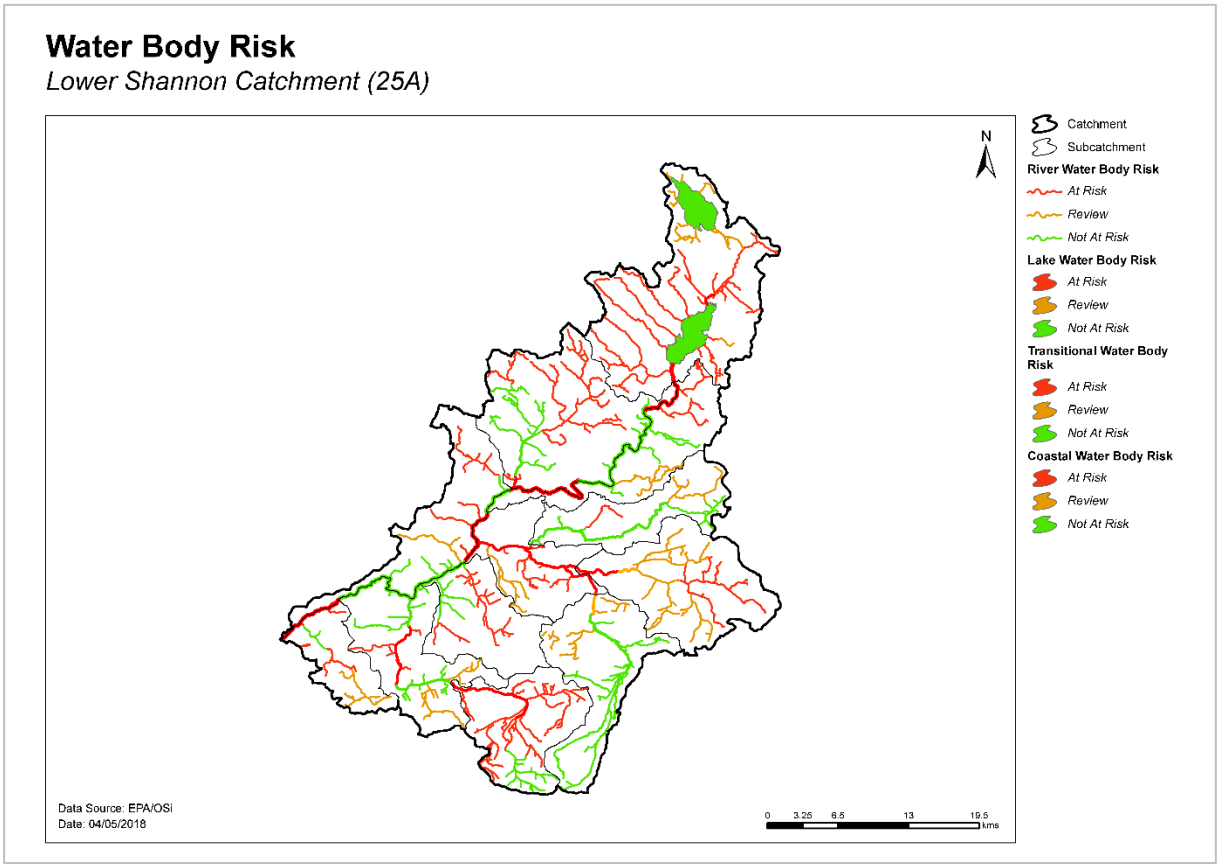

Figure 8. Surface water body risk

2.4 Risk of not meeting groundwater body environmental objectives

- Seven groundwater bodies are *Not at Risk* (Figure 9, Table 3) and require no additional investigative assessment or measures to be applied, other than those measures that are already in place.
- Ten groundwater bodies are in *Review* (Figure 9, Table 3). For eight of the groundwater bodies this is due to elevated nitrate concentrations. One groundwater body (Inny) is in *Review* as it is hydrologically linked to surface waters that are not meeting water quality objectives where it is considered likely that groundwater is a contributing source of nutrients. Another groundwater body (GWDTE Raheenmore Bog (SAC000582)) is in *Review* due to drainage.

- One groundwater body (GWDTE-Clara Bog (SAC000572) is *At Risk* of not meeting its quantitative objectives due to marginal drainage. Measures will be needed to reduce the impact in relation to the drainage of Clara Bog.

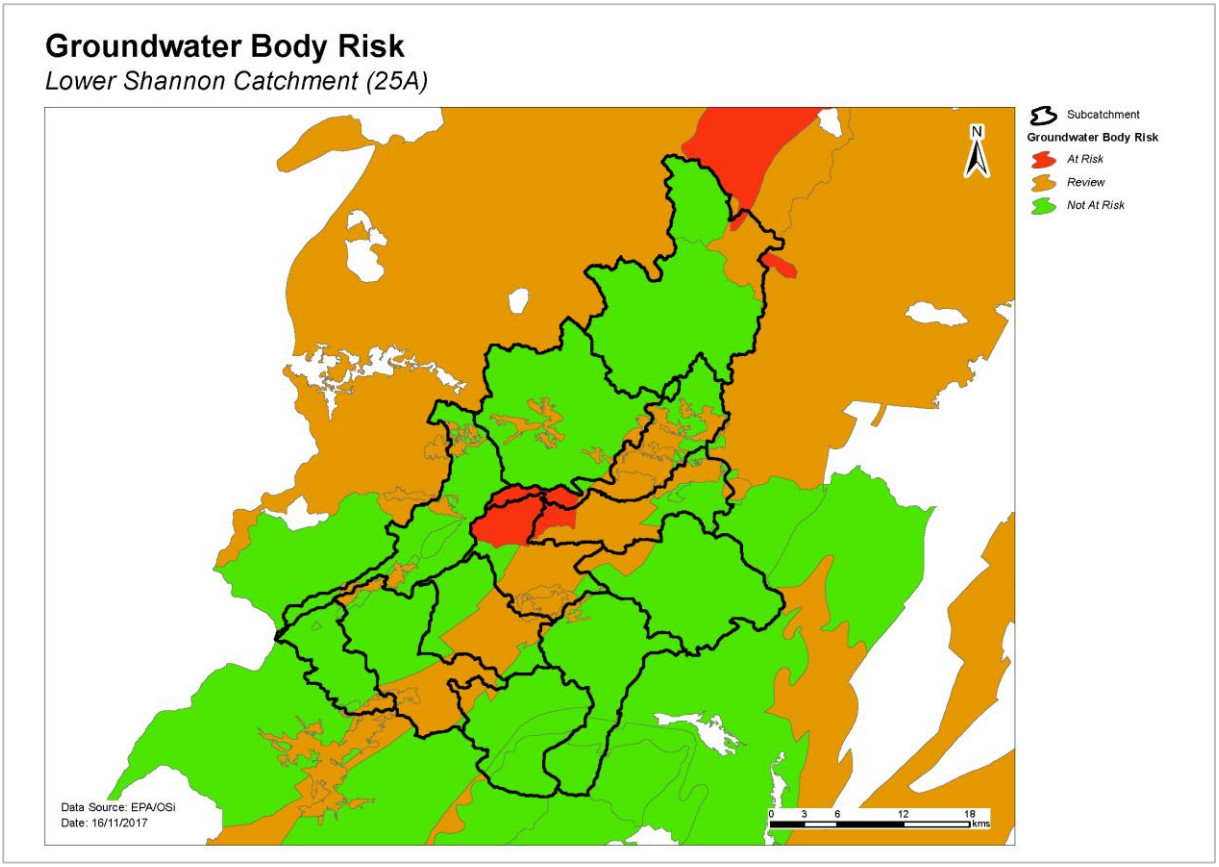

Figure 9. Groundwater body risk

2.5 Protected areas

2.5.1 Drinking water abstractions

- There are 37 abstractions in the Lower Shannon (Brosna) Catchment comprising 11 private group water schemes and 13 public water schemes (Appendix 4).
- Twenty-eight of the abstractions are from seven groundwater bodies (Boor Gravels, Slieve Bloom North, Geashill, Gageborough-Brosna Gravels Group 1, Clara, Tullamore, Clonaslee West), five are from one lake (Frewin Hill High Level Reservoir – Owel Main), three are from river water bodies (Brosna_080, Gorragh_010 and Clodiagh (Tullamore)_010), and one is from a small lake at the headwaters of a river (Ballinderry Lake on Gageborogh_030). The list of the public supplies and the associated water bodies is provided in Appendix 4.
- All sources were compliant with the standard for nitrate in 2015.
- All sources were compliant with the standards for pesticides in 2015.

2.5.2 Bathing waters

- There are two designated freshwater bathing waters and both are in satisfactory condition.
- The list of the bathing waters and the associated water bodies is provided in Table 4.

Table 4. Designated bathing waters in the catchment

Bathing water		Water body intersection		Objective met?	
Name	Code	Name	Code	Yes	No
Lilliput, Ennell	IESHBWL25_188_0100	Ennell	IE_SH_25_188	✓	
Portnashangan, Lough Owel	IESHBWL26_703_0100	Owel Main	IE_SH_26_703	✓	

2.5.3 Shellfish areas

- There are no designated shellfish areas in the Lower Shannon (Brosna) catchment.

2.5.4 Nutrient Sensitive Areas

- There are three designated Nutrient Sensitive Areas (NSAs) – (Brosna (River), Lough Ennell and Tullamore (River)) associated with two urban waste water treatment plants (Mullingar and Tullamore).
- Both urban waste water treatment plants are compliant with the environmental objectives.
- The list of NSAs, the associated agglomerations and intersecting water bodies are provided in Table 5.

Table 5. Nutrient sensitive areas in the catchment

Nutrient Sensitive Area		Agglomeration		Water body intersection		Objective met?		Comment
Name	Code	Name	Code	Name	Code	Yes	No	
Brosna (River)	IERI_SH_2001_0012	Mullingar	D0008	Brosna_030	IE_SH_25B090100	✓		Tertiary treatment is in place
				Brosna_040	IE_SH_25B090200			
				Brosna_050	IE_SH_25B090250			
				Brosna_060	IE_SH_25B090400			
				Brosna_070	IE_SH_25B090450			
				Brosna_080	IE_SH_25B090600			
				Brosna_090	IE_SH_25B090710			
				Brosna_100	IE_SH_25B090761			
				Brosna_110	IE_SH_25B090800			
				Brosna_120	IE_SH_25B090950			
				Brosna_130	IE_SH_25B091000			
				Brosna_140	IE_SH_25B091200			
Lough Ennell	IELK_SH_2001_0023			Ennell	IE_SH_25_188			
Tullamore (River)	IERI_SH_1994_0006	Tullamore	D0039	CLODIAGH (TULLAMORE)_050	IE_SH_25C060500	✓		Tertiary treatment is in place

2.5.5 Natura 2000 Sites

- There are 10 Special Areas of Conservation (SACs) in the catchment, not all of which have water quality and/or quantity conservation objectives for their qualifying interests.
- All six water bodies (1 river and 5 groundwater bodies) with water dependent qualifying interests within these SACs have met their WFD Protected area objectives (Appendix 5).
- There are four Special Protected Areas (SPAs) in the catchment:
  - Lough Ennell SPA
  - Lough Owel SPA

- Middle Shannon Callows SPA
- Slieve Bloom Mountains SPA

As there are no specific water quality and quantity supporting conditions identified in the site-specific conservation objectives for these SPAs, the intersecting water bodies are not assigned priority action for WFD protected area purposes in the second cycle.

2.6 Heavily modified and artificial water bodies

- There are no designated heavily modified water bodies (HMWBs) in the catchment.
- There are six designated artificial water bodies (AWBs) in the catchment, all of which were at Maximum ecological potential. These include:
  - The Royal Canal (West of Lough Owel Feeder);
  - Royal Canal Lough Owel Feeder;
  - Royal Canal (East of Lough Owel Feeder);
  - Royal Canal Main Line;
  - Grand Canal Main Line; and
  - Grand Canal Main West of Lowtown.

3 Significant issues in *At Risk* water bodies

- Excess phosphorus leading to eutrophication is an issue in some rivers, however spikes in ammonia concentrations are also an issue in a smaller number of water bodies.
- Alteration of hydromorphological (or physical) conditions are a significant issue including the input of excessive fine sediment. Such impacts have altered the morphology of water bodies and in turn, altered habitat conditions.
- There is one *At Risk* groundwater body (GWDTE-Clara Bog (SAC000572)) and the significant issue here is drainage.

4 Significant pressures

4.1 Water bodies

Where water bodies have been classed as *At Risk*, by water quality or survey data, significant pressures have been identified.

- Figure 10 shows a breakdown of the number of *At Risk* water bodies in each significant pressure category.

4.1.1 Rivers and lakes

- None of the lakes are *At Risk* and therefore significant pressures have not been identified.
- Significant pressures have been identified during the initial characterisation process in 26 river water bodies, 14 of which have multiple pressures. The significant pressures will be refined as further characterisation is carried out.
- The significant pressure affecting the greatest number of *At Risk* water bodies is hydromorphological followed by agriculture, urban waste water, forestry, peat, diffuse urban, industry and other (Figure 10).

4.1.2 Groundwater

- There is one *At Risk* groundwater body (GWDTE-Clara Bog (SAC000572) which relates to the quantitative impact in relation to drainage of Clara Bog.

4.2 Pressure type

4.2.1 Hydromorphology

- There are 12 water bodies which are considered At Risk due to morphological issues. These are summarised in Table 5(a). Typically, these types of pressures either have the effect of degrading the habitat or riparian zone of the river, obstructing flows, separating the river from its flood plain or instigating a secondary water quality issue such as siltation. Eight water bodies within the Brosna subcatchment are subject to extensive modification mainly due to the presence of drainage schemes.

- Reaches within two river water bodies of the Brosna subcatchment were noted to be culverted. A private hydroelectric plant was also noted within a river water body shared by the Brosna SC_020 and SC_030 subcatchments. Water bodies that are *At Risk* and impacted by hydromorphological pressures are also shown in Figure 11 and listed in Appendix 3.

Table 5(a) – Hydromorphological Pressures in the Brosna Sub-Catchment

Pressure	**Sub-Catchment**	**Waterbody Code**
Modification due to Drainage Schemes (Channelisation)	Brosna_SC_080	Brosna_140
	Brosna_SC_050	Boora_010
	Brosna_SC_040	Clodiagh_050
	Brosna_SC_030	Ballynagrenia Stream_010
	Brosna_SC_010	Brosna_020
		Brosna_040
		Dysart Stream_010
		Monaghanstown Stream_010
Land Drainage	Silver (Kilcormac)_SC_010	Silver (Kilcormac)_020
In River Structures	Brosna_SC_020	Brosna_080
	Brosna_SC_030	Gageborough_020
	Brosna_SC_070	Silver (Kilcormac)_050

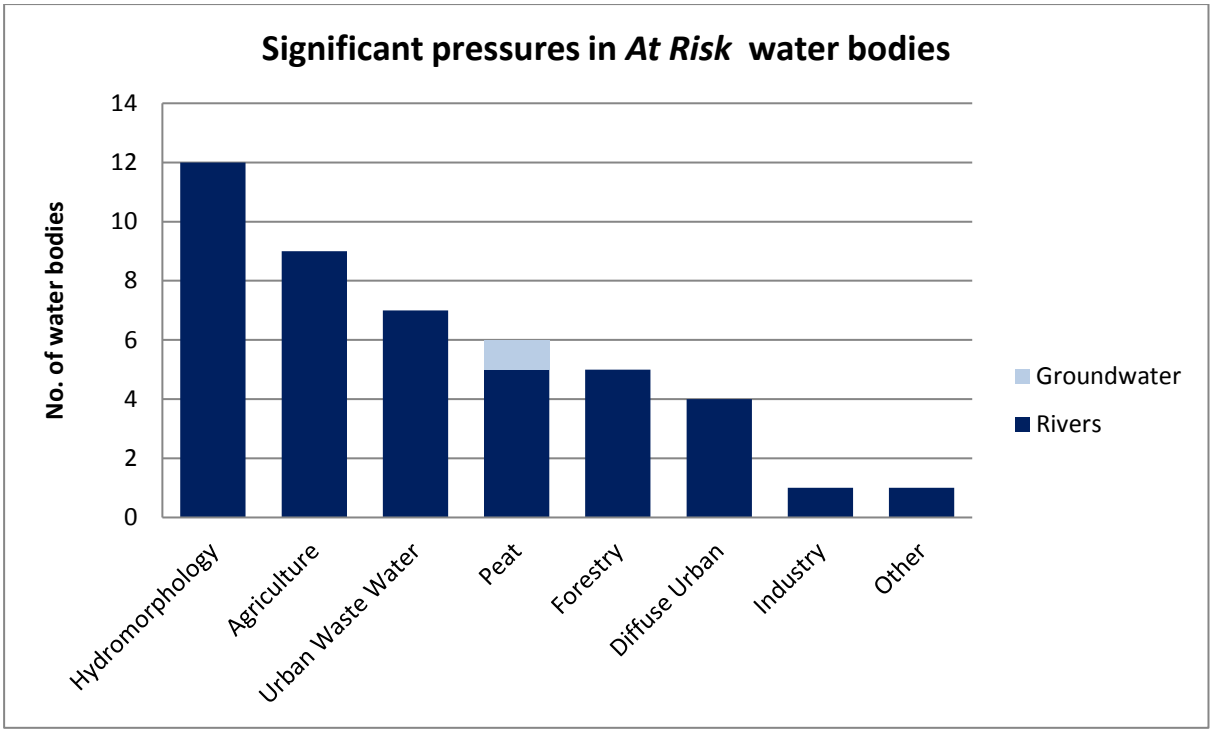

Figure 10. Significant pressures impacting on *At Risk* water bodies

4.2.2 Agriculture

- Agriculture is a significant pressure in the catchment areas of nine surface water bodies (Figure 12, Appendix 3). The issues related to farming are primarily nutrients and morphological, with diffuse sources of phosphate in poorly draining areas along the channels (also confirmed by biological surveys). Animal access also affects a large proportion of the water bodies *At Risk* from agriculture which can result in morphological impacts. The pollution impact potential map showing areas of relative risk for phosphorus loss from agriculture to surface water is given in Appendix 6.

4.2.3 Urban waste water treatment plants

- Urban Waste Water Treatment Plants (WWTPs) and agglomeration networks have been highlighted as significant pressures in seven *At Risk* water bodies; details are given in Table 6 and Figure 13. Tullamore agglomeration network is scheduled to be upgraded by 2028, however, the WWTP, rather than the agglomeration network, has been identified as a significant pressure impacting Tullamore_040.

4.2.4 Forestry

- Forestry has been identified as a significant pressure in the catchment areas of 5 water bodies (Figure 14, Appendix 3). The significant issues are a combination of phosphorus loss to water and hydromorphological impacts from the release of sediment, primarily related to clearfelling and forestry activities on peaty soils. In addition, there have been noted spikes in total ammonia.

4.2.5 Extractive Industry

Peat

- Peat drainage and extraction have been identified as a significant pressure in five river water bodies (Figure 15, Appendix 3). Elevated ammonia concentrations and silt are the significant issues. Peat drainage is also identified as a significant pressure on GWDTE-Clara Bog. IE__G_039.

Table 6. Waste Water Treatment Plants and agglomerations identified as Significant Pressures in *At Risk* water bodies and expected completion dates for associated upgrade works, where applicable.

Facility name	Facility Type	Water Body	2010-15 Ecological Status	Expected Completion Date
Kilcormac D0225	1,001 to 2,000 p.e.	Silver (Kilcormac)_030	Moderate	*N/A* [1]
Ballinagar D0362	500 to 1,000 p.e.	Tullamore_020	Moderate	*N/A* [1]
Tyrellspass D0099	2,001 to 10,000 p.e.	Brosna_050	Moderate	*N/A* [1]
Moate D0097	2,001 to 10,000 p.e.	Moate Stream_010	Moderate	*N/A* [1]
Tullamore D0039	> 10,000 p.e.	Tullamore_040	Poor	*2028* [2]
Mucklagh D0364	500 to 1,000 p.e.	*Clodiagh (Tullamore)_050* [3]	Poor	*N/A* [1]
Clara D0142	2,001 to 10,000 p.e.	*Brosna_080* [3]	Moderate	*N/A* [1]

4.2.6 Diffuse urban

- Diffuse urban pressures, caused by misconnections, leaking sewers and runoff from paved and unpaved areas has been identified as a significant pressure in four water bodies – the Brosna_020 which passes through Mullingar and Brosna_030 which is downstream of Mullingar, the Brosna_080 which passes through Clara and the Moate Stream_010 which is downstream of Moate (Figure 16, Appendix 3). Elevated nutrients are the significant issue.

4.2.7 Industry

- An industrial site has been identified as a significant pressure in Brosna_100 (Figure 17), with elevated total ammonia concentrations being the issue of concern.

4.2.8 Other

Abstraction

- A reduction in water levels due to abstraction is impacting river water body Clodiagh (Tullamore_050) (Figure 18).

[1] *Currently not specified in improvement plans.*

[2] *The Tullamore agglomeration network, rather than the WWTP, is scheduled to be upgraded by 2028.*

[3] *The agglomeration network, rather that the WWTP, has been identified as a significant pressure impacting Clodiagh (Tullamore)_050 and Brosna_080.*

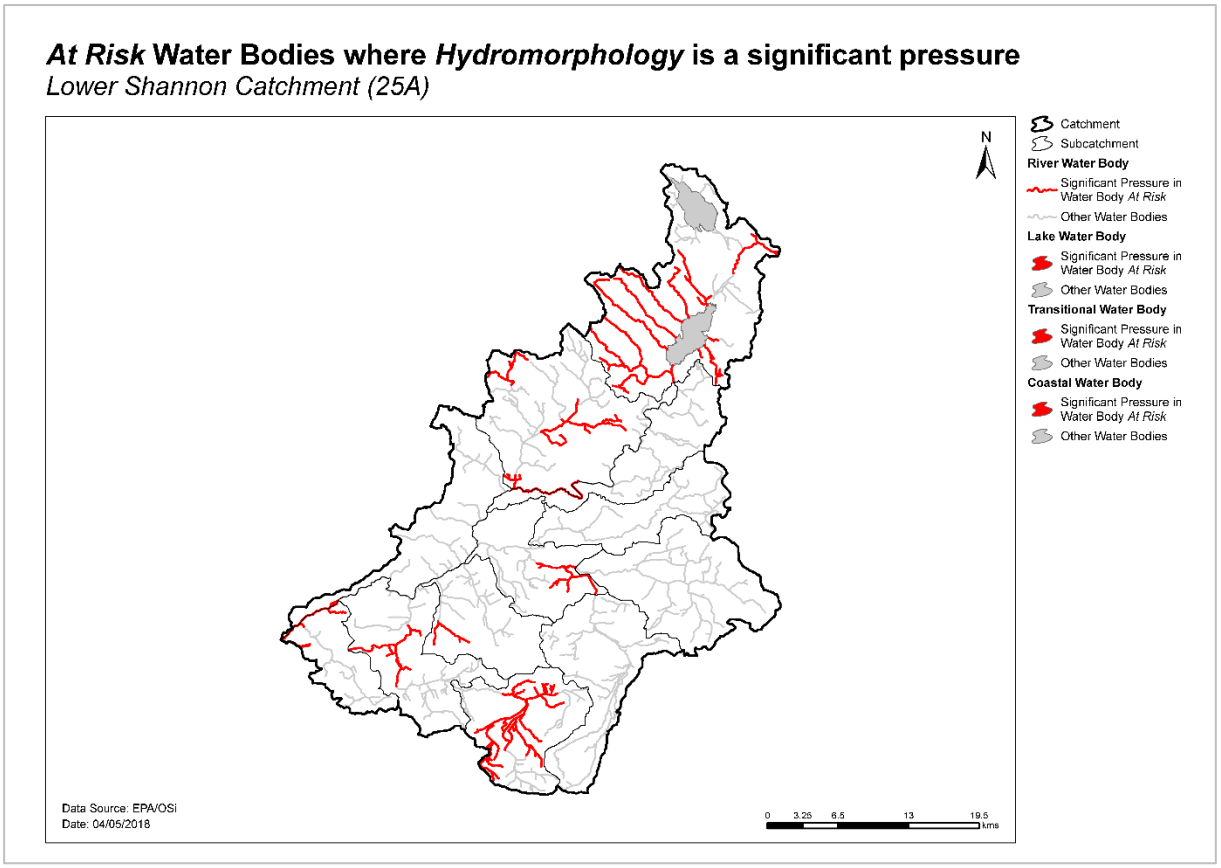

Figure 11. Water bodies that are *At Risk* and are impacted by hydromorphological pressures

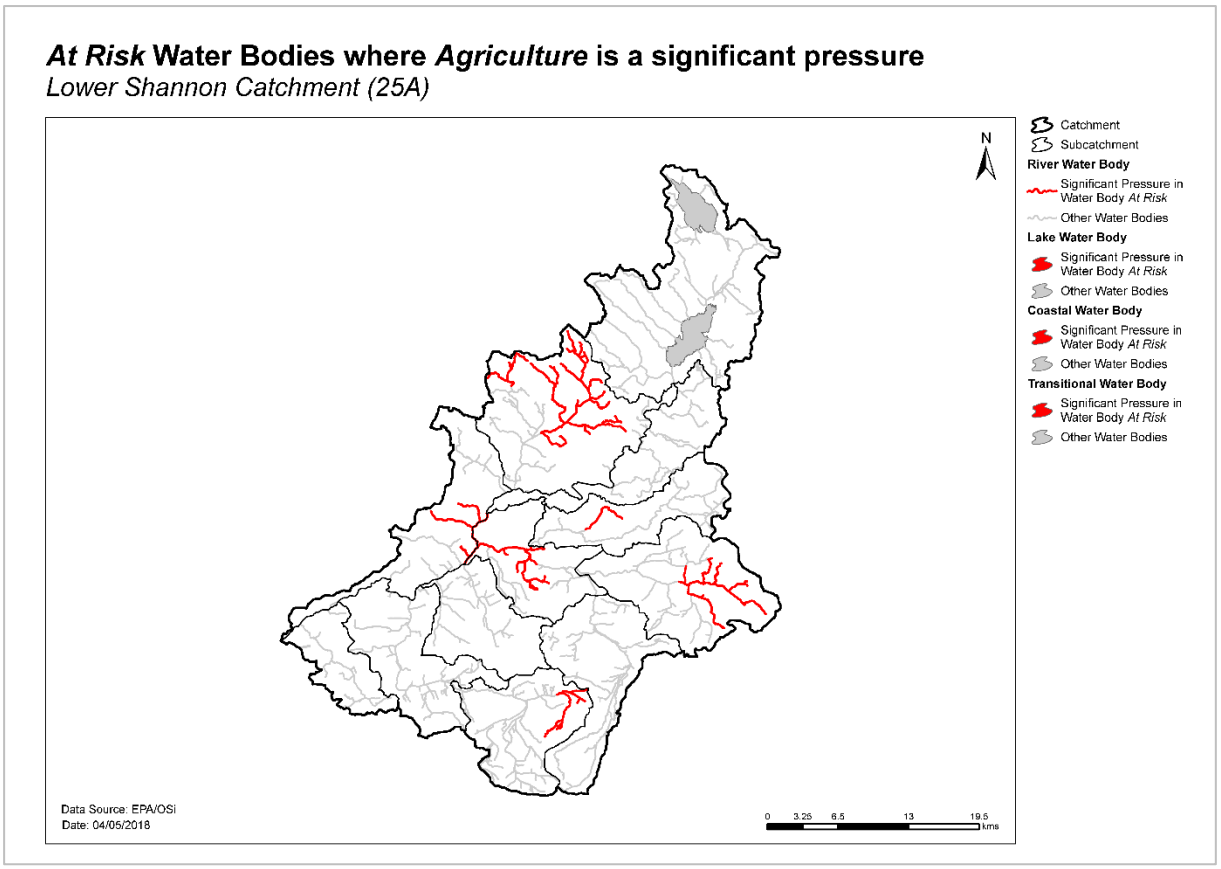

Figure 12. Water bodies that are *At Risk* and are impacted by agricultural activities

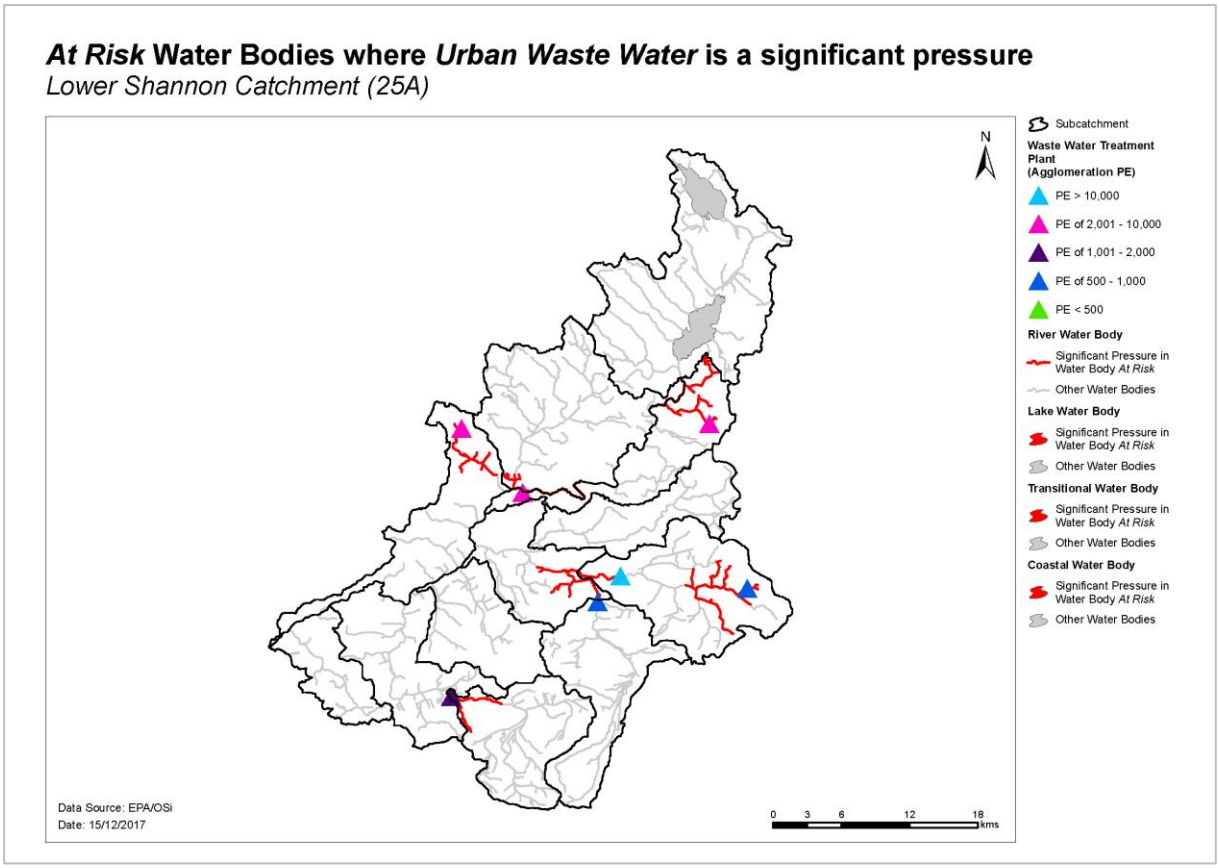

Figure 13. Water bodies that are *At Risk* and are impacted by urban waste water

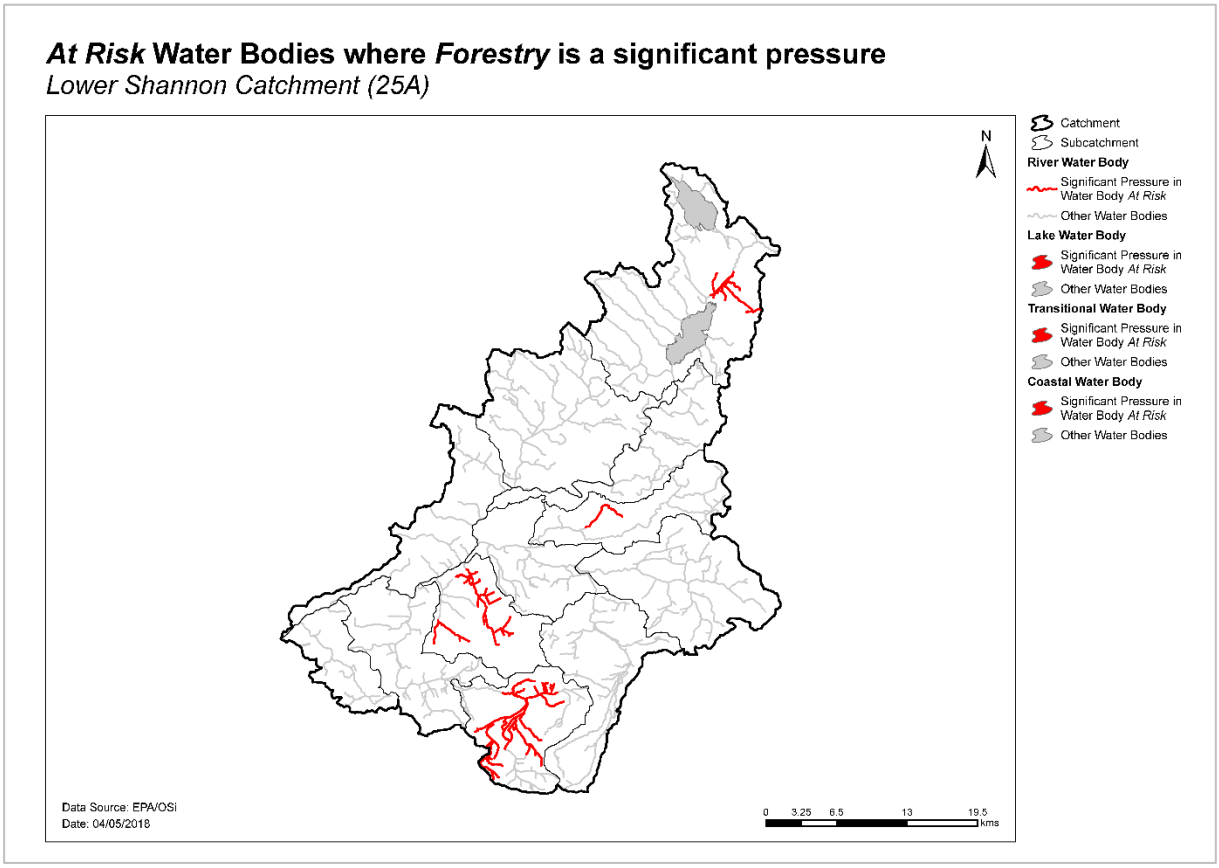

Figure 14. Water bodies that are *At Risk* and are impacted by forestry activities

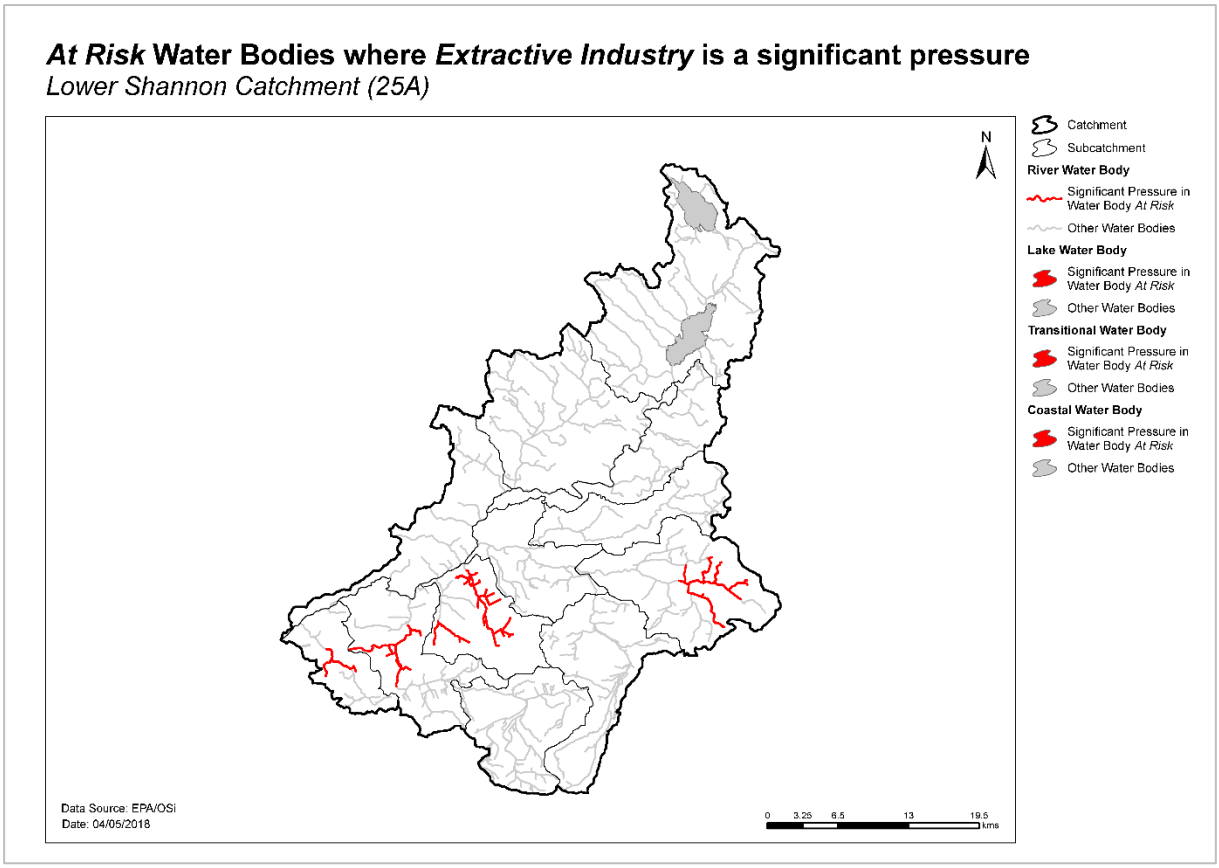

Figure 15. Water bodies that are *At Risk* and are impacted by peat

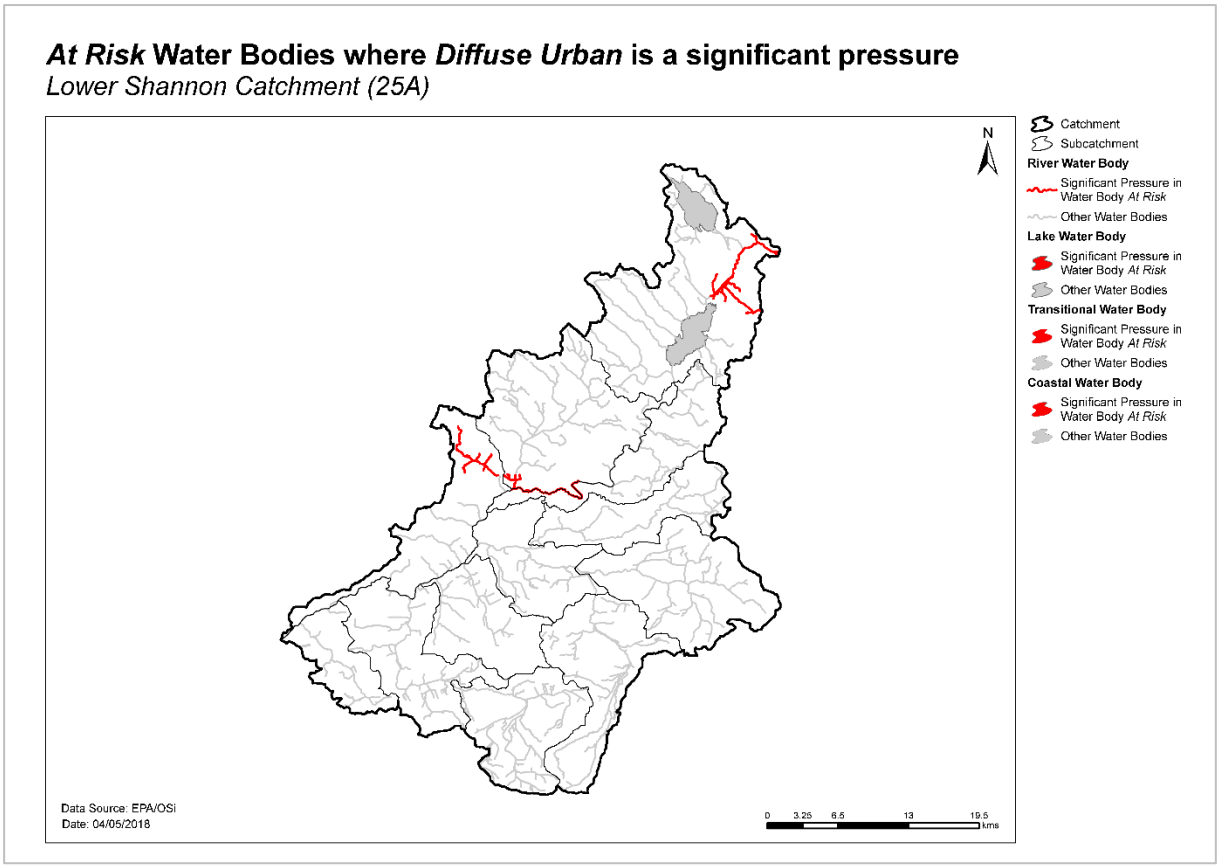

Figure 16. Water bodies that are *At Risk* and are impacted by diffuse urban

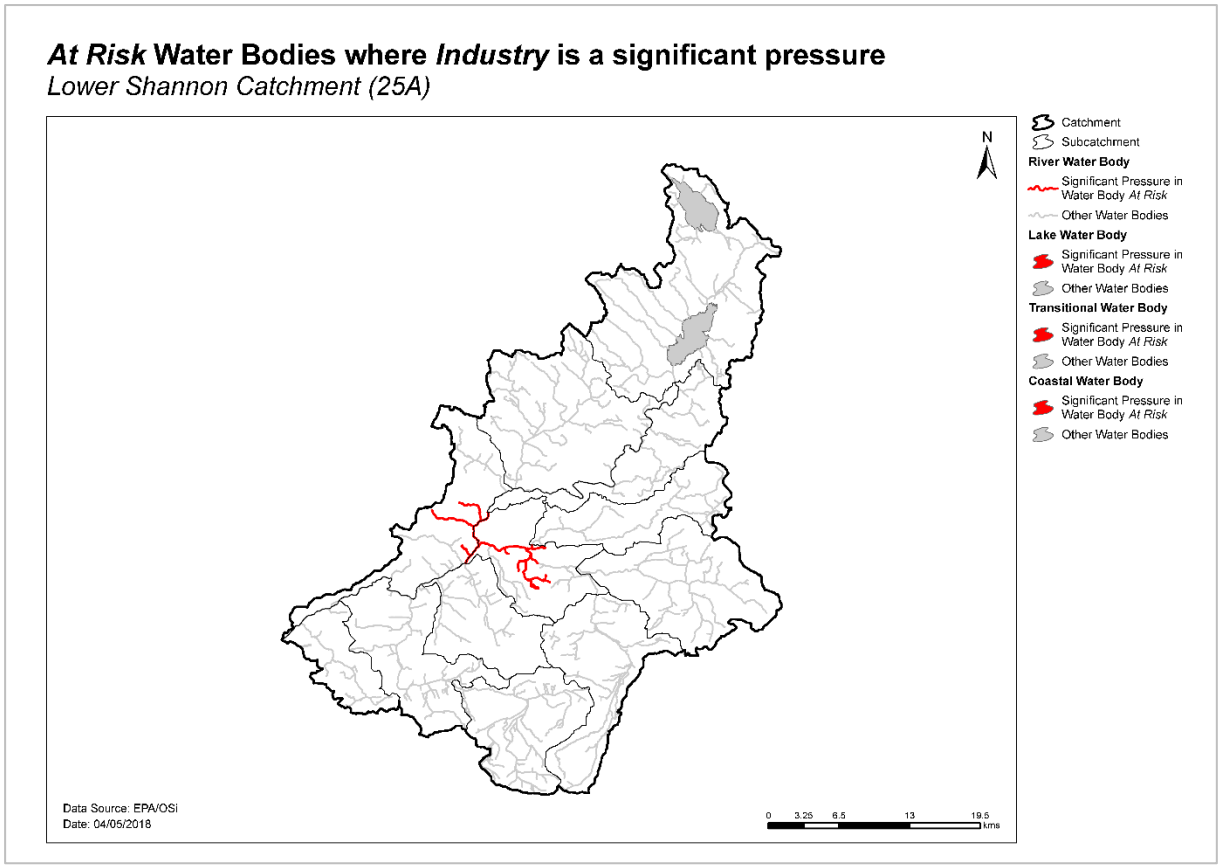

Figure 17. Water bodies that are *At Risk* and are impacted by industry

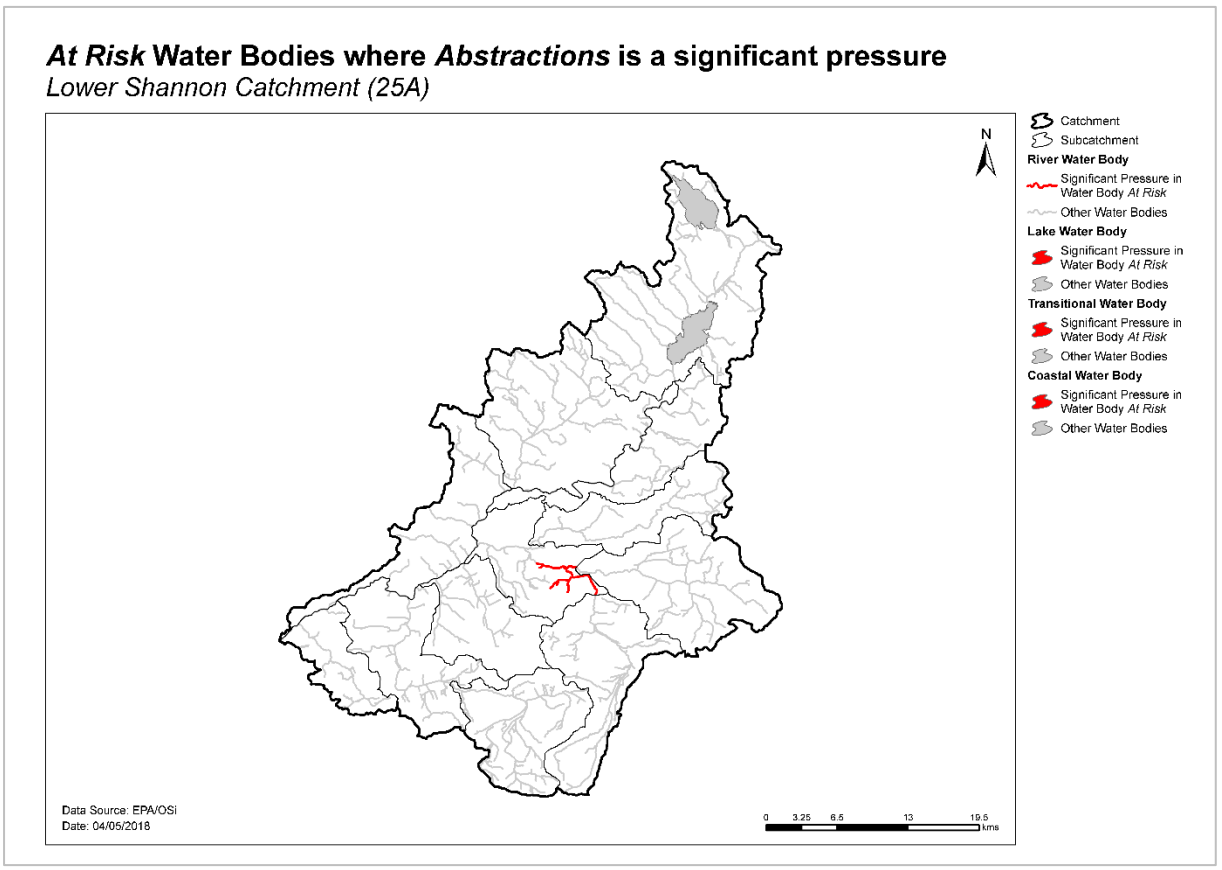

Figure 18. Water bodies that are *At Risk* and are impacted by abstraction

5 Load reduction assessment

5.1 River water body load reductions

- Phosphate is the main parameter influencing water quality in rivers in the catchment.
- For water bodies where phosphorus monitoring data are available, the reduction in P load that would be required to bring the mean concentration back to the EQS of 0.035 mg/l as P, can be estimated using a simple method based on the average 2013 to 2015 concentration and the average flow, or the estimated 30th percentile flow (Q30) where flow data are not available. The relative load reductions are ranked on a national scale from Very High (>1 kg/Ha/y), to High (0.5-1 kg/Ha/y), to Medium (0.25-0.5 kg/Ha/y) to Low (<0.25 kg/Ha/y). Note that P load reductions may also be required in other water bodies, but without chemistry monitoring data a quantitative estimate cannot be calculated.
- The results of the orthophosphate load reduction assessment for the 25A Lower Shannon catchment highlight that only two water bodies of the 60 water bodies in the catchment require phosphate load reduction (Table 8). The highest load reduction is required in the Brosna_030 water body with a total of 1,264Kg/yr, followed by the Tullamore_020 with a total of 250Kg/yr. The 2015 baseline concentrations for the Brosna_030 and the Tullamore_020 are 0.068mg/l and 0.042mg/l, with estimated Q30 flows of 1.2m3/s and 1.1m3/s, respectively.

Table 7. Relative load reductions required in monitored water bodies that are *At Risk*.

Water Body	P Load Reduction Required
Brosna_030	High
Tullamore_020	Low

6 Further Characterisation and Local Catchment Assessments

- Further characterisation through local catchment assessments is needed in 26 of the *At Risk* water bodies to refine the understanding of the significant pressures at the site/field scale so that specific and targeted measures can be identified.
- Further characterisation through local catchment assessments is needed in 17 *Review* water bodies to refine the understanding of the significant pressures at the site/field scale so that specific and targeted measures can be identified.
- Brief definitions on the 10 IA assessment scenarios are given in Appendix 7 and the number of IAs required for each scenario are given in Table 8.

Table 8. Investigative assessment allocation for *At Risk* and *Review* river and lake water bodies

Risk	IA 1	IA 2	IA 3	IA 4	IA 5	IA 6	IA 7	IA 8	IA 9	IA 10	Total
At Risk	34	0	4	0	1	4	10	0	0	0	**53**
Review	3	0	14	2	0	1	0	0	0	0	**20**
Note water bodies may have multiple categories of Local Catchment Assessments											

7 Catchment summary

- Of the 64 surface water bodies, 26 are *At Risk* of not meeting their WFD objectives.
- Hydromorphological (or physical) conditions (including the input of excessive fine sediment) and poor habitat quality are major issues for several surface water bodies. The issues primarily

relate to drainage schemes, bank erosion, animal access, forestry and a private hydroelectric plant.

- Excess nutrient loss, mainly phosphate, leading to eutrophication is also an issue for rivers and lakes in the catchment. The significant pressures relating to excess nutrients are primarily diffuse agricultural, but also forestry activities, urban waste water, peat workings and urban diffuse.
- There is one *At Risk* groundwater body which relates to the drainage of Clara Bog.

8 Areas for Action

The characterisation outcomes described above have highlighted that there is significant work to do in the catchment to protect and restore water quality, and meet the objectives of the WFD. During the development of the draft river basin management plan it became apparent that there would be a need to prioritise areas for collective action so that the best return on investment could be achieved. 190 Areas for action have been selected nationally in a process as described below. There are 4 areas for action in the Lower Shannon (HA25A) catchment.

8.1 Process of Selection

Following the publication of the draft river basin management plan in early 2017, the EPA and the Local Authority Waters and Communities Office (LAWCO) jointly led a collaborative regional workshop process to determine where, from a technical and scientific perspective, actions should be prioritised in the second cycle. The prioritisation process was based on the priorities in the draft river basin management plan, the evidence from the characterisation process, and the expertise, data and knowledge of public body staff with responsibilities for water and the different pressure types. The recommended areas for action selected during the workshops were then agreed by the Water and Environmental Regional Committees.

The recommended areas for action are an initial list of areas where action will be carried out in the second cycle. All water bodies that are *At Risk* still however, need to be addressed. As issues are resolved, areas for action will be removed from the list and new areas will be added. If additional monitoring shows that new issues have arisen, new areas may become a priority and may need to be added to the work programme.

The initial list of areas for action is not therefore considered as a closed or finite list; it simply represents the initial areas where work will be carried out during the second WFD planning cycle from 2018 to 2021.

8.2 Outcomes of process

The outcomes for the Lower Shannon (Brosna) catchment are summarised below.

- Four recommended areas for actions (Table 9, Figure 19) were selected.
- These are the Lough Ennel, Gageborough, Boora and Silver (Kilcormac).
- These include ten *At Risk* river water bodies.
- None of the groundwater bodies, which are *At Risk* or *Review* due to groundwater contribution of nutrients to surface water, intersect with recommended areas for action in the Lower Shannon (Brosna).

A remaining 33 *At Risk* and *Review* surface water bodies were not included in the recommended areas for action for the second cycle. The distribution of these is presented in Figure 20. These include:

- Thirty-three river and lake water bodies – 16 *At Risk* and 17 *Review*

Table 9. Recommended Areas for Action in the Lower Shannon (Brosna) Catchment

Recommended area for action	Number of water bodies	SCs	Local authority	Benefit
Lough Ennel	1	25A_10	Westmeath	• Important fishery - wild brown trout. • Building on restoration works completed by IFI. • Potential pilot hydromorphology project. • Important for angling tourism. • Feeder streams to Lough Ennell. • Socio economic benefit for town.
Gageborough	3	25A_9	Westmeath	• Joint County project. • Potential 'quick wins'. • Headwaters to river Gageborough. • Group water scheme in area. • One deteriorated water body.
Boora	2	25A_2	Offaly	• Bog project to examine potential for improvement by rewetting, in collaboration with Bord na Mona. • Long term challenge. • Area important for tourism.
Silver (Kilcormac)	4	25A_12 25A_11	Offaly	• Building on existing work completed by Offaly County Council. • Build on works completed by IFI, in conjunction with Bord na Mona. • Headwaters to a High Ecological Status objective water body. • Three potential 'quick wins'. • Group water scheme in area. • One deteriorated water body.

9 Environmental Objectives

The environmental objectives are the target status for each *At Risk* or *Review* waterbody and the date by which that status is expected to be achieved (Appendix 3). Where a water body is *Not at Risk* and is already at its target status, the environmental objective is deemed to have been met.

9.1 Surface Water

- Assuming resources are available and actions are taken in the recommended areas for action, of the ten *At Risk* river water bodies, it is predicted that five (60%) will improve by 2021 and five (40%) will achieve their objective by 2027, see Table 11.

Table 11. Environmental objective dates for water bodies in the Areas for Action

Risk Category	No. of Water Bodies	No. of WBs for 2021 Improvement	No. of WBs for 2027 Status Improvement
At Risk	10	5	5
Review	0	0	0
Not at Risk	0	0	0
Total	10	5	5

- Twenty-one water bodies have met their 2015 environmental objective.
- As action is not yet planned to be taken in the remaining 16 *At Risk* surface water bodies, a 2027 date is applied to all 16 water bodies.
- For the 17 *Review* surface water bodies, the absence of information on these water bodies means that there is no scientific basis to quantify an environmental objective date and therefore a 2027 date is applied, see Table 12.

Table 12. Environmental objectives dates in the *At Risk* and *Review* surface water bodies not included in Areas for Action

Risk Category	No. of Water Bodies	No. of WBs for 2021 Improvement	No. of WBs for 2027 Status Improvement
Rivers			
At Risk	16	0	16
Review	15	0	15
Lakes			
At Risk	0	0	0
Review	2	0	2
Total	33	0	33

9.2 Groundwater

- Seventeen of the eighteen groundwater bodies are currently Good status and, therefore, have met their environmental objectives.
- The one groundwater body, GWDTE-Clara Bog (SAC000572), in the Lower Shannon catchment that is less than Good status has an environmental objective date of 2027.

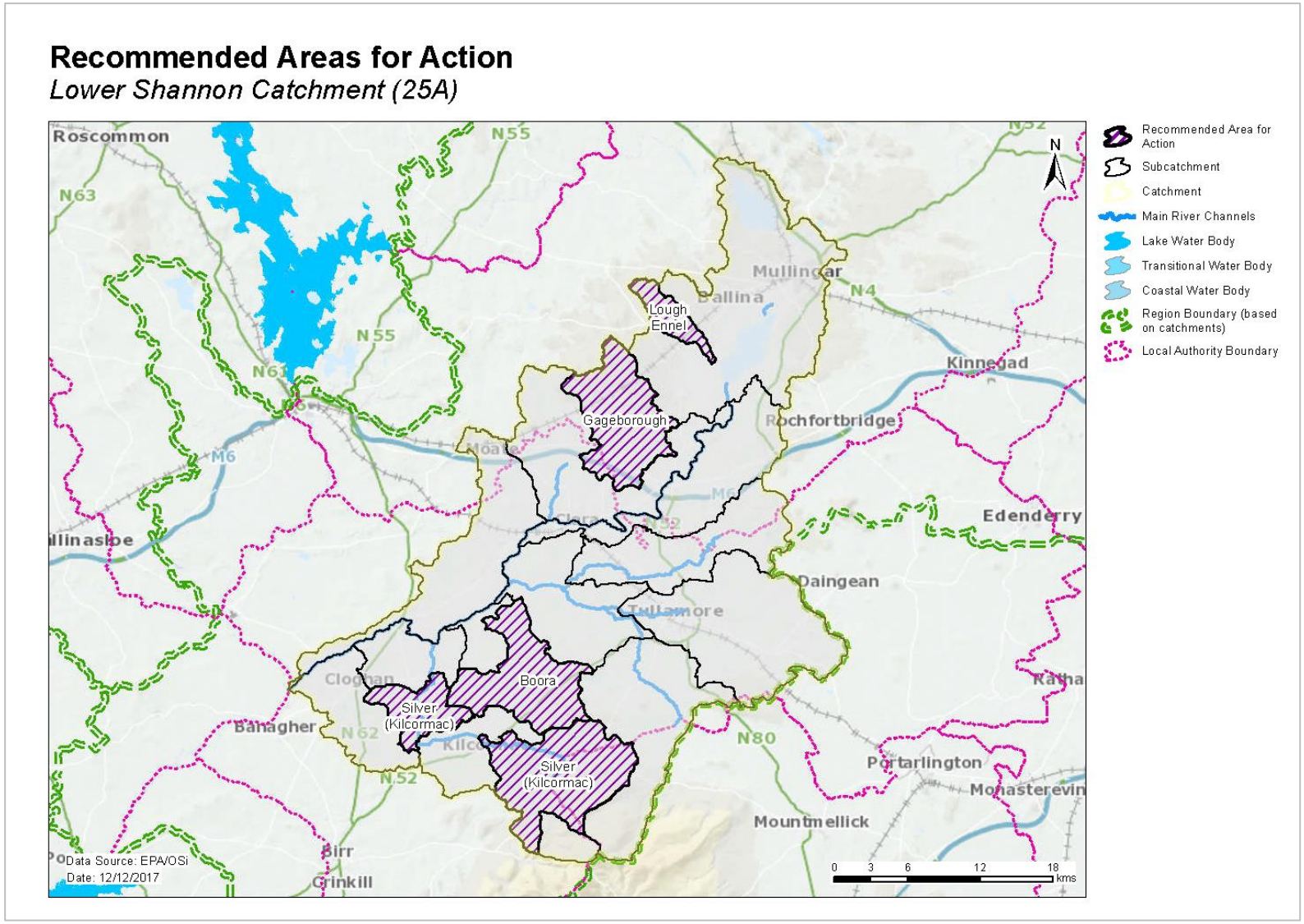

Figure 19. Location of Recommended Areas for Action in the Lower Shannon (Brosna) Catchment

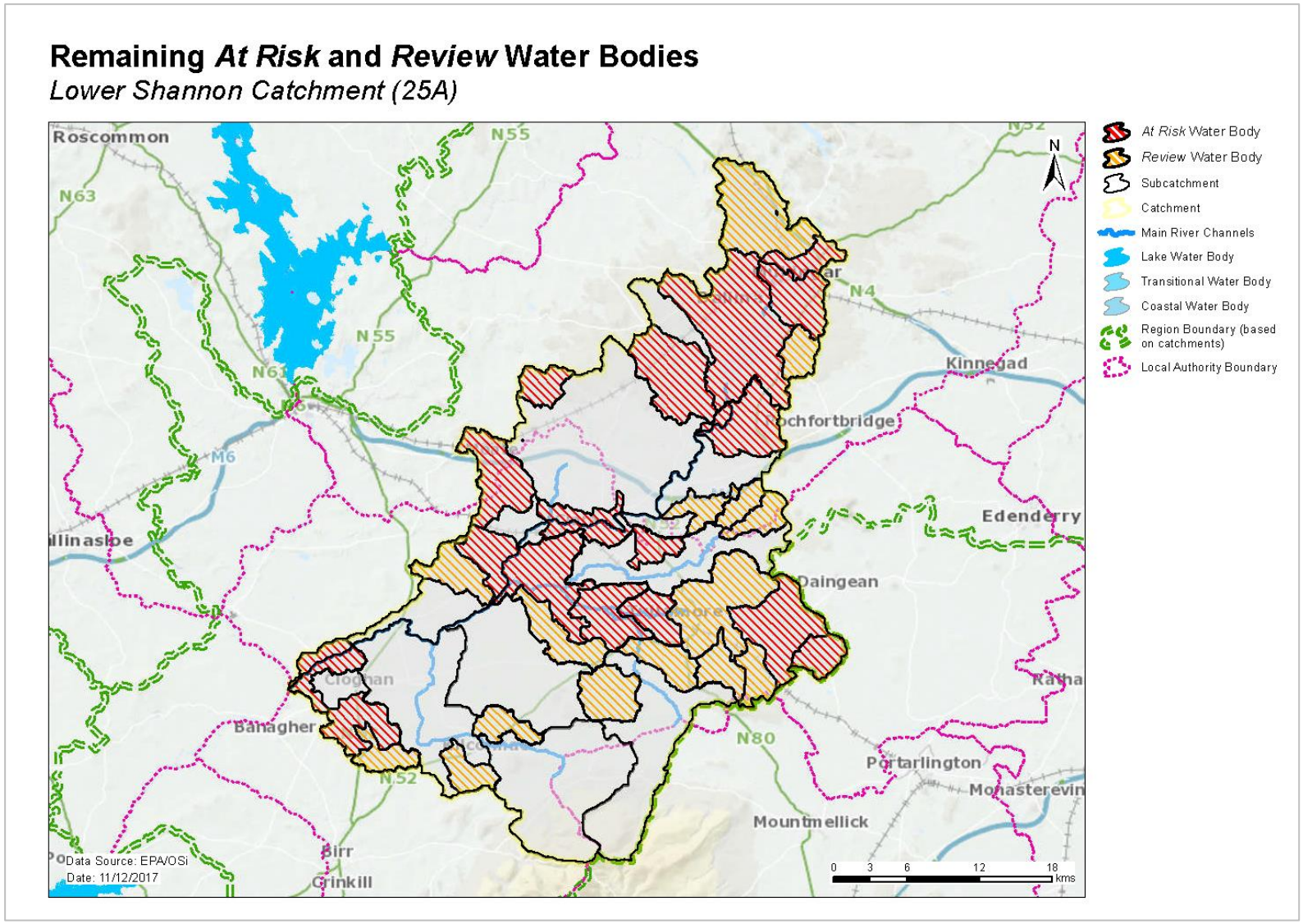

Figure 20. Location of *At Risk* and *Review* water bodies located outside Recommended Areas for Action in the Lower Shannon (Brosna) Catchment

10 Acknowledgements

This Lower Shannon (Brosna) Catchment Assessment (Version 2) has been produced by the Catchment Science & Management Unit, EPA, with the assistance of the following:

- Offaly County Council
- Westmeath County Council.
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- Inland Fisheries Ireland.
- Local Authorities Waters & Communities Office.
- Irish Water.
- RPS Group.
- Ecological Monitoring & Assessment Unit, EPA.
- Hydrometric & Groundwater Section, EPA.
- Informatics Section, EPA.
- Laboratories, EPA.
- Office of Environmental Enforcement, EPA.
- Department of Housing, Planning and Local Government.
- DAFM Agriculture.
- DAFM Forest Service.
- Bord Na Mona.
- Coillte.
- Teagasc.
- Geological Survey of Ireland.
- National Federation of Group Water Scheme.
- National Parks and Wildlife Service.
- Waterways Ireland.

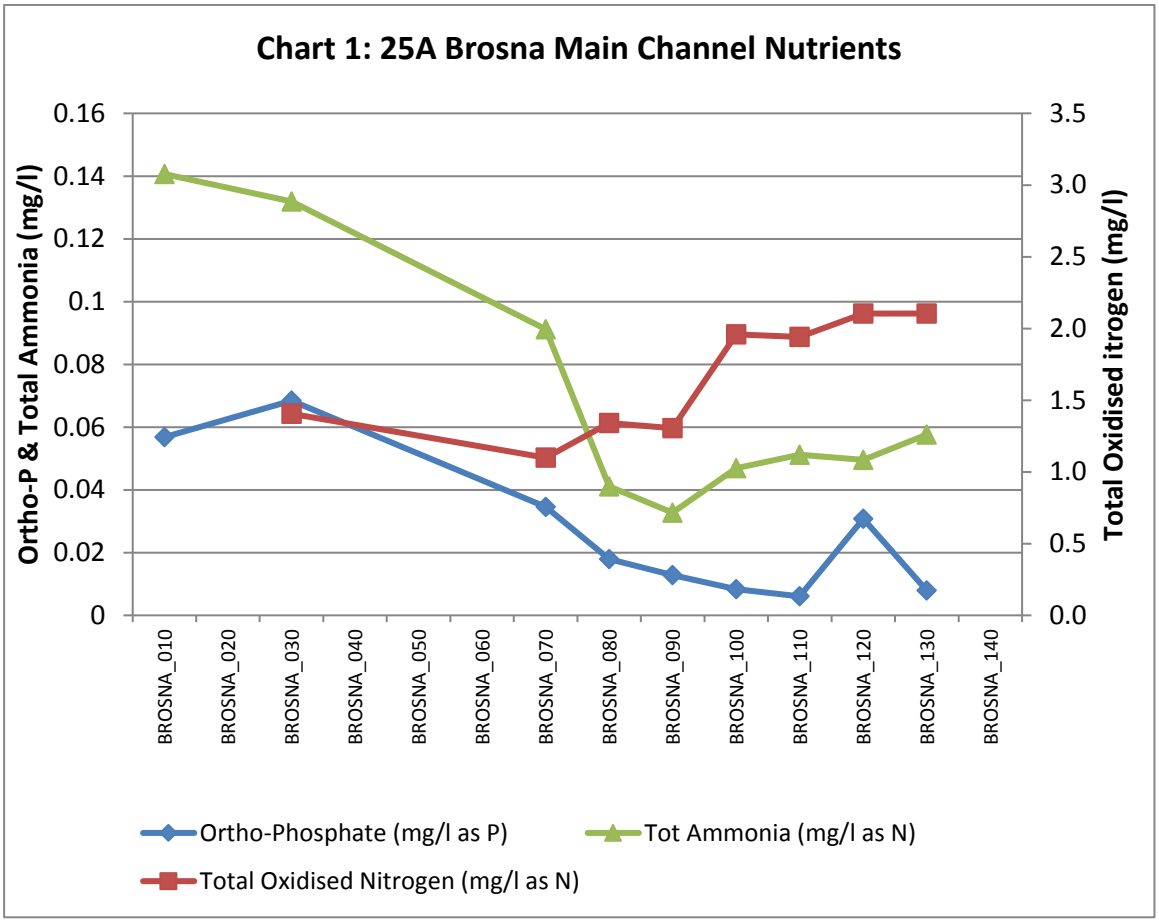
Appendix 1 High ecological status objective water bodies

Water body/Site	Type	Codes	2015 Status
Gorragh_010	River	IE_SH_25G090300	High

Appendix 2 Catchment scale nutrient concentrations and in-stream loads

The Brosna River is the main river in the 25A Lower Shannon catchment which flows into the Shannon (Lower)_010. The SHANNON (LOWER)_010 is also the receiving water for the SHANNON (UPPER)_0130, the BLACKWATER (SHANNONBRIDGE)_020 and the DERRYHOLMES_010 water bodies. The results for the instream Brosna water quality trend assessment are presented in Chart 1.

Elevated concentrations of orthophosphate and total ammonia (above the Environmental Quality Standard (EQS) of 0.035mg/l for P and 0.065mg/l for ammonia) are observed in the headwaters of the Brosna River (BROSNA_010 to BROSNA_070). TON concentrations are below the 2.6mg/l threshold, however become close to this threshold in the lower reaches of the river (BROSNA_100 to BROSNA_140).



Appendix 3 Summary information on *At Risk* and *Review* surface water bodies

Subcatchment code	Water body code	Water body name	Water body type	Risk	Ecological Status 07-09	Ecological Status 10-15	High Ecological Status Objective Water Body Y/N	Significant Pressures	Date to Meet Environmental Objective	Recommended Area for Action Name
25A_1	IE_SH_25B091200	Brosna_140	River	At Risk	Moderate	Moderate	N	Hymo	2027	
25A_1	IE_SH_25L010090	Little (Cloghan)_010	River	Review	Unassigned	Unassigned	N		2027	
25A_1	IE_SH_25L010200	Little (Cloghan)_020	River	At Risk	Moderate	Moderate	N	Peat	2027	
25A_10	IE_SH_25B090006	Brosna_020	River	At Risk	Poor	Poor	N	DU,Hymo	2027	
25A_10	IE_SH_25B090100	Brosna_030	River	At Risk	Bad	Poor	N	DU,For	2027	
25A_10	IE_SH_25B090200	Brosna_040	River	At Risk	Unassigned	Moderate	N	Hymo	2027	
25A_10	IE_SH_25B280390	Brosna_010	River	Review	Unassigned	Unassigned	N		2027	
25A_10	IE_SH_25D050400	Dysart Stream (Lough Ennell)_010	River	At Risk	Poor	Moderate	N	Hymo	2027	Lough Ennel
25A_10	IE_SH_25D160150	Dunboden Park Stream_010	River	Review	Unassigned	Unassigned	N		2027	
25A_10	IE_SH_25M010500	Monaghanstown_010	River	At Risk	Poor	Moderate	N	Hymo	2027	
25A_10	IE_SH_26_608	Owel Southeast Part	Lake	Review	Unassigned	Unassigned	N		2027	
25A_11	IE_SH_25J270990	Kyleboher_010	River	Review	Unassigned	Unassigned	N		2027	
25A_11	IE_SH_25Q150990	Kilnagall_010	River	Review	Unassigned	Unassigned	N		2027	
25A_11	IE_SH_25S020700	Silver (Kilcormac)_050	River	At Risk	Good	Moderate	N	Hymo,Peat	2027	Silver (Kilcormac)
25A_12	IE_SH_25B180100	Ballynacarrig_010	River	At Risk	Moderate	Moderate	N	Ag	2021	Silver (Kilcormac)
25A_12	IE_SH_25S020200	Silver (Kilcormac)_020	River	At Risk	Moderate	Moderate	N	For,Hymo	2021	Silver (Kilcormac)
25A_12	IE_SH_25S020400	Silver (Kilcormac)_030	River	At Risk	Moderate	Moderate	N	UWW	2027	Silver (Kilcormac)
25A_2	IE_SH_25B080100	Boora_010	River	At Risk	Unassigned	Moderate	N	For,Hymo,Peat	2027	Boora
25A_2	IE_SH_25P050300	Pollagh Stream (Brosna)_010	River	At Risk	Moderate	Moderate	N	For,Peat	2027	Boora
25A_3	IE_SH_25D120200	Durrow Abbey Stream_010	River	At Risk	Unassigned	Moderate	N	Ag,For	2027	
25A_3	IE_SH_25S030010	Silver (Tullamore)_010	River	Review	Unassigned	Unassigned	N		2027	
25A_3	IE_SH_25Y080860	Cornaher_010	River	Review	Unassigned	Unassigned	N		2027	
25A_4	IE_SH_25M520760	Meelaghans_010	River	Review	Unassigned	Unassigned	N		2027	
25A_4	IE_SH_25Q440920	Killeenmore 25_010	River	Review	Unassigned	Unassigned	N		2027	
25A_4	IE_SH_25T030030	Tullamore_010	River	At Risk	Moderate	Moderate	N	Ag	2027	
25A_4	IE_SH_25T030100	Tullamore_020	River	At Risk	Poor	Moderate	N	Ag,Peat,UWW	2027	
25A_4	IE_SH_25T030300	Tullamore_030	River	Review	Unassigned	Unassigned	N		2027	
25A_4	IE_SH_25T030400	Tullamore_040	River	At Risk	Poor	Poor	N	UWW	2027	
25A_5	IE_SH_25B090761	Brosna_100	River	At Risk	Moderate	Moderate	N	Ag,Ind	2027	
25A_5	IE_SH_25C060500	Clodiagh (Tullamore)_050	River	At Risk	Moderate	Poor	N	Hymo,Other,UWW	2027	

Subcatchment code	Water body code	Water body name	Water body type	Risk	Ecological Status 07-09	Ecological Status 10-15	High Ecological Status Objective Water Body Y/N	Significant Pressures	Date to Meet Environmental Objective	Recommended Area for Action Name
25A_5	IE_SH_25D130400	Derrycooly Stream_010	River	Review	Unassigned	Unassigned	N		2027	
25A_6	IE_SH_25B640900	Ballynacanty_010	River	Review	Unassigned	Unassigned	N		2027	
25A_6	IE_SH_25C060360	Clodiagh (Tullamore)_040	River	Review	Unassigned	Unassigned	N		2027	
25A_7	IE_SH_25B090250	Brosna_050	River	At Risk	Moderate	Moderate	N	UWW	2027	
25A_7	IE_SH_25B090600	Brosna_080	River	At Risk	Moderate	Moderate	N	DU,Hymo,UWW	2027	
25A_7	IE_SH_25T450930	Tonaphort_010	River	Review	Unassigned	Unassigned	N		2027	
25A_8	IE_SH_25L040890	Lemanaghan Stream_010	River	Review	Unassigned	Unassigned	N		2027	
25A_8	IE_SH_25M050400	Moate Stream_010	River	At Risk	Poor	Moderate	N	DU,UWW	2027	
25A_9	IE_SH_25_92	Ballinderry	Lake	Review	Unassigned	Unassigned	N		2027	
25A_9	IE_SH_25B160400	Ballynagrenia Stream_010	River	At Risk	Moderate	Moderate	N	Ag,Hymo	2027	
25A_9	IE_SH_25G010100	Gageborough_010	River	At Risk	Moderate	Moderate	N	Ag	2021	Gageborough
25A_9	IE_SH_25G010300	Gageborough_020	River	At Risk	Good	Moderate	N	Ag,Hymo	2021	Gageborough
25A_9	IE_SH_25S040500	Syonan Castle Stream_010	River	At Risk	Moderate	Moderate	N	Ag	2021	Gageborough

Ag: Agriculture

DWW: Domestic Waste Water

For: Forestry

Hymo: Hydromorphology

Ind: Industry

M+Q: Mines and Quarries

Peat: Peat Drainage and Extraction

DU: Diffuse Urban

UWW: Urban Waste Water

Note: Significant Pressures for Review water bodies have not been included as they will need to be confirmed as part of an Investigative Assessment.

Protected Area: If a water body is one or more of the following: Drinking Water Protected Area; Bathing Water; Shellfish Area; Nutrient Sensitive Area or; a Natura 2000 site with a water dependent qualifying interest with a water quality and/or quantity conservation objective, then it has been highlighted as a protected area in this table.

Appendix 4 Drinking water supplies in the catchment

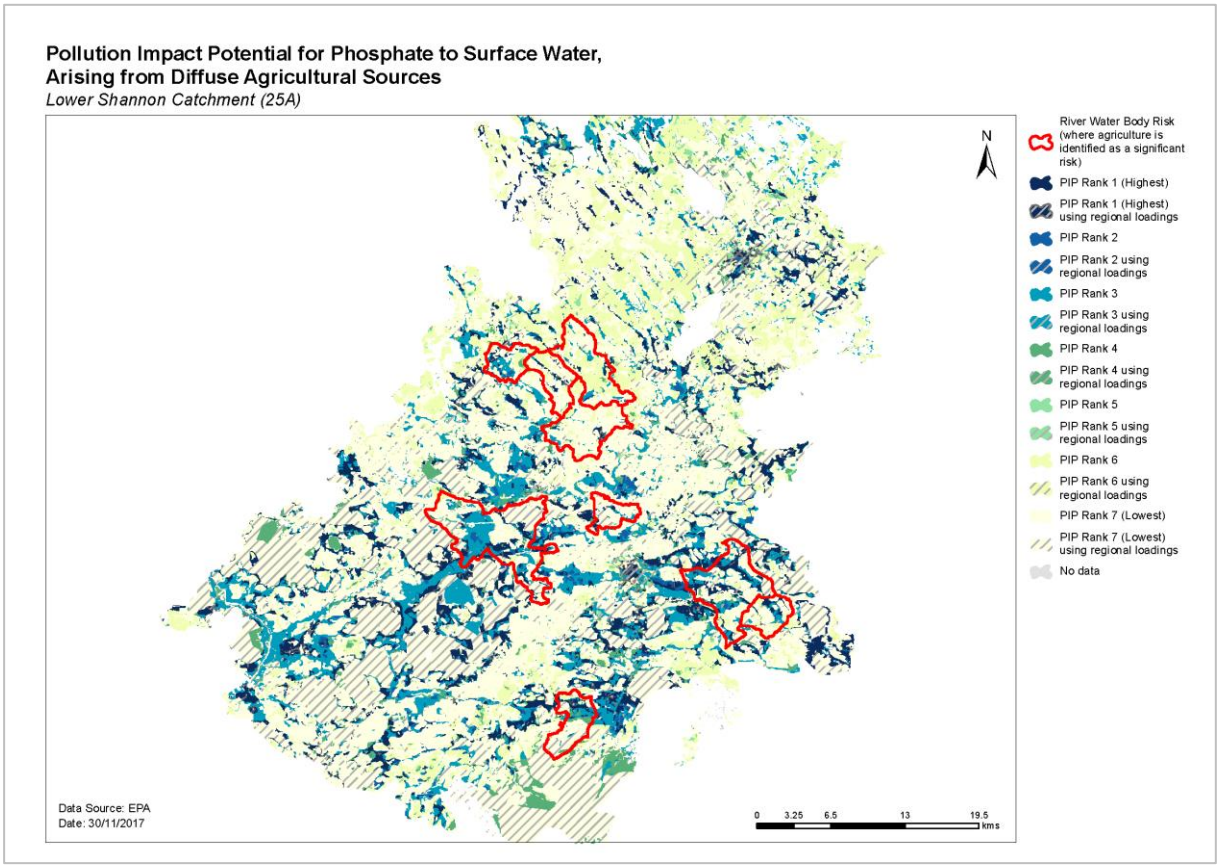
Scheme Code	Scheme Name	Water Body	Water Body Code	Objective met?
2500PRI2007	Boher Leamonaghan	Boor Gravels (GWB)	IE_SH_G_258	Yes
2500PRI2009	Cadamstown	Slieve Bloom North (GWB)	IE_SH_G_210	Yes
2500PRI2002	Ballinagar	Geashill (GWB)	IE_SH_G_103	Yes
2500PRI2005	Balydaly-Wood Of O			
2500PRI2015	Killeigh/Cloneygowen			
	Killeigh/Cloneygowen			
2500PRI2016	Meelaghans			
2500PUB1014	Mountbolus P.W.S.			
	Mountbolus P.W.S.			
2500PRI2018	Tubber	Gageborogh-Brosna Gravels Group 1 (GWB)	IE_SH_G_253	Yes
	Tubber			
2500PUB1009	Moyclare RWSS (Well 1)	Clara (GWB)	IE_SH_G_240	Yes
	Moyclare RWSS (Well 2)			
2500PRI2080	Endrim Pu.G.W.S.			
2500PUB1003	Clara/Ferbane RWSS P.W.S.	Clara (GWB)	IE_SH_G_240	Yes
	Clara/Ferbane RWSS P.W.S.	Brosna_080 (RWB)	IE_SH_25B090600	Yes
2500PRI2003	Ballyboy	Tullamore (GWB)	IE_SH_G_232	Yes
2500PRI2014	Durrow			
2500PUB1011	Kilcormac P.W.S.			
2500PUB1015	Rahan – Agall/Hollimshill P.W.S.			
	Rahan – Agall/Hollimshill P.W.S.			
2500PUB1016	Rahan – Tully P.W.S.			
	Rahan – Tully P.W.S.			
3200PRI2004	Ballybroder G.W.S.			
2500PUB1020	Tullamore P.W.S.			
	Tullamore P.W.S.	Clonaslee West (GWB)	IE_SH_G_066	Yes
	Tullamore P.W.S.			
	Tullamore P.W.S.			
	Tullamore P.W.S.			
	Tullamore P.W.S.	Gorragh_010	IE_SH_25G090300	Yes
	Tullamore P.W.S.	Clodiagh (Tullamore)_010	IE_SH_25C060220	Yes
3200PUB1008	Ardnapondra Reservoir	Ballinderry Lough (LWB) *linked to* Gageborogh_030	IE_SH_25_92 IE_SH_25G010500	Yes
3200PUB1005	Frewin Hill High Level Reservoir	Owel Main	IE_SH_26_703	Yes
3200PUB1006				
3200PUB1007				
3200PUB1009				
3200PUB1012				

Appendix 5 Prioritisation of water bodies with Natura 2000 site qualifying interests

SAC Name	Relevant Qualifying interests	Target status	Water body type	Water bodies	Status (risk)	Prioritise?	Code	Survey data?
Charleville Wood SAC 000571	none							
Clara Bog SAC 000572	none							
Clonaslee Eskers and Derry Bog SAC 000859	7230	Good GW level	Groundwater	Geashill GWB	Good (NAR)	No	IE_SH_G_103	No
			Groundwater	Clonaslee West GWB	Good (NAR)	No	IE_SH_G_066	No
Lough Ennell SAC 000685	7230	Good GW level	Groundwater	Clare GWB	Good (NAR)	No	IE_SH_G_240	No
Lough Owel SAC 000688	3140	At least Good	Lake	Owel Main	Good (NAR)	No	IE_SH_26_703	No
	7230	Good GW level	Groundwater	GWDTE-Lough Owel Fens and Mires (SAC000688 and SAC000692)	Good (NAR)	No	IE_SH_G_166	No
	1092	At least Moderate	Lake	Owel Main	Good (NAR)	No	IE_SH_26_703	No
			River	Brosna_010	Unassigned (R)	No	IE_SH_25B280390	No
Raheenmore Bog SAC 000582	none							
River Shannon Callows SAC 000216	none							
Scragh Bog SAC 000692	7230	Good GW level	Groundwater	GWDTE-Lough Owel Fens and Mires (SAC000688 and SAC000692)	Good (NAR)	No	IE_SH_G_166	No
Slieve Bloom Mountains SAC 000412	none							
Split Hills and Long Hill Esker SAC 001831	none							

Appendix 6 Pollution Impact Potential (PIP) Map for Phosphate

For areas where agriculture is deemed as the significant pressure, areas of high risk to surface water can be targeted. The map below shows relative risk of loss of phosphate to surface water. The risk of phosphate losses is strongly correlated on whether the land is poorly draining or free draining and the loadings applied i.e. significant loadings applied on poorly draining areas result in a high potential risk to surface water. However, this figure does not imply that actual losses from these areas are occurring but is a useful tool for informing where resources should be focused (i.e. by allowing high risk areas to be identified and prioritised for further investigation). PIP maps are available online at a scale of 1:20,000 and can be accessed by public bodies via the EDEN process.



Appendix 7 Local catchment assessment categories

Category	Assessment & Measures Evaluation Details
IA1	Further information provision (e.g. from IFI, LAs, EPA)
IA2	Point source desk-based assessment
IA3	Assessment of unassigned status water bodies, requiring field visit(s)
IA4	Regulated point sources, requiring field visit/s
IA5	Stream (catchment) walk to evaluate multiple sources in a defined (1 km) river stretch (used as the basis for estimating resource requirements)
IA6	Stream (catchment) walk in urban areas
IA7	Stream (catchment) walk along >1 km river stretches
IA8	Stream (catchment) walk along high ecological status (HES) objective rivers
IA9	Lakes assessment, requiring field visits
IA10	Groundwater assessments, requiring field visits