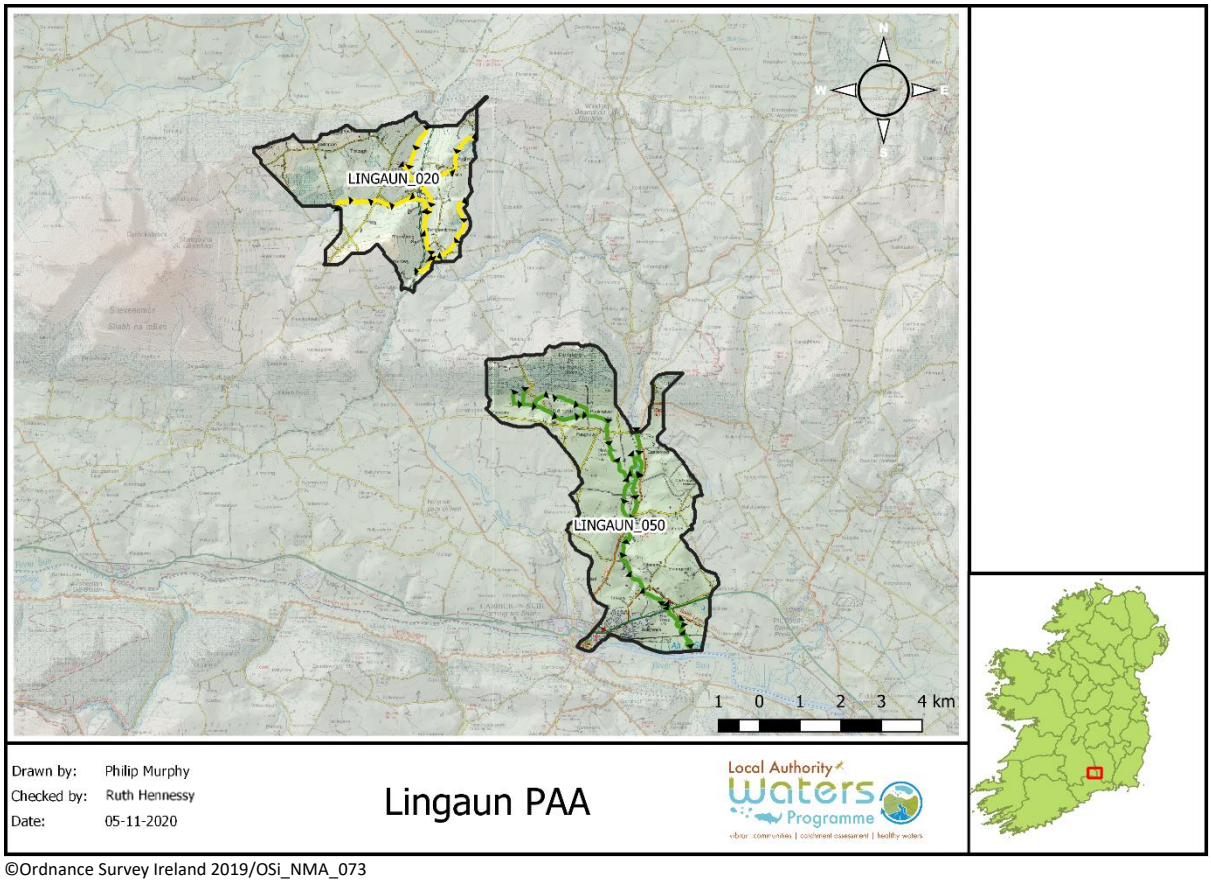
AFA0106

Lingaun Priority Area for Action

Desk Study



Document Control Sheet

LA Waters Programme Office	South East
Document Title	AFA0106 Priority Area for Action Desk Study
Document No.	South East Rp AFA Lingaun_F01

Date	**Version**	**Status**	**Author**		**Reviewer**	
05/11/2020	Draf_01	Complete	Philip Murphy			

Table of Contents

List of Figures

List of Tables

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 (LAWPRO).

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)
All maps in this document containing OSI maps are under the following copyright:

Disclaimer:

Summary

Lingaun Priority Action Area (PAA) contains just two waterbodies (Lingaun_020 and 050) but is hydrologically connected to three other waterbodies (Lingaun_010, 030, and 040). The PAA is located in County Tipperary and partly in County Kilkenny. It is within the Suir catchment area. It is the responsibility of the Local Authority Waters Programme (LAWPRO) South East team.

Regional workshops were held in Roscrea from the 6th to the 9th 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, the Lingaun was selected as a PAA for the following reasons :

- to bring all waterbodies in the sub-catchment to Good status
- to improve one deteriorated waterbody
- to address one waterbody that failed to meet protected area objective for drinking water due to an MCPA (herbicide) failure (once in 2015 and once in 2016).

The Lingaun_020 is currently *At Risk*. Lingaun_020 is not a High-Status objective waterbody. The current ecological status is Moderate at Lingaun Br monitoring station. An elevated level of orthophosphate (PO_4) is the significant issue. The significant pressures are urban and domestic wastewater discharge. The most likely pathway with respect to the significant issue is overland flow if point sources are ruled out in the fieldwork stages.

The Lingaun_050 is currently *Not At Risk*. The current ecological status is Good at The Three Bridges monitoring station. An elevated level of Total Oxidised Nitrogen (TON or NO_3) is the significant issue. There were no significant pressures determined for this waterbody. The predominate land use in both catchments is pasture. The most likely pathway relevant to this significant issue in the Lingaun_050 is groundwater flow and/or sub-surface flow.

The workplan for the Lingaun PAA will follow the guidance of the Investigative Assessment (IA7) that has been assigned to these waterbodies by the EPA. LAWPRO will carry out a local catchment assessment (LCA) to confirm the impact from point sources of urban and domestic wastewater. Multiple sites will be selected for Small Stream Impact Score (SSIS) assessments and physio-chemical parameter measurements including at Br u/s Whitehall and Br Nr Annsborough monitoring stations to rule out any pressures or impacts incoming from Lingaun_010 and Lingaun_040. Multiple water chemistry samples will be carried out over several weeks to determine where and if nutrient issues are still significant.

1 Background

The Lingaun PAA is located in South East Tipperary north of Carrick on Suir town. The entire river system is approximately 87 km long and discharges into the river Suir east of the town. Background information are waterbody details are shown in Table 1-1 and Table *1-2*. The reasons for selecting the Lingaun as a PAA are shown in Table 1-3.

Table 1-1: Background information on the Lingaun PAA.

Priority Area for Action	Catchment Number	Catchment Name	Sub-catchment	Region	Local Authority
Lingaun	16	Suir	16_15 Lingaun_SC_010	SE	Tipperary

Table 1-2: Waterbody (WB) details for Lingaun PAA.

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

Table 1-3: Reasons Lingaun PAA was selected.

Reason for selection	• Would bring all water bodies in the sub catchment to Good status. • One deteriorated water body. • One water body that failed to meet protected area objective for drinking water (MCPA failure).

There are two maps below which outline the waterbody catchment boundary. Figure 1-1 shows the waterbody ecological status from 2018. Figure 1-2 shows the waterbody WFD Risk status. Table 1-4 shows summary information for waterbodies within and outside the PAA boundary including ecological status over time and the significant pressures that were identified in the initial characterisation process. Table 1-5 shows the list of monitoring points on the Lingaun_020 and 050 and Figure 1-3 shows their location.

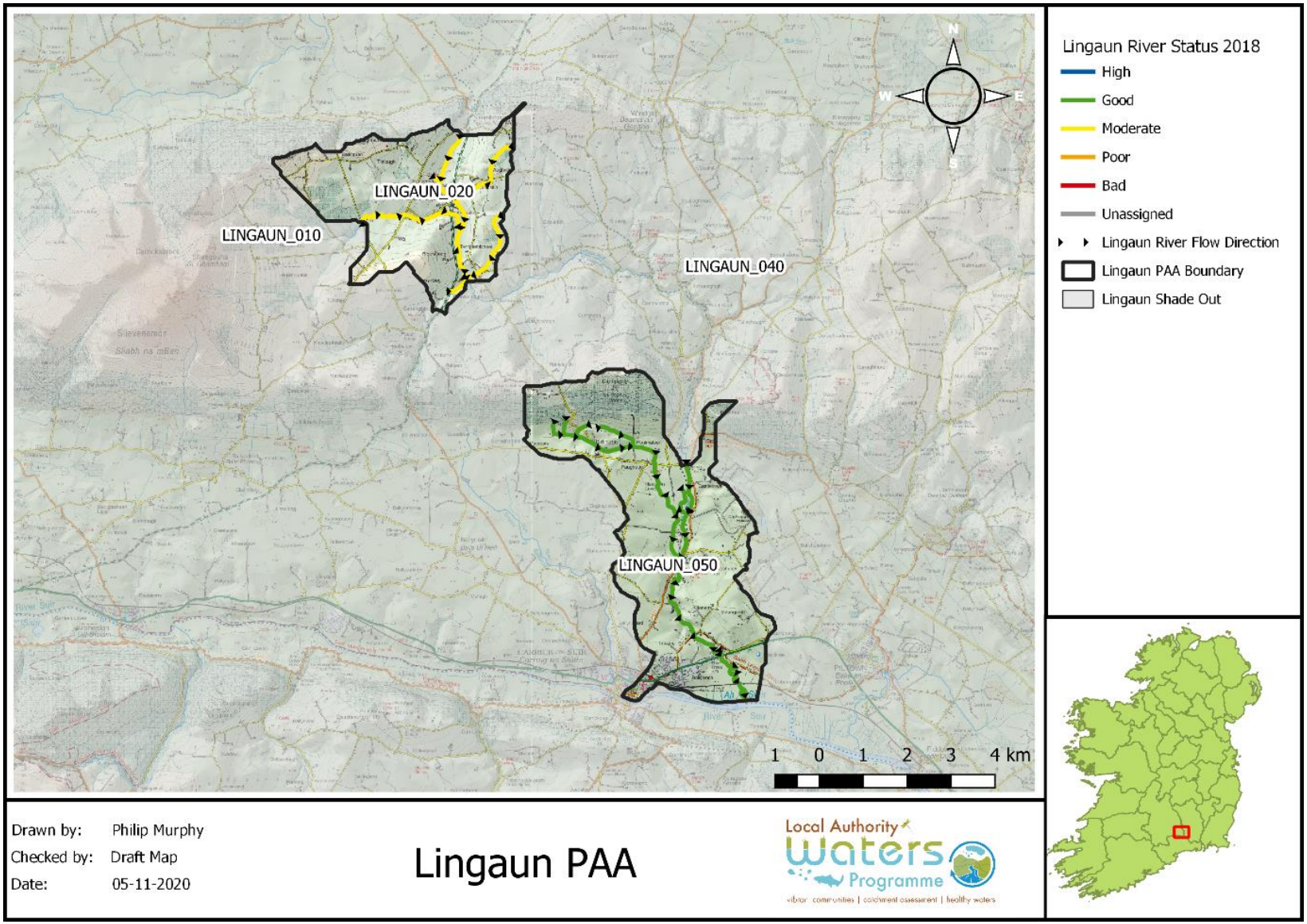


Figure 1-1: Lingaun Priority Area for Action Ecological Status (2013-2018).

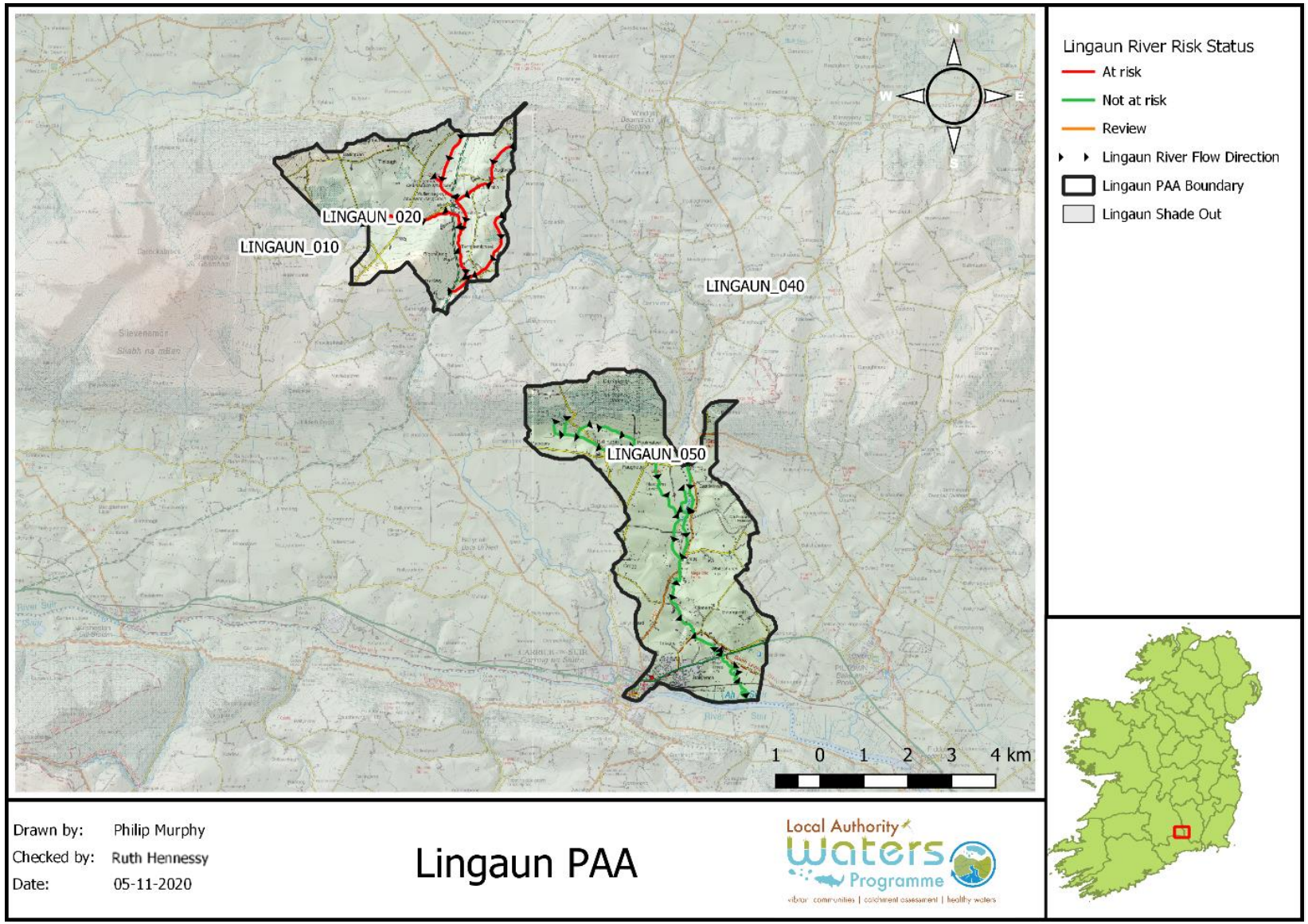


Figure 1-2: Lingaun Priority Area for Action WFD Risk Map.

Table 1-4: Summary table of individual waterbodies within the Lingaun PAA.

Water body Code	Water body Name	Risk	Obj.	Ecological Status				Pressures		
				2007-2009	2010-2012	2010-2015	2013-2018	Category	Subcategory	Sig? (Y/N)
IE_SE_16L010050	LINGAUN_010	*Not at risk*	High	Good	High	High	Moderate	N/A	N/A	N/A
IE_SE_16L010200	LINGAUN_020	*At Risk*	Good	Good	Good	Moderate	Moderate	Urban Waste Water	Agglom. PE <500 (Grangemockler)	Yes
								Domestic Waste Water	Waste Water discharge	Yes
IE_SE_16L010300	LINGAUN_030	*Not at risk*	Good	Good	High	Good	Moderate	N/A	N/A	N/A
IE_SE_16L010400	LINGAUN_040	*Not at risk*	Good	Good	Good	Good	Good	N/A	N/A	N/A
IE_SE_16L010300	LINGAUN_050	*Not at risk*	Good	Good	Moderate	Good	Good	No pressures data available		

Source: WFD App. Grey coloured cells indicate which waterbodies are outside PAA boundary but hydrologically connected.

Table 1-5: List of monitoring stations for Lingaun PAA waterbodies.

Water body Name	MP Code	Station	Type	Monitoring Results
LINGAUN_020	RS16L010100	Whitehall Br	PreWfd	No
	RS16L010200	Lingaun Br	Operational	Yes
LINGAUN_050	RS16L010450	0.5 km d/s Cregg Br	PreWfd	No
	RS16L010500	1 km d/s Cregg Br	PreWfd	Yes
	RS16L010550	Footbridge 500 m u/s The Three Br	Investigative	Yes
	RS16L010600	The Three Bridges	Operational	Yes

Source: WFD App

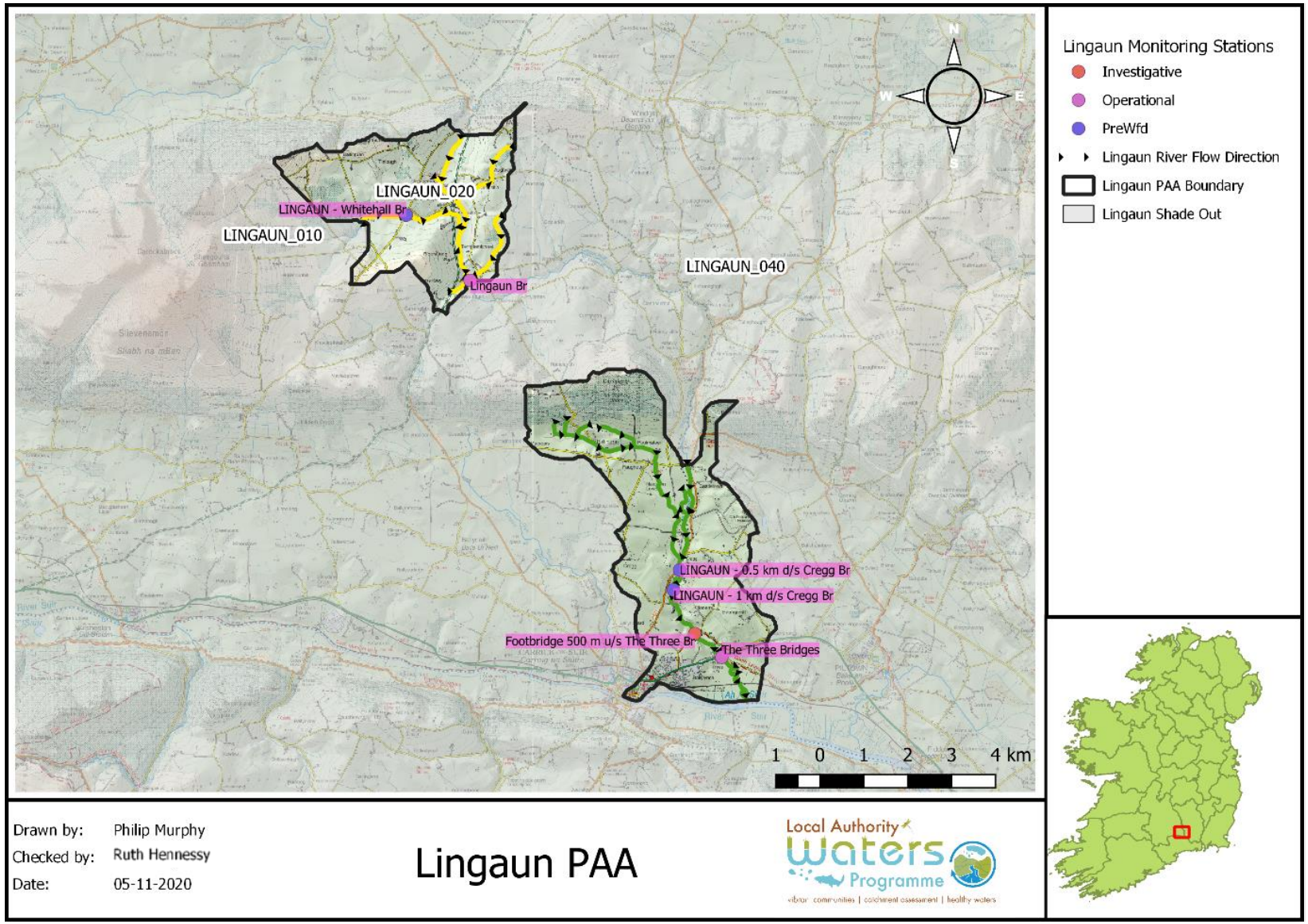


Figure 1-3: Map of Lingaun monitoring station locations.

2 Receptor information

Table 2-1 shows the receptor information for Lingaun_020 and 050. Please go to **Error! Reference source not found.** (Appendix 9.1) for an updated version of this table which includes all Lingaun waterbodies (24/01/2022).

2.1 Overview table

Table 2-1: Receptor information for Lingaun PAA.

Waterbody ID		**Lingaun_020**	**Lingaun_050**
Risk Category		*At Risk*	*Not at risk*
Biological Status	**2010-2015**	Moderate	Good
	2013-2018	Moderate	Good
	Trends in Q values **2016-2018 Q value data** **Fish status (where rel)**	Good status 2002 to 2011, Moderate status 2011 to 2017 Nitrate level is affecting status N/A	Moderate in 2011, Good in 2014 and 2017 N/A N/A
Monitoring station with hydrochemistry data		Lingaun Br	Footbridge 500 m u/s The Three Br
PO_4 (mg/l P)	**Baseline**	2017: 0.046	2017: 0.039
	Indicative quality	Moderate	Moderate
	Trends – sig.?	Upwards - No	Upwards - Yes
	Dist. to threshold	Far	Far
NH_4 (mg/l N)	**Baseline**	2017: 0.030	2017: 0.019
	Indicative quality	High	High
	Trends – sig.?	Upwards - No	Upwards - No
	Dist. to threshold	Far	Far
NO_3 (mg/l N)	**Baseline**	2017: 2.257	2017: 3.833
	Indicative quality	Moderate	Moderate
	Trends – sig.?	Downwards - No	Downwards - No
	Dist. to threshold	Far	Far
Supporting Conditions	**Chemical Conditions**	Pass	Pass
	Oxygenation Conditions	Pass	Pass
	Acidification Conditions	Pass	Pass
Hydromorphology			
RHAT score		N/A	N/A
Evidence of Arterial drainage		N/A	N/A
Ecological Status (2013–2018)		Moderate	Good
Protected Areas		Yes	Yes
WFD Objective		Good	Good
EPA biologist notes (if any)		*Date surveyed, 21/09/2019: In 2019, Station 0050 (Br u/s Whitehall Br) improved to Good ecological quality.*	
Significant issue/impact for receptor		PO_4	NO_3

2.2 Hydrochemistry

2.2.1 Lingaun_020

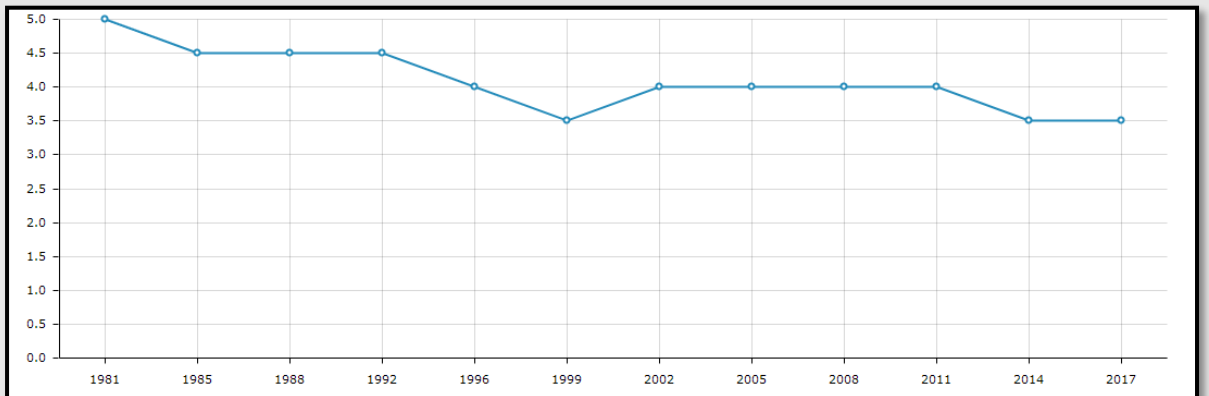
Lingaun_020 receptor assessment details are shown in Table 2-1, Figure 2-1 (ecological status details) and Figure 2-2 (Q value chart).

- **Lingaun Br monitoring station**:
    - 2017 baseline (mg/l):
        - **$P0_4$**: 0.046 – 131% of threshold
        - **NH_4**: 0.030 – 46% of threshold
        - **NO_3**: 2.257 – 64% % of threshold
    - Annual results (mg/l):
        - **PO_4 2016 to 2018**: 0.021, 0.069, 0.046 respectively
        - **NH_4 2016 to 2018**: 0.021, 0.046, 0.023 respectively
        - **NO_3 2016 to 2018**: 2.4, 1.7, 2.6 respectively
    - Trends:
        - **$P0_4$**: Long term: Consistently below threshold. Short term: Sharp increase (2017)
        - **NH_4**: Long term: Regularly below threshold. Short term: Sharp increase (2017)
        - **NO_3**: Long term: Consistently below threshold. Short term: Below threshold

Hydrochemistry data for Lingaun_020 indicates that nutrients are not typically a significant issue. Nutrient levels were typically below their respective thresholds in the long term, however PO_4 and NH_4 elevated sharply in the short term. For NH_4, incidental events in 2012 and 2017 seemed to have led to significantly elevated levels, however the 2017 baseline level is still sufficiently below the threshold (0.030 mg/l). Similarly, incidental events in 2009 and 2017 for PO_4 led to significantly elevated levels, but the 2017 baseline levels remained above the threshold. Furthermore, PO_4 levels remained significantly elevated in 2018. Therefore, PO_4 is a significant issue in the waterbody. Reasons for the cause of incidental increases in PO_4 and NH_4 levels may be identified in fieldwork.

Status Iterations	SW 2013-2018	
Ecological Status or Potential	Moderate	
Biological Status or Potential	Moderate	
Invertebrate Status or Potential	Moderate	
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	Good	
Nitrate	Good	
Ammonium	High	
Phosphorous Conditions	High	
Orthophosphate	High	

Figure 2-1: Lingaun_020 waterbody status details.



	1981	1985	1988	1992	1996	1999	2002	2005	2008	2011	2014	2017
Result	5	4.5	4.5	4.5	4	3.5	4	4	4	4	3.5	3.5
Classification	High	High	High	High	Good	Moderate	Good	Good	Good	Good	Moderate	Moderate
Q-Value	5	4-5	4-5	4-5	4	3-4	4	4	4	4	3-4	3-4

Figure 2-2: Lingaun_020 Q value chart.

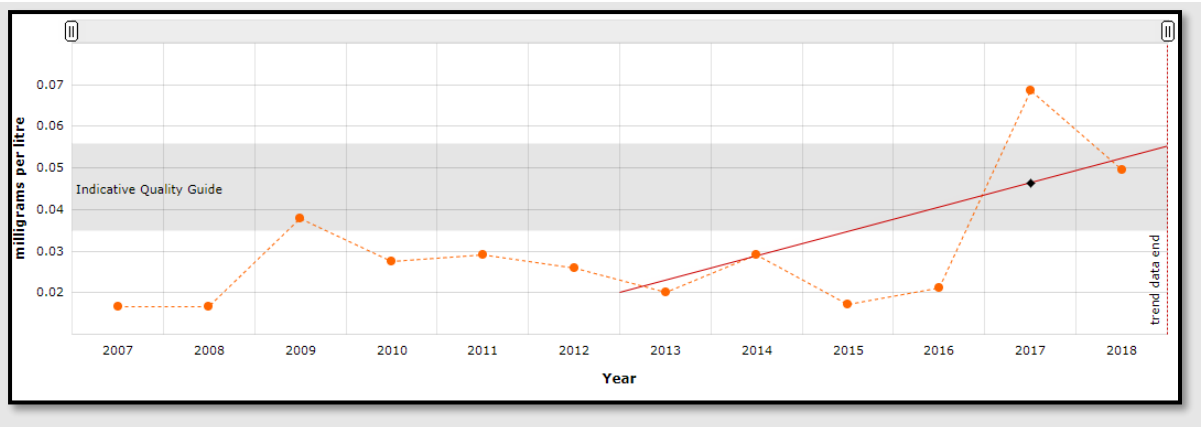


Figure 2-3 Lingaun_020 Orthophosphate (PO_4) hydrochemistry data.

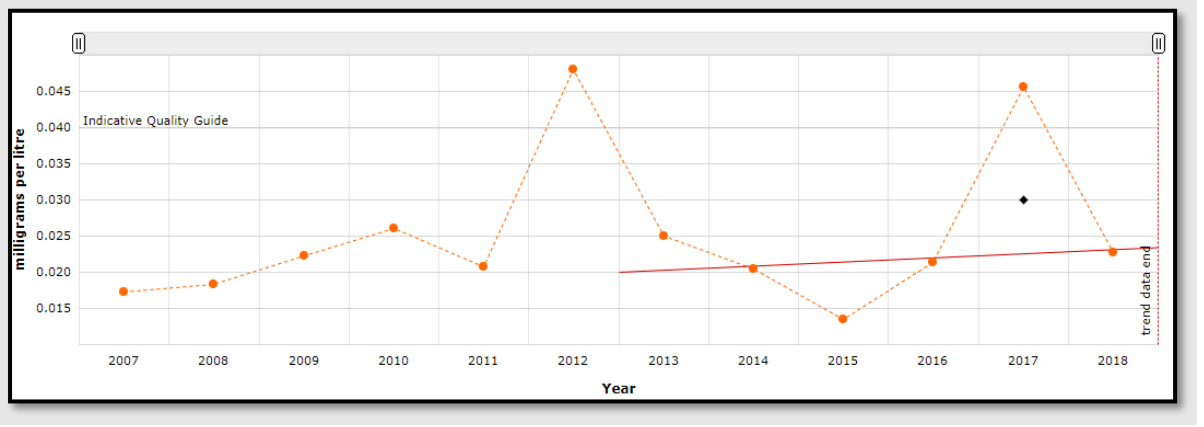


Figure 2-4 Lingaun_020 Ammonium (NH_4) hydrochemistry data.

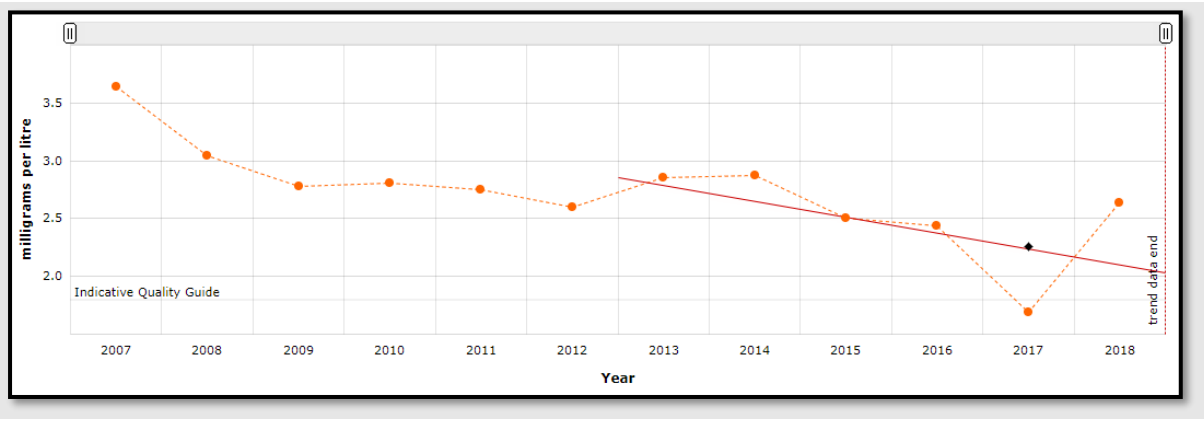


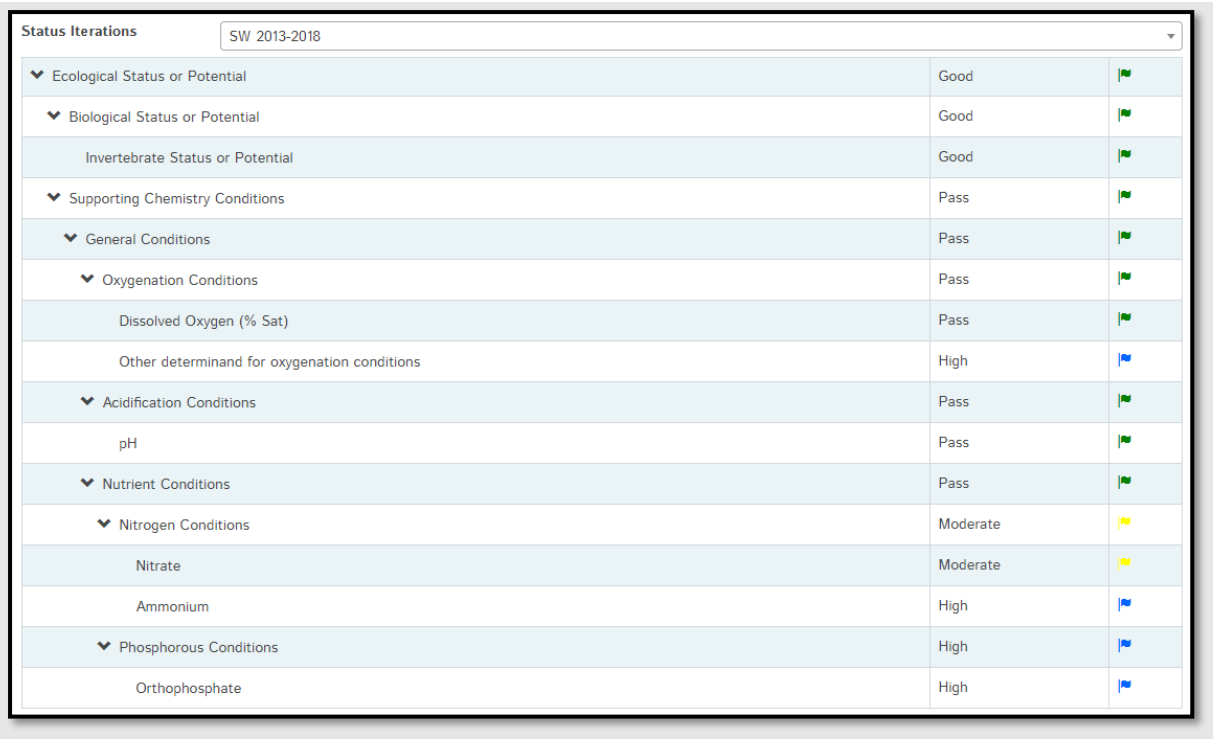
Figure 2-5 Lingaun_020 Nitrate (NO_3) hydrochemistry data.

2.2.2 Lingaun_050

Lingaun_050 receptor assessment details are shown in Table 2-1, Figure 2-1 (ecological status details) and Figure 2-2 (Q value chart).

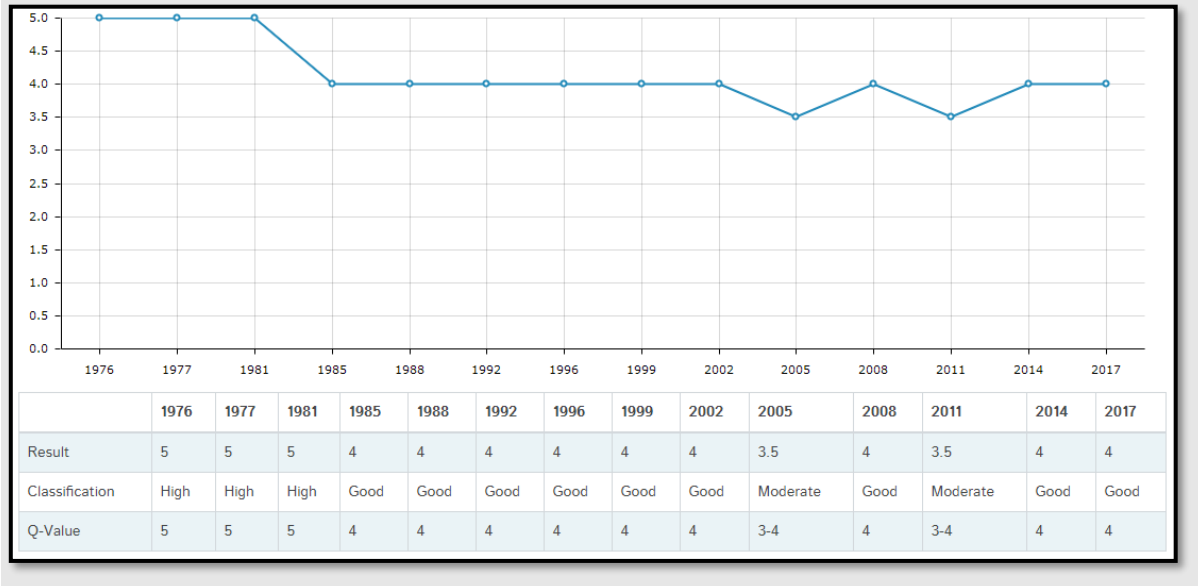
- **Footbridge 500 m u/s The Three Br monitoring station**:
    - 2017 baseline (mg/l):
        - **PO_4**: 0.039 – 111% of threshold
        - **NH_4**: 0.019 – 29% of threshold
        - **NO_3**: 3.8 – 108% of threshold
    - Annual results (mg/l):
        - **PO_4 2016 to 2018**: 0.026, 0.054, 0.037 respectively
        - **NH_4 2016 to 2018**: 0.020, 0.020, 0.018 respectively
        - **NO_3 2016 to 2018**: 3.7, 3.7, 4.1 respectively
    - Trends:
        - **PO_4**: Long term: Regularly below threshold. Short term: Sharp increase (2017)
        - **NH_4**: Long term: Consistently below threshold. Short term: Below threshold
        - **NO_3**: Long term: Regularly above threshold. Short term: Above threshold

Hydrochemistry data for Lingaun_050 indicates that NO_3 is a significant issue. Although PO_4 levels were significantly elevated in the short term this is not typical as the long term trend suggests that PO_4 is usually below the threshold. Results indicate NH_4 was consistently below the threshold. Results suggest NO_3 is regularly above the threshold in both the long and short term. Reasons for the cause of the short-term increase in PO_4 should be identified in fieldwork.



Status Iterations	SW 2013-2018	
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	Moderate	
Nitrate	Moderate	
Ammonium	High	
Phosphorous Conditions	High	
Orthophosphate	High	

Figure 2-6: Lingaun_050 waterbody status details.



	1976	1977	1981	1985	1988	1992	1996	1999	2002	2005	2008	2011	2014	2017
Result	5	5	5	4	4	4	4	4	4	3.5	4	3.5	4	4
Classification	High	High	High	Good	Good	Good	Good	Good	Good	Moderate	Good	Moderate	Good	Good
Q-Value	5	5	5	4	4	4	4	4	4	3-4	4	3-4	4	4

Figure 2-7: Lingaun_050 Q value chart.

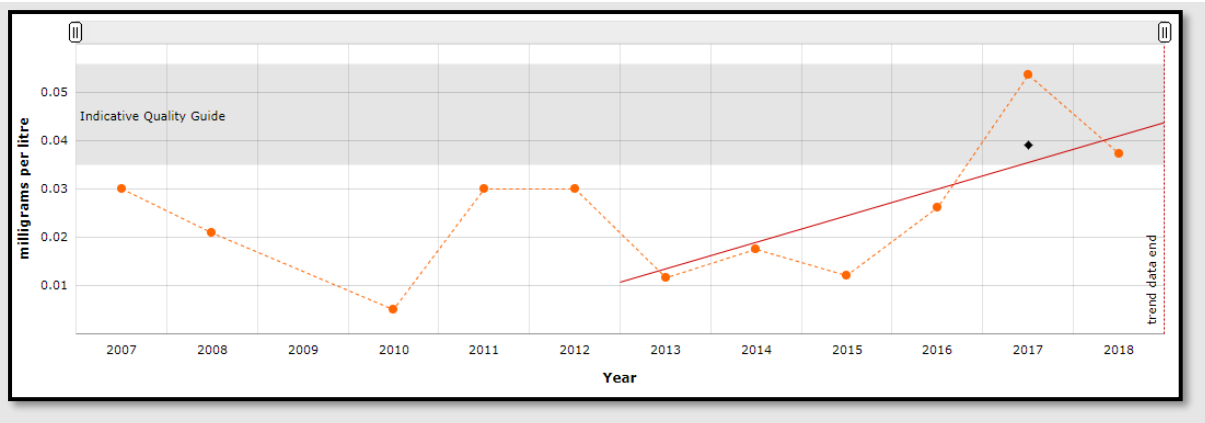


Figure 2-8 Lingaun_050 Orthophosphate (PO_4) hydrochemistry data.

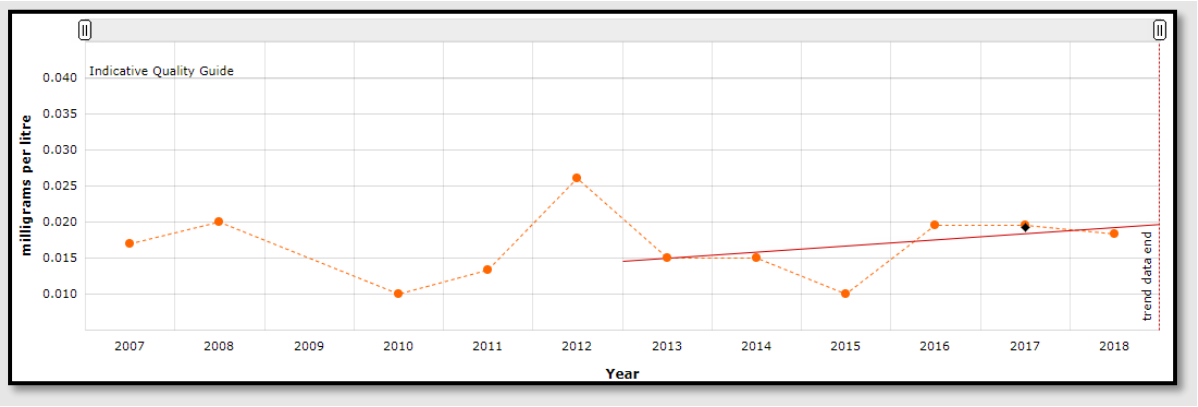


Figure 2-9 Lingaun_050 Ammonium (NH_4) hydrochemistry data.

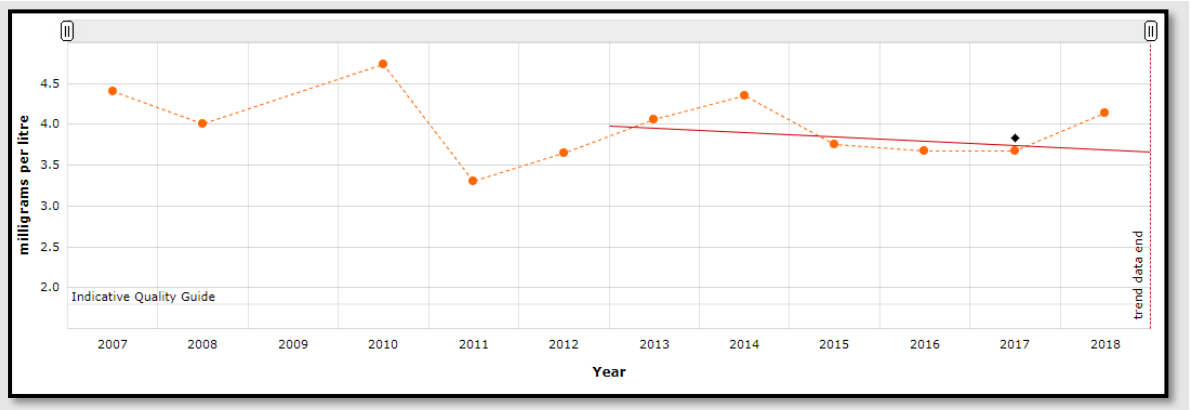


Figure 2-10 Lingaun_050 Nitrate (NO_3) hydrochemistry data.

2.2.3 Nutrient load apportionment estimation

The Lingaun river system is made up of 5 hydrologically connected waterbodies (only 2 of which are inside the PAA boundary) which discharges into the river Suir. For a more complete picture of the nutrient load distribution throughout the river system, nutrient loads were calculated at each monitoring station, using the data shown in Table 2-2. The calculations below are estimates only and are based on the best data available. They are also assuming point sources are not significant and so these results represent a hypothetical scenario. Note, Total Oxidised Nitrogen (TON) was used as a proxy for nitrate (most soluble and mobile form of nitrogen which is most vulnerable to losses to waterways) for convenience of calculations.

The result for the nutrient apportionment estimates per waterbody are shown in Table 2-3. The levels of PO_4 and NH_4 are insignificant in the context of diffuse sources of these nutrients as shown by the estimates at sub-basin area level (Table 2-3). However, NO_3 levels are shown to increase substantially as the river flows towards the Suir despite the area of the sub-basin changing (Table 2-3). This suggests that NO_3 loss from diffuse sources steadily increases in each sub-basin of the waterbody. The significant pressures section will be used to identify the potential sources of these nutrient losses and the most likely loss pathway that they are vulnerable to. In the context of diffuse source pressures Figure 2-11 shows TON per waterbody sub-basin area and Figure 2-12 shows the reduction needed per waterbody to achieve the water quality threshold of 2.3 mg/l (90% of the nitrogen Environmental Quality Standard (EQS) for coastal and low salinity water and is used as a proxy for surface waterbodies in this case. Point sources are expected to contribute to the total nutrient load in these estimates if they are significant.

Table 2-2 Data used to calculate nutrient load apportionment for Lingaun waterbodies.

Waterbody	Chemistry (annual)			Flow	Area	
				NATQ30	Hydrological	Sub-basin
	NO_3	PO^4	NH_4	(m3/sec)	(km^2)	(km^2)
Lingaun_010	1.460	0.039	0.015	0.108	5.2	5.2
Lingaun_020	2.640	0.049	0.023	0.517	22.6	17.4
Lingaun_030	3.500	0.041	0.026	1.242	55.6	33.0
Lingaun_040	3.640	0.062	0.027	1.712	72.9	17.4
Lingaun_050	4.140	0.037	0.018	2.178	91.1	18.2

Table 2-3 Nutrient load per waterbody shown as concentration per day and per year and as a proportion of the waterbody area in kg ha yr^{-1}.

Waterbody	Concentration						Conc./sub-basin area in ha		
	(kg/day)			(kg/yr)			(kg/ha/WB/yr)		
	NO_3	PO4	NH4	NO_3	PO4	NH4	NO_3	PO4	NH4
Lingaun_010	14	0	0	4,965	133	51	10	0	0
Lingaun_020	118	2	1	43,040	799	375	22	0	0
Lingaun_030	376	4	3	137,067	1,606	1,018	29	0	0
Lingaun_040	539	9	4	196,570	3,348	1,458	34	1	0
Lingaun_050	779	7	3	284,335	2,541	1,236	48	0	0

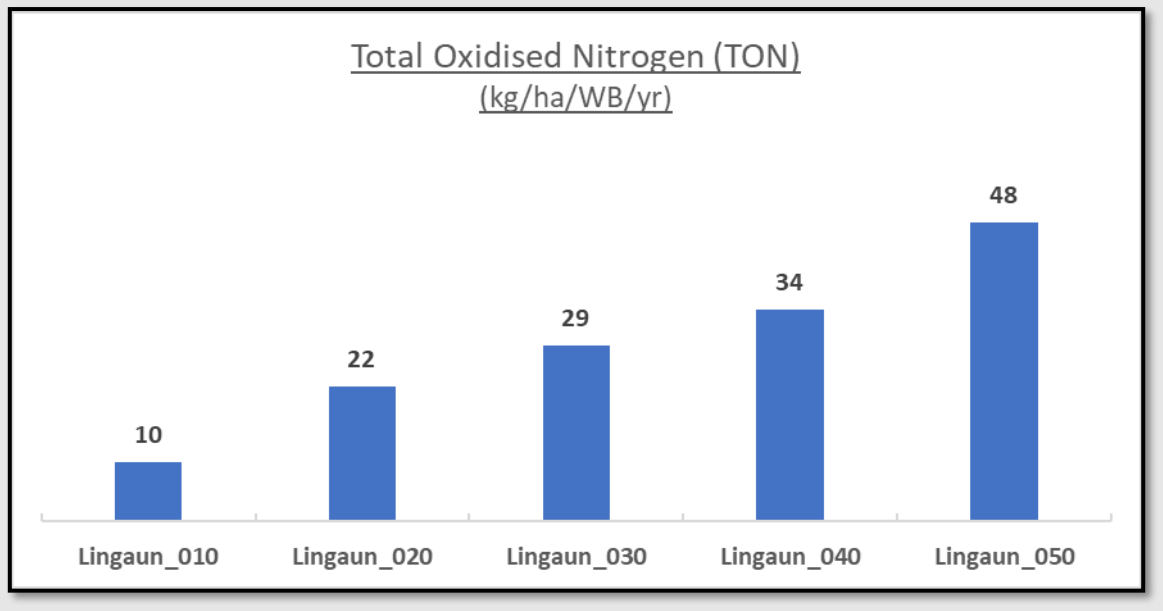


Figure 2-11 Total Oxidised Nitrogen (TON, proxy for nitrate – NO_3) levels per Lingaun waterbody area assuming point sources are not significant.

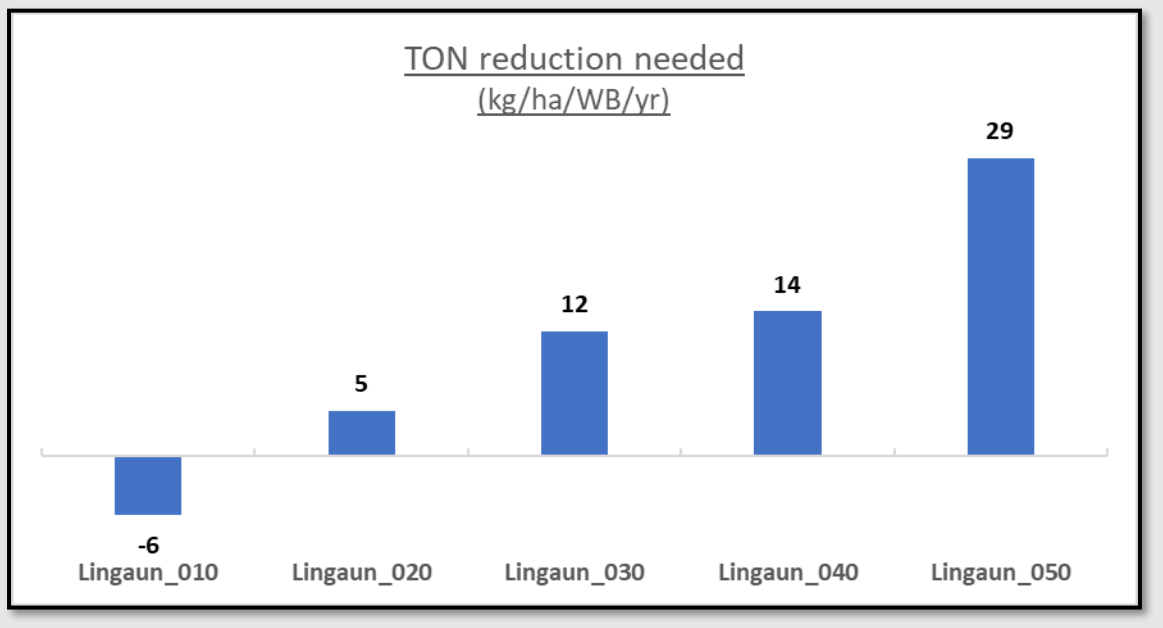


Figure 2-12 Total Oxidised Nitrogen (TON, proxy for nitrate – NO_3) reduction needed from diffuse sources per Lingaun waterbody area assuming point sources are not significant.

2.3 Hydromorphology

The Morphological Quality Index (MQI) indicates that both waterbodies (Lingaun_020 and 050) are predominantly Good, with some stretches of High, and a single stretch of Moderate see Figure *2-13*.

2.4 Protected areas

Protected areas are areas that have been designated as requiring special protection because of their particular importance. The following protected areas are connected to the Lingaun PAA (Table 2-4):

Table 2-4 Protected areas connected with the Lingaun PAA.

Water body	Protected area	Type	Association type	Other ID
Lingaun_020	Lower River Suir SAC	SAC	Overlapping / partly within protected area	002137
	Mullinavat	Drinking water - groundwater	Within protected area	Not available
Lingaun_050	Lower River Suir SAC	SAC	Overlapping / partly within protected area	002137
	Lingaun_050 drinking water supply	Drinking water – surface water	Within protected area	Not available
	Carrick on Suir drinking water supply	Drinking water – groundwater	Within protected area	Not available
	Clonmel drinking water supply	Drinking water – groundwater	Within protected area	Not available
	Suir Estuary (Upper) Nutrient Sensitive Area		Overlapping / partly within protected area	PA4_0031a

See Figure 2-14 for a map of SAC and NHA protected areas.

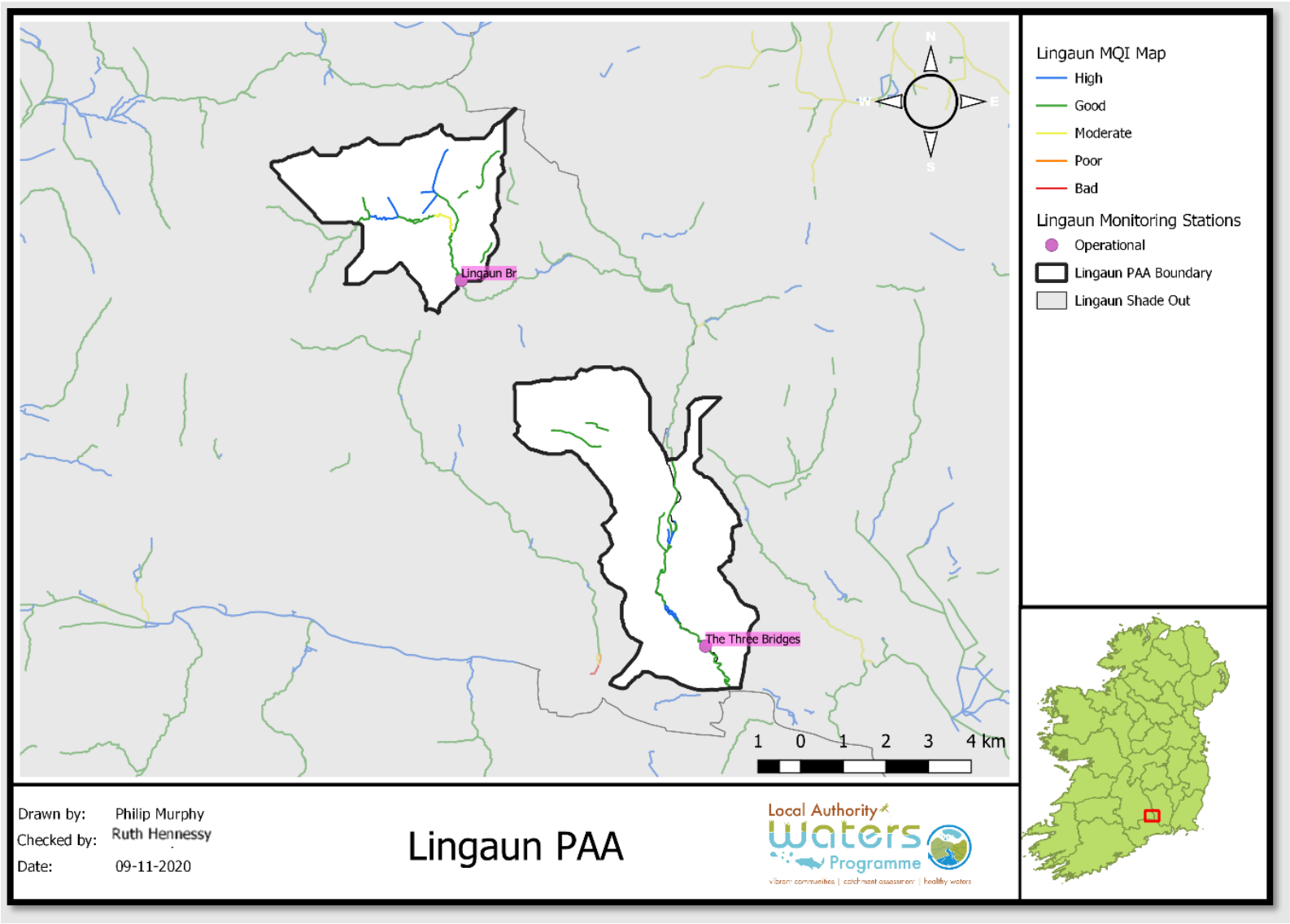


Figure 2-13 Lingaun Morphological Quality Index (MQI) Map.

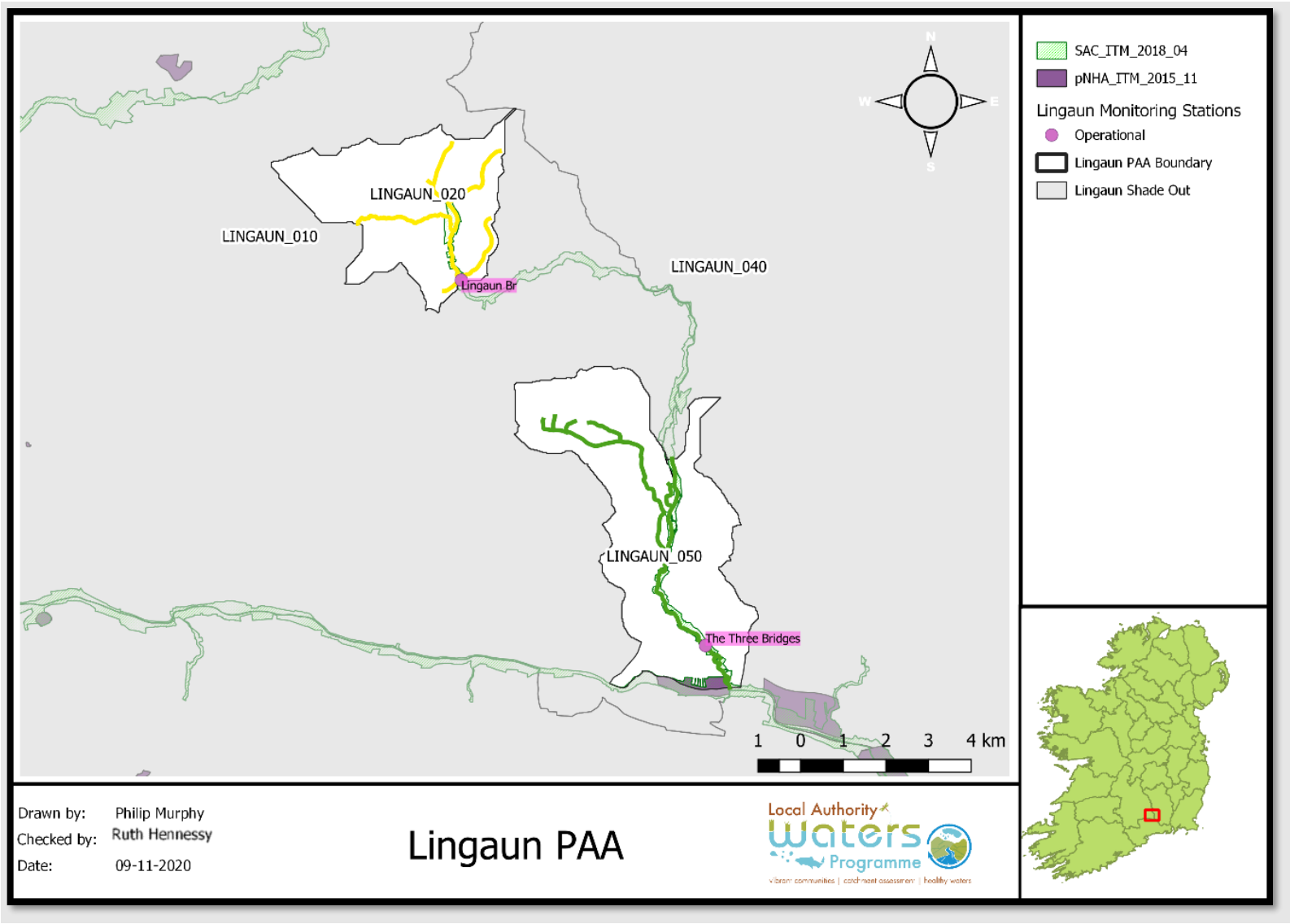


Figure 2-14 Lingaun Protected Areas Map.

3 Significant pressures

3.1 Initial EPA characterisation

Table 3-1: Lingaun_020 and 050 Pressure details

Water body Name	Pressures			
	Category	Subcategory	Sig? (Y/N)	Pressure & Impact details
LINGAUN_020	Urban Waste Water	Agglomeration PE < 500 (Grangemockler)	Yes	Identified as a significant pressure. May require an upgrade. Further investigation required to determine the extent of the impacts.
	Domestic Waste Water	Waste Water discharge (Slieveview)	Yes	During the south east regional workshop it was reported that parts of Grangemockler village are served by septic tanks and a section 4.
Lingaun_050	No pressures identified	N/A	N/A	N/A

Lingaun_020 has two significant point source pressures (Grangemockler agglomeration and a wastewater discharge section 4). There were no significant pressures in Lingaun_050 as it is currently *Not at Risk*.

Urban Wastewater Agglomeration PE < 500 - (Grangemockler)

There are no upgrade details currently logged for this wastewater treatment plant (WWTP). The Impact details section (EPA App) contained the following information: *2010-2015 Cycle; Identified as a significant pressure. May require an upgrade. Further investigation required to determine the extent of the impacts. 2013-2018 Cycle Update; The agglomeration consists of 2 septic tanks. There are 2 separate discharges, ecological station, 16L010200, which is approximately 5 km d/s of SW002 & 1.5 km d/s of SW001, was Mod again in 2017. Plant Design PE 200 & Agglomeration PE 90 with Primary Treatment. No ambient data available and limited information on the compliance history of this plant as it is certified.*

Minimal data (single data points) were available for calculating assimilative capacity. The results were as follows; Headroom utilised values for BOD, PO_4, and NH_4 were 4%, 0%, and 9% respectively (see Appendix 9.2). An SSIS will be carried out in accordance with the Certificate of Authorisation (CoA) procedure (see Appendix 9.3). This will be carried out on Grangemockler WWTP as part of the fieldwork local catchment assessment.

Domestic Wastewater Discharge (Slieveview Section 4)

Communications with Tipperary County council indicate work is on-going to work with the stakeholder involved in this Section 4 so that water quality data can be gathered. No assimilative capacity assessment can be carried out so fieldwork will be required to determine if wastewater discharge from domestic infrastructure is a significant pressure.

Other pressures and land use

The Lingaun_050 was included because of a pesticide issue that occurred at the drinking water abstraction recorded by Tipperary County Council (Appendix 9.4) However, pesticides are not expected to be an on-going problem, only incidental. The phosphate and nitrate Pollution Impact Potential (PIP) maps are shown below (Figure *3-3* and Figure *3-4*). These maps can be used to identify areas where the potential risk is greatest for nutrient and herbicide losses. A land use map of

the PAA is shown in Figure *3-2* also. If the selected point sources (Figure 3-1) are not determined as significant, the land use map may help to determine what other potential pressures may be impacting the waterbody.

3.2 Conclusion on the Significant Pressures:

The significant pressures on Lingaun_020 are point sources and no pressures were identified for Lingaun_050. An LCA following the CoA guidelines will be required to determine if the waterbody is significantly impacted by Grangemockler and Slieveview. There may be non-point pressures in the PAA and the pathway analysis will determine the most likely pathway for these non-point pressures to impact the waterbody.

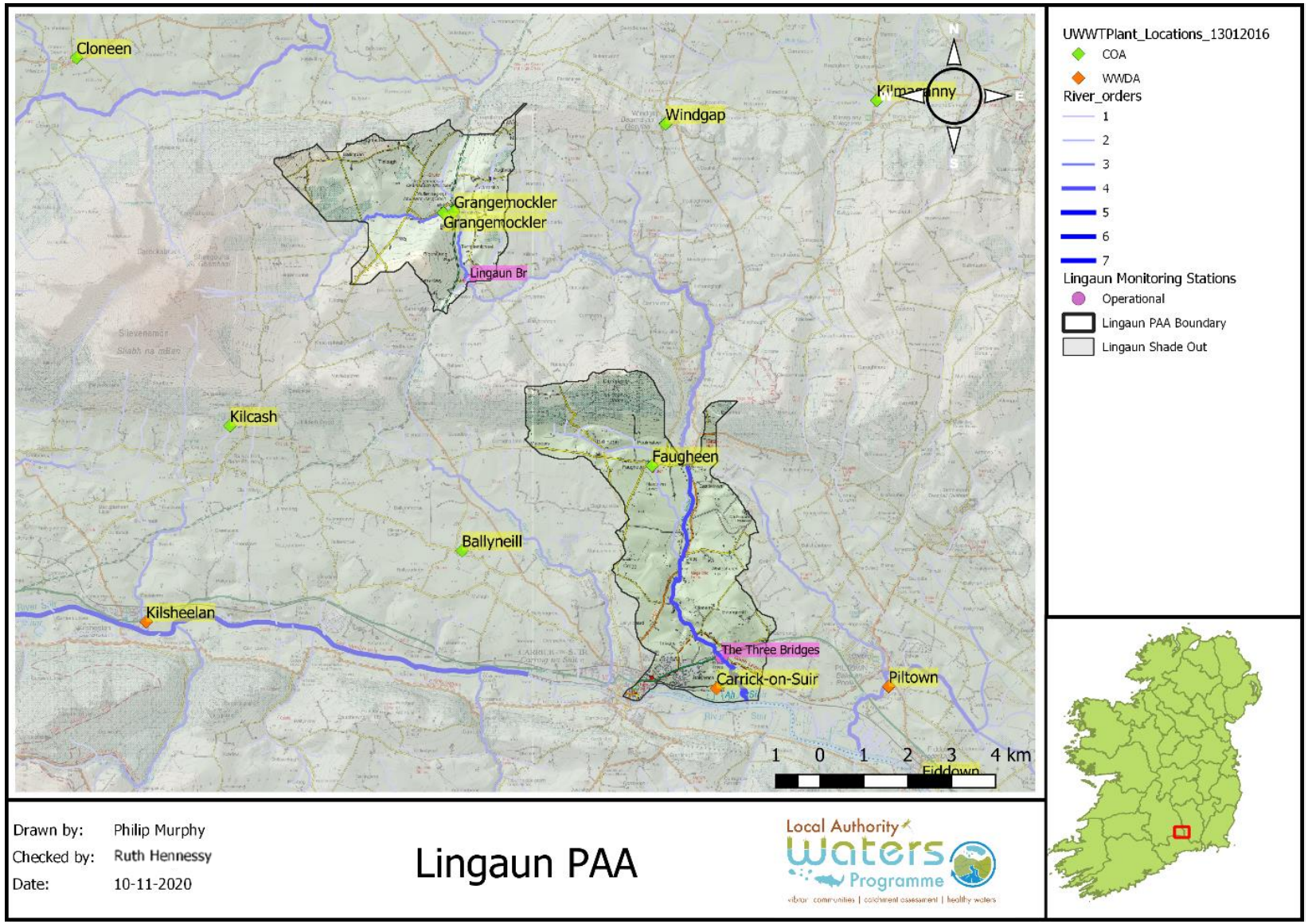


Figure 3-1 Lingaun point source Map.

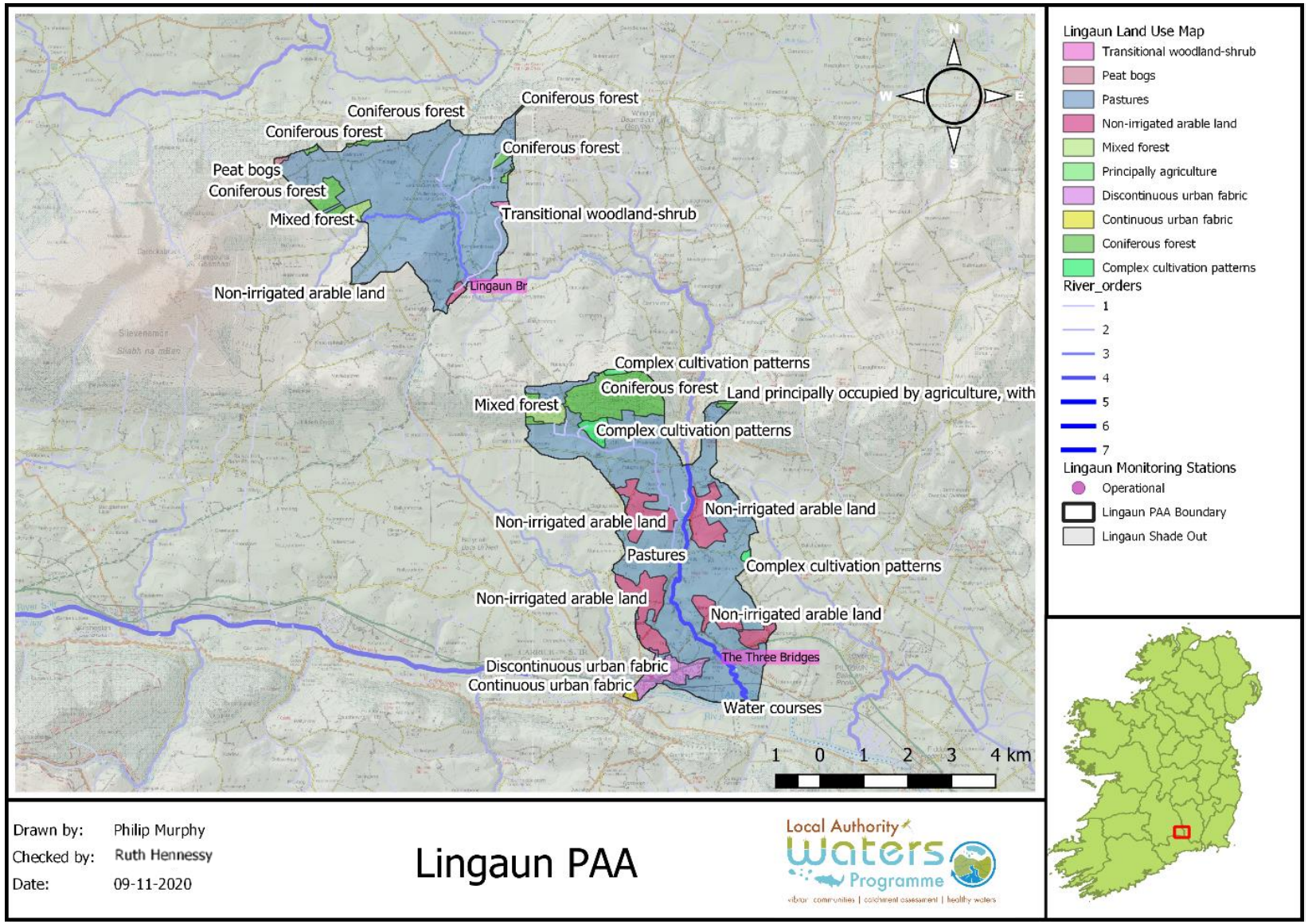


Figure 3-2: Lingaun PAA land use Map.

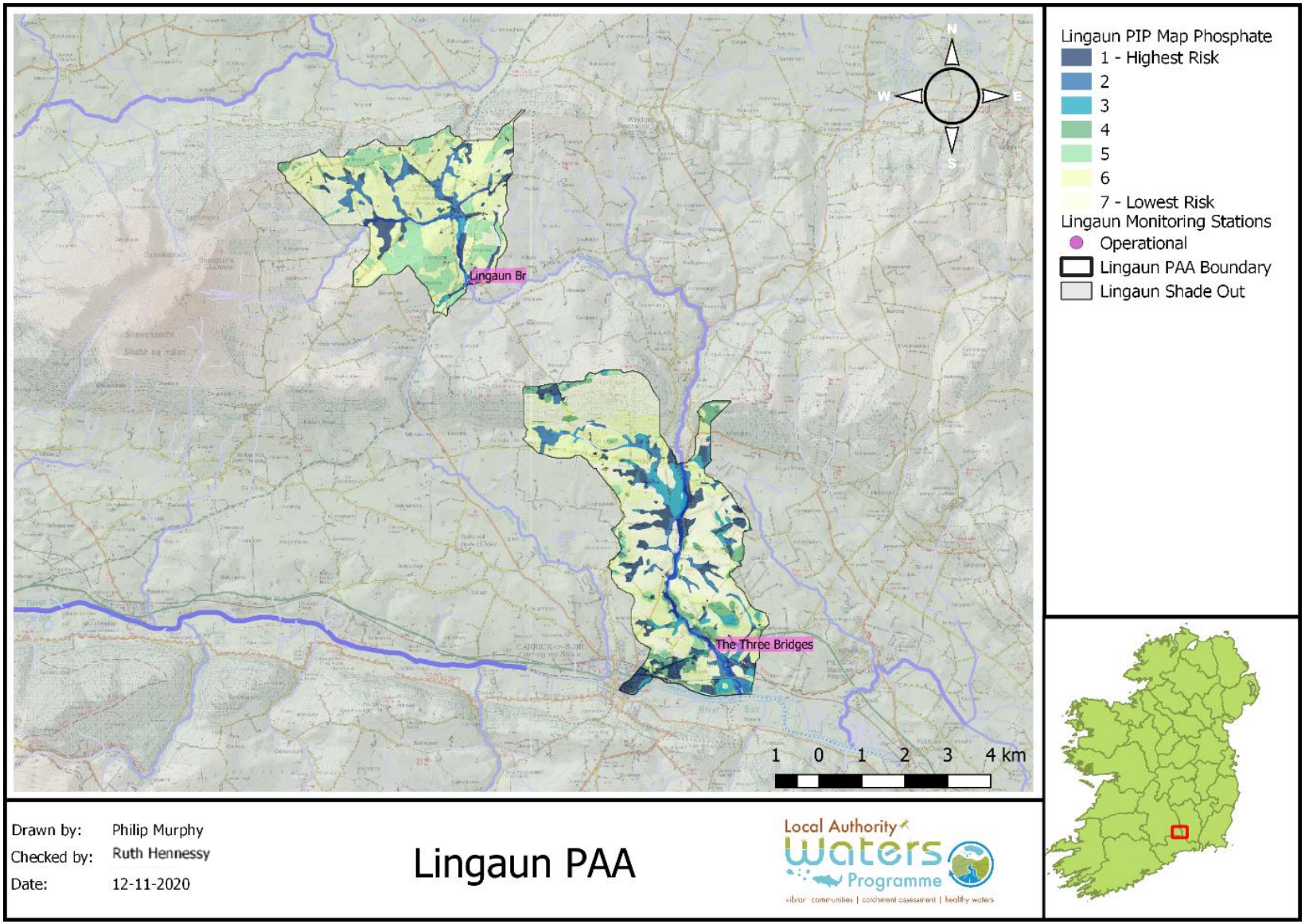


Figure 3-3 Lingaun PAA Phosphate to surface water Pollution Impact Potential Map.

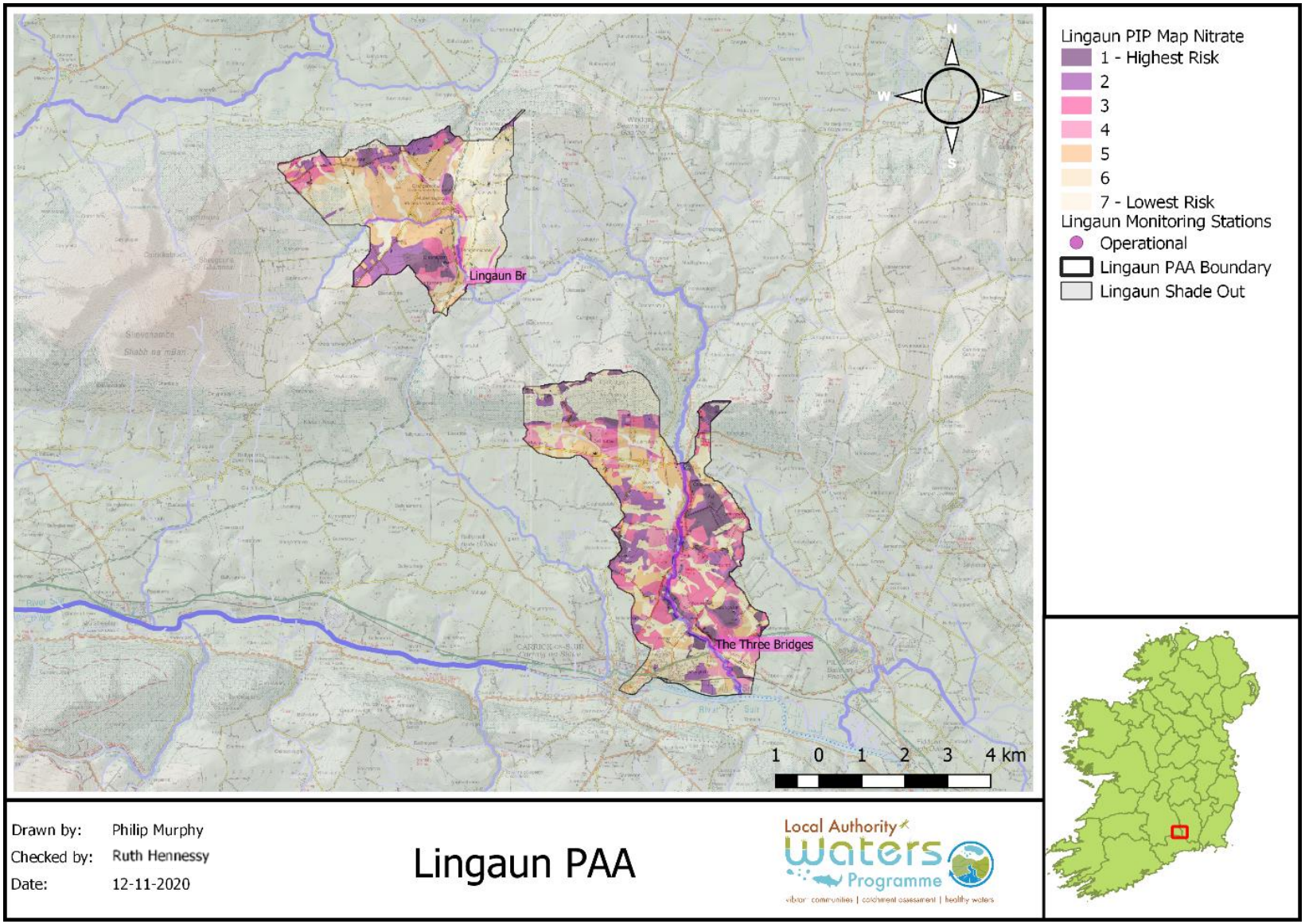


Figure 3-4 Lingaun PAA Nitrate to surface water Pollution Impact Potential Map.

4 Pathways Information

The significant pressures determined by the EPA are point sources so the pathway analysis is not relevant to them. However, due to the assimilative capacity calculation indicating that one of the point sources is not significant and the nutrient load apportionment results, there may be other pressures, potentially non-point or diffuse, that are contributing to the nutrient load in the PAA. This pathway analysis may help to address issues if point sources are ruled out at the fieldwork stage.

4.1 Aquifers and bedrock

Aquifers and bedrock maps are shown in Figure *4-1* and Figure *4-2*. There are three main aquifer types for the Lingaun PAA – Regionally Important bedrock aquifers (Rkd and Rf), Locally Important aquifers (Li) and Poor Bedrock aquifers (Pi). Both Rkd and Rf are aquifers with good storage which likley have "*substantial groundwater discharge to surface*". Additionally, Rkd is expected to be "*dominated by diffuse flow*" due to the degree of Karstification that characterises it. These aquifers will be grouped together as one and selected as Compartment 1 for the pathway analysis *waters* (> 2000 m^3 day^{-1}). The Li aquifer characterised as having a "*limited and relatively poorly connected network of fractures*" and so has "*low recharge acceptance*". This aquifer will be selected as Compartment 2 (100-400 m^3 day^{-1}). The Pi aquifer is likley to have lower permeability, storage capacity and recharge acceptance than the Li aquifer. This aquifer will be selected as Compartment 3 for the pathway analysis (< 100 m^3 day^{-1}). The main bedrock type is Dinantian Pure Bedded or Unbedded limestone and Devonian Kiltorcan-type Sandstone. There is also Silurian Metasediments and Volcanics bedrock.

4.2 Karst features and/or sand and gravel aquifers

There are no sand and gravel aquifers in the Lingaun PAA. There are however a number of Karst features (multiple Enclosed Depressions and Swallow Holes) in the Lingaun_050 sub-basin (Figure 4-5).

4.3 Soils and subsoils

Soil maps are shown in Figure *4-4* and Figure *4-3*. The PAA is mostly covered by well drained soils, but there are extensive areas of poorly drained too, and to a lesser extent again, alluvium soils. The main subsoils have either moderate permeability or are derived from till.

4.4 Pathways

Aquifer type and soil type was used to broadly characterise the likley flow paths in the Lingaun PAA. There were three compartments;

- Compartment 1: Regionally important aquifers (Rkd and Rf)
    - Sub compartment 1A: Where Till or moderately permeable subsoils are overlain by well drained topsoil, the pathway is **groundwater flow**.
    - Sub compartment 1B: Where moderately permeable subsoils are overlain by poorly drained topsoil, the pathway is **overland flow**.
- Compartment 2: Locally Important Aquifer (Li)
    - Sub compartment 2A: Where Till or moderately permeable subsoils are overlain by well drained topsoil, the pathway is **sub surface flow**
    - Sub compartment 1B: Where moderately permeable subsoils are overlain by poorly drained topsoil, the pathway is **overland flow**.
- Compartment 3: Poor Aquifer (Pi)
    - Sub compartment 3A: Where Till or moderately permeable subsoils are overlain by well drained topsoil, the pathway is **sub surface flow**

- Sub compartment 3B: Where moderately permeable subsoils are overlain by poorly drained topsoil, the pathway is **overland flow**.

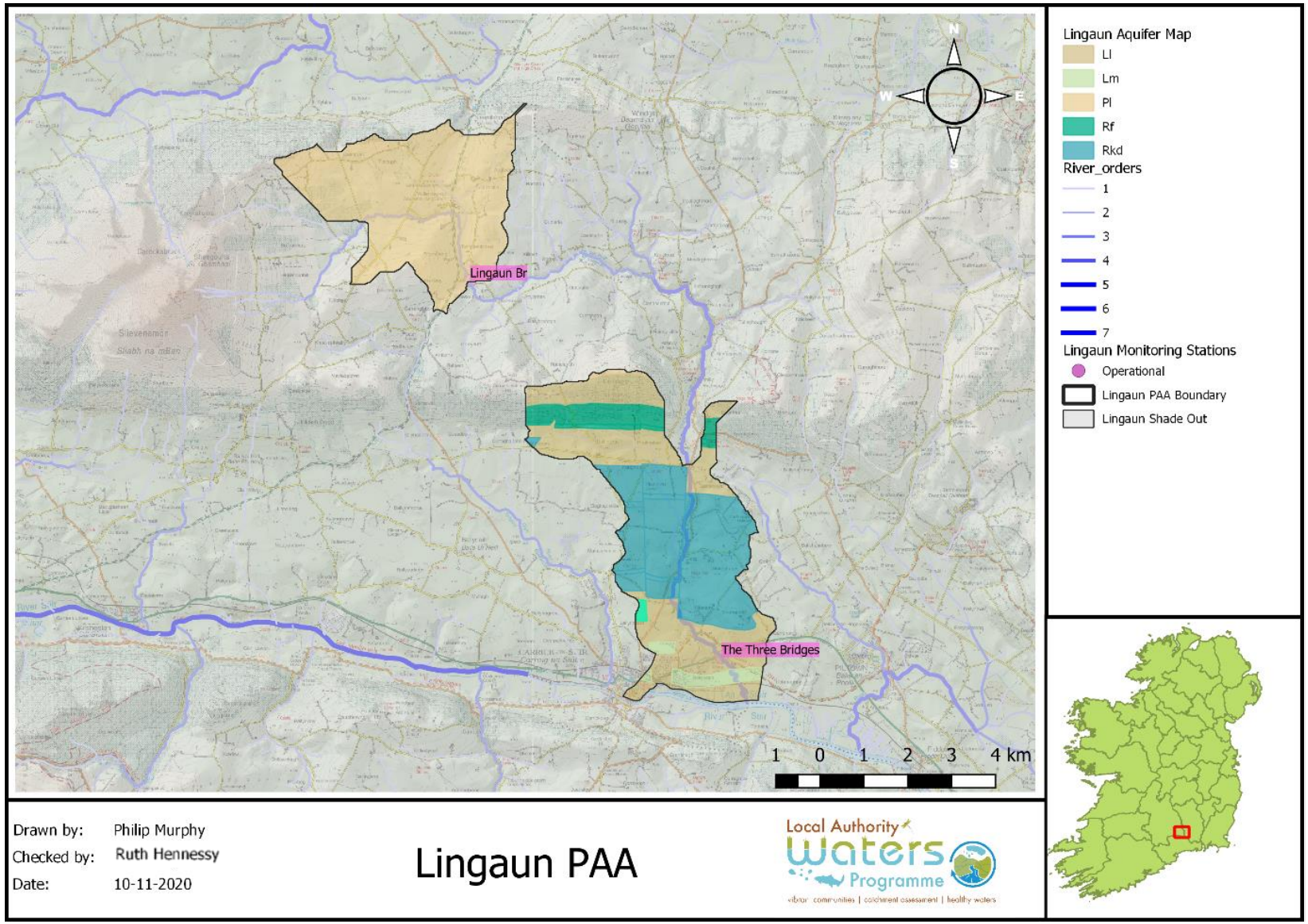


Figure 4-1: Lingaun PAA aquifer Map.

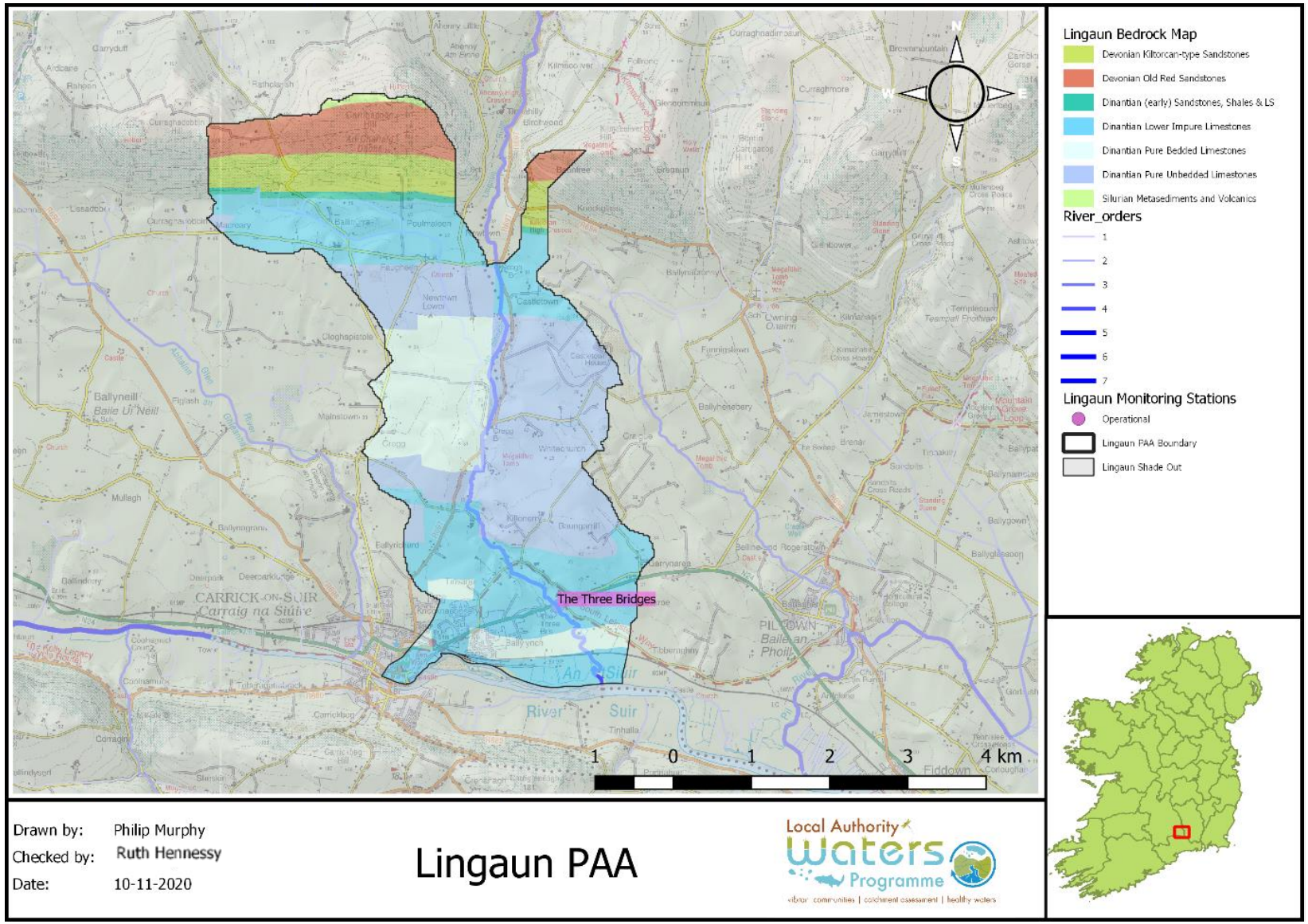


Figure 4-2: Lingaun PAA bedrock Map.

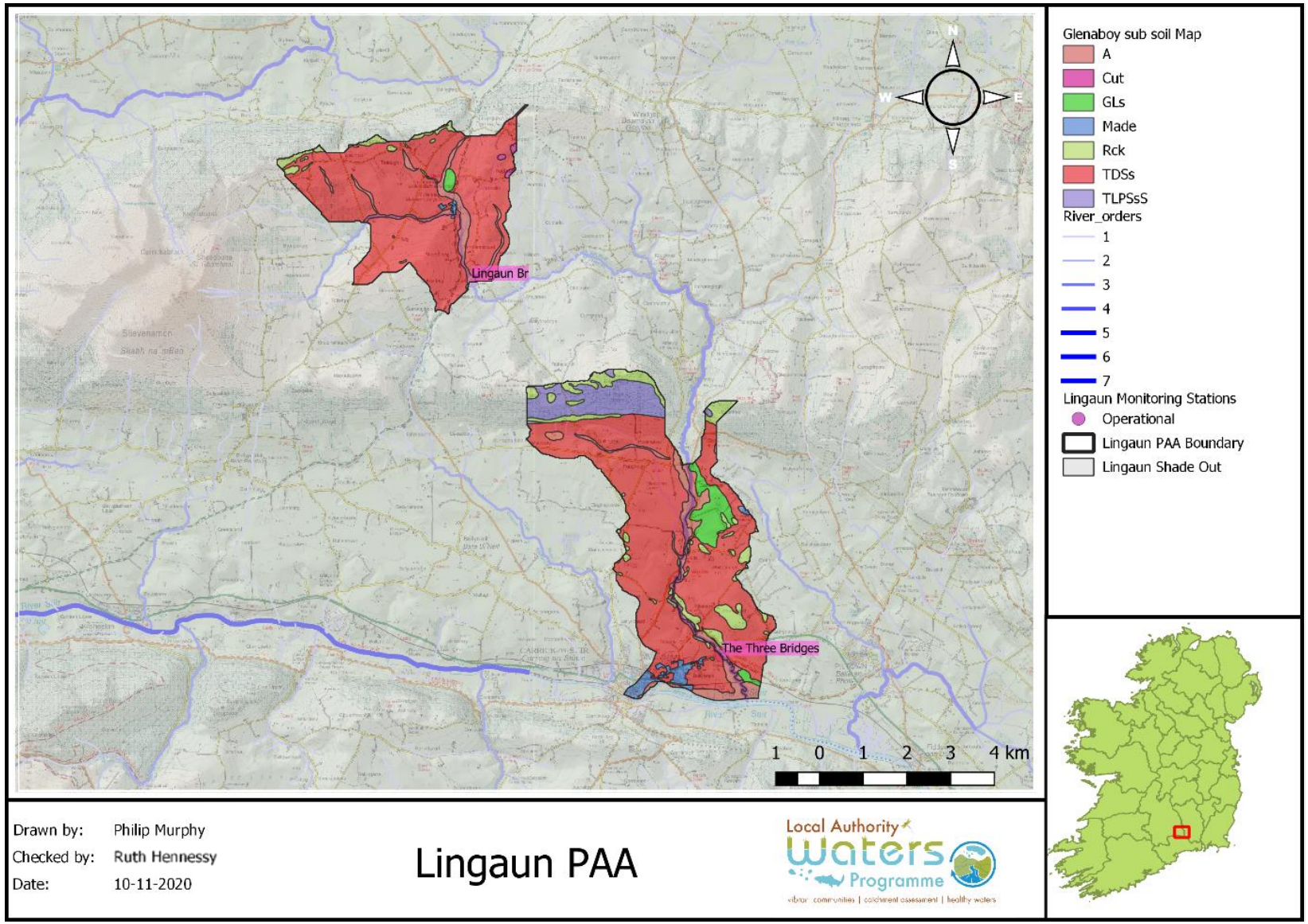


Figure 4-3: Lingaun PAA sub-soil Map.

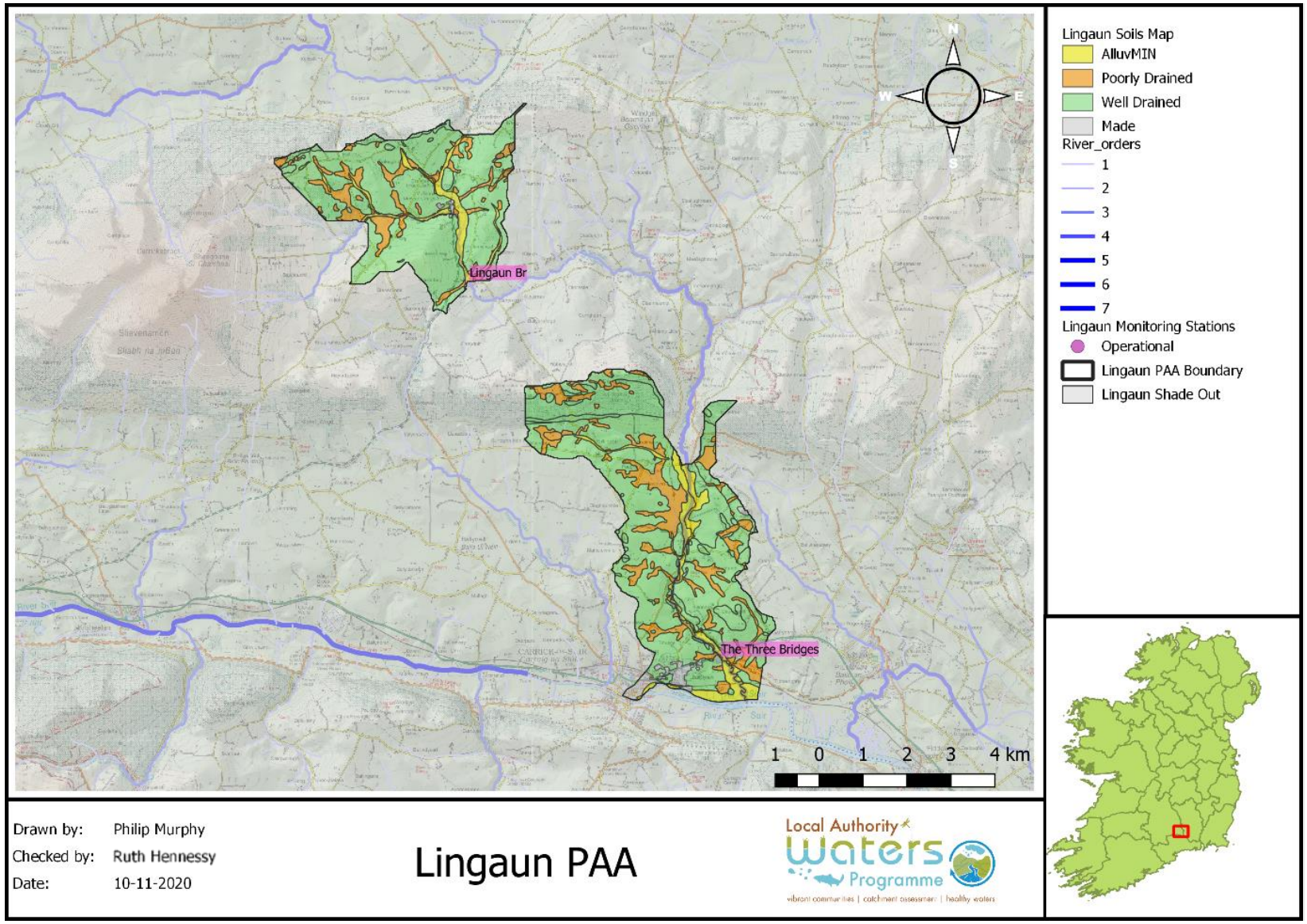


Figure 4-4: Lingaun PAA soil Map.

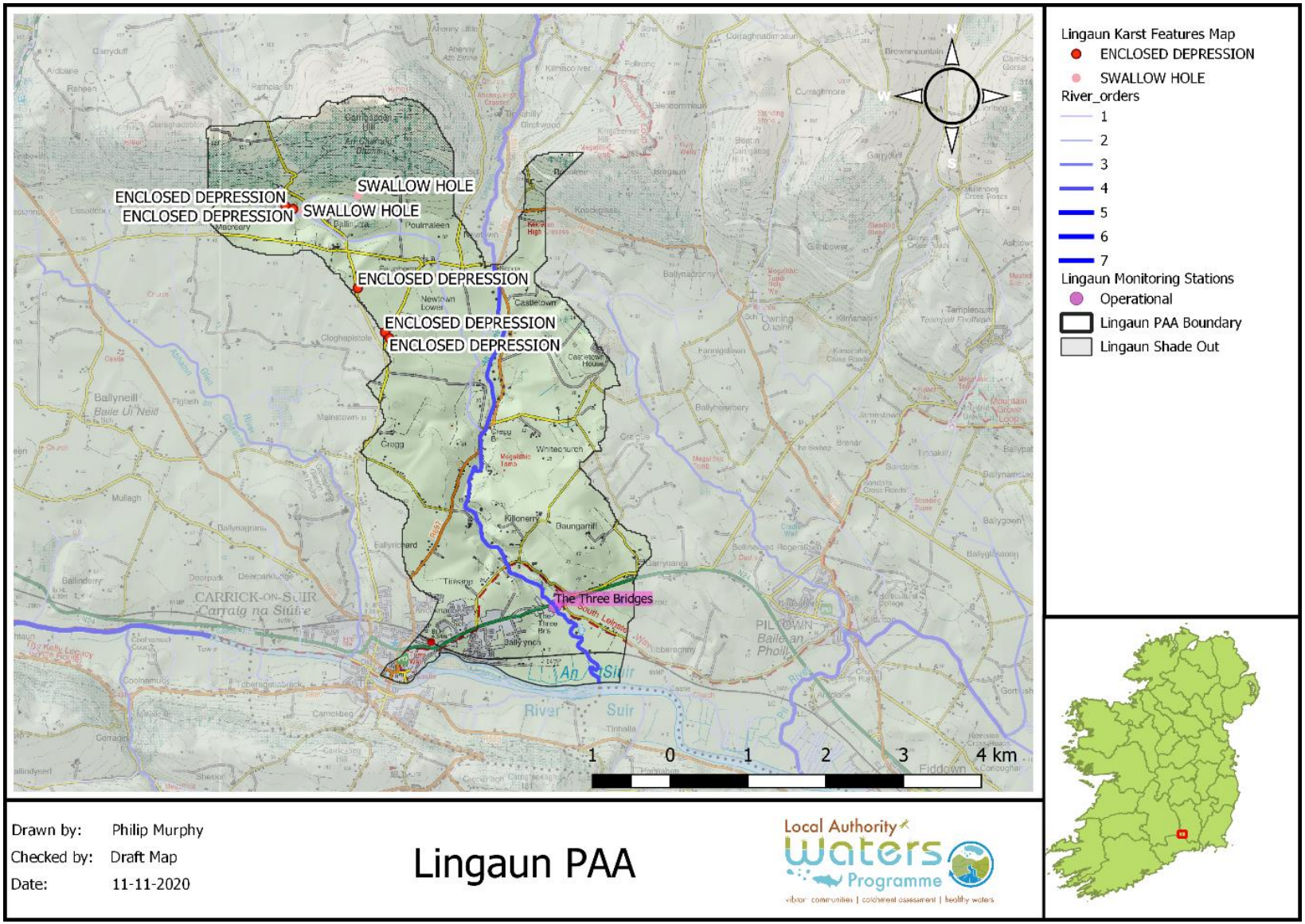


Figure 4-5 Lingaun PAA Karst features Map.

5 Interim conclusions on the PAA

The Lingaun PAA is a two waterbody PAA (Lingaun_020 and 050) but is hydrologically connected to three other waterbodies which are outside the PAA boundary (Lingaun_010, 030, and 040). Lingaun_020 is an *At Risk* waterbody that has been dropped to Moderate ecological status since 2011 and not recovered. Linguan_050 is *Not at Risk*, does not have any significant issues and is currently at Good status. It was selected as a PAA to bring all water bodies in the sub catchment to Good status, improve one deteriorated waterbody, and address one waterbody that failed to meet protected area objective for drinking water due to an MCPA (herbicide) failure.

5.1 Lingaun_020

- Lingaun_020 is *At Risk.*
- The Ecological status (SW 2013-2018) was Moderate – Lingaun Br monitoring station
- An elevated level of PO_4 is the significant issue.
- The significant pressures are urban and domestic wastewater discharge.
- The WWTP in Grangemockler may require an upgrade (Agglom. PE < 500) but was not considered to be significantly impacting the waterbody based on assimilative capacity assessment.
- The Domestic Wastewater Discharge (Slieveview Section 4) requires an LCA to determine if an impact is occurring in the waterbody as a result of this pressure.
- The predominate land use in the catchment is pasture.
- Point sources are deemed to be the significant pressure and so the pathway is irrelevant, however the most likely pathway with respect to the significant issue is overland flow if point sources are ruled out in the fieldwork stages.

5.2 Lingaun_050

- Lingaun_050 is *Not at Risk.*
- The Ecological status (SW 2013-2018) was Good – The Three Bridges monitoring station
- A consistent and increasing level of NO_3 is the significant issue.
- Lingaun_050 was included because of a pesticide issue that occurred at the drinking water abstraction recorded by Tipperary County Council.
- There were no significant pressures determined for this waterbody.
- The predominate land use in the catchment is pasture.
- The most likely pathway relevant to this significant issue is groundwater flow or sub-surface flow.

6 Workplan

6.1 EPA further characterisation actions

Table 6-1: Lingaun PAA further characterisation action details.

WB Name	Id	Action	Responsible Organisation	Further Characterisation Action details
Lingaun_020	FC000229	IA7 Multiple Sources in Multiple Areas	LAWPRO	IA4 on Grangemockler. IA7 to focus on septic tanks and section 4 in grangemockler village.
Lingaun_050	FC000841	IA7 Multiple Sources in Multiple Areas	LAWPRO	MCPA issues which may also be present in the upstream waterbodies. Use the P susceptibility maps to identify high risk areas.

6.2 Local Catchment Assessment

- Follow guidance included in the IA4 and IA7.
- Communicate with relevant agencies to gather any more information relating to urban and domestic wastewater pressures.
- Carry out targeted local catchment assessment.
- Investigate point sources in the LCA through the CoA method.
- Carry out SSIS and measure physio-chemical parameters at Lingaun Br, and The Three bridges monitoring stations to determine the current invertebrate status for the waterbody.
- Carry out SSIS and measure physio-chemical parameters at Br u/s Whitehall Br monitoring station to rule out any pressures or impacts incoming from Lingaun_010.
- Carry out SSIS and measure physio-chemical parameters at Br Nr Annsborough Ho monitoring station to rule out any pressures or impacts incoming from Lingaun_040.
- Carry out water multiple chemistry samples over a number of months to determine where and if nutrient issues are still significant.
- If point sources areas are determined as not significant then use chemistry sample results.

7 Review of possible mitigation options

Measures implemented to prevent or mitigate point sources.

8 Communications

8.1 Community Information Meeting

- Meeting held: Via Zoom - 29th of March 2021, 7.30 – 8.30 pm
- No of attendees: 23 (excluding LAWPRO and ASSAP staff)
- Issues raised at meeting: Septic tanks/wastewater treatment, Inland Fishery projects.

8.2 Farmers Information Meeting

- Meeting held: ASSAP advisors to organise farmers meeting
- No of attendees:
- Issues raised at meeting:

9 Appendix

9.1 Lingaun summary waterbody details for WFD Cycle 3.

Waterbody ID		Lingaun_010	Lingaun_020	Lingaun_030	Lingaun_040	Lingaun_050
Risk Category		*At Risk*	*At Risk*	*At Risk*	*Not At Risk*	*Not at risk*
Biological Status	2010-2015	High	Moderate	Good	Good	Good
	2013-2018	Moderate	Moderate	Moderate	Good	Good
	Trends in Q values 2016-2018 Q value data Fish status (where rel)	High – 2011, 2014 Moderate – 2017 Good – 2019 Moderate – 2020*	Good status 2002 to 2011, Moderate status 2014 to 2020	High – 2011 Good – 2014 Moderate 2017 & 2020	Good – 2011 to 2020	Moderate in 2011, Good in 2014, 2017, and 2020
Monitoring station with hydrochemistry data		Br u/s Whitehall Br	Lingaun Br	Br at Inchanaglogh	Br nr Annsborough Ho	Footbridge 500 m u/s and The Three Br
PO_4 (mg/l P)	Baseline (2017)	0.037	0.046	0.054	0.061	0.039
	Indicative quality	Moderate	Moderate	Moderate	Poor	Moderate
	Trends – sig.?	Upwards – No	Upwards - No	Upwards – No	Upwards – No	Upwards - Yes
	Dist. to threshold	Far	Far	Near	Far	Far
NH_4 (mg/l N)	Baseline (2017)	0.020	0.030	0.035	0.030	0.019
	Indicative quality	High	High	High	High	High
	Trends – sig.?	Downwards – No	Upwards - No	Upwards - No	Upwards - No	Upwards - No
	Dist. to threshold	Far	Far	Near	Near	Far
NO_3 (mg/l N)	Baseline (2017)	1.405	2.257	3.053	3.273	3.833
	Indicative quality	Good	Moderate	Moderate	Moderate	Moderate
	Trends – sig.?	Downwards – No	Downwards - No	Downwards - No	Downwards – No	Downwards - No
	Dist. to threshold	Near	Far	Far	Far	Far
Supporting Conditions	Chemical Conditions	Pass	Pass	Pass	Pass	Pass
	Oxygenation Conditions	Pass	Pass	Pass	Pass	Pass
	Acidification Conditions	Pass	Pass	Pass	Pass	Pass
Hydromorphology						
RHAT score		HymoClass-High	N/A	N/A	N/A	N/A
Evidence of Arterial drainage		N/A	N/A	N/A	N/A	N/A
Ecological Status (2013–2018)		Moderate	Moderate	Moderate	Good	Good
Protected Areas		Mullinvat Drinking water	Lower River Suir SA Mullinvat Drinking water	Lower River Suir SA Mullinvat and Thomastown Drinking water	Lower River Suir SA Mullinvat, Thomastown, and Carrick on Suir Drinking water	Lower River Suir SA Mullinvat, Thomastown, and Carrick on Suir Drinking water. Nutrient sensitive area – Suit Estuary Upper.
WFD Objective		High	Good	Good		Good
EPA biologist notes (if any)		The condition of the uppermost site of the Lingaun has again declined to unsatisfactory condition, with a siltation impact originating from a combination of cattle access and felling of forestry upstream. The other sites assessed remain in the same condition as was the case in 2017, with Stations				

Waterbody ID	Lingaun_010	Lingaun_020	Lingaun_030	Lingaun_040	Lingaun_050
	0200 and 0300 at unsatisfactory Moderate ecological quality and the two lower stations with faunal compositions with sufficient pollution sensitive species to qualify as being in Good ecological quality, indicating satisfactory conditions.				
Significant issue/impact for receptor	Not assessed in Desk Study	PO_4 – from Desk Study	Not assessed in Desk Study	Not assessed in Desk Study	NO_3 – from Desk Study

9.2 Lingaun Assimilative Capacity calculation – Grangemockler.

Facility Name	Grangemockler	**Reference Number:** *Licence/COA number as relevant*	A0416-01

1) River flow at nearest downstream WFD monitoring point

either enter lps data in cell B3 or enter lpd data into cell D3, overwriting cell formula (1m3=1000 litres)

River Flow	0.517	m3/sec	44668800	lpd	Ligaun Br	NAQ30	0.517	NAQ95	0.065

2) Effluent Dry Weather Flo (Ctrl)

*usually determined by PE*200lpd*

Effluent DWF	18	m3/day	18000	lpd
Total D/S flow			44686800	lpd

3) Resultant concentration calculations for the discharge at nearest downstream WFD monitoring point

	Upstream conc using notional clean conc (mg/l)	U/S Conc (actual) mg/l	Upstream load using notional clean conc (mg/l)	U/S Load (actual) (mg/d)	Annual Average Effluent Conc (mg/l)	Effluent Load (mg/d)	Total Load using notional clean (mg/d)	Real Total Load (mg/d)	Final D/S Conc using notional clean (mg/l)	Final D/S conc using actual results (mg/l)	30%ile EQS (Cmax)
BOD (mg/l)	0.26	0.90	11613888	4E+07	57.5	1035000	12648888	41236920	0.28	0.923	1.50
P (mg/l)	0.005	0.037	223344	2E+06	2.45	44100	267444	1696846	0.006	0.038	0.035
NH4-N (mg/l)	0.008	0.02	357350.4	893376	10.4	187200	544550.4	1080576	0.01	0.024	0.07

4) Headroom assessment (at nearest downstream WFD monitoring point), using existing water quality:

Head Room mg/l = Cmax-C

Cmax = Max permissible conc (EQS) (mg/l)

C = Background upstream conc. (mg/l)

	mg/l
BOD Headroom =	0.60
MRP Headroom =	0.00
Ammonia N Headroom=	0.05

	Upstream conc (mg/l)	Final D/S Conc mg/l	Percentage Headroom utilised
BOD	0.90	0.92	4
MRP	0.037	0.038	-49
NH4N	0.020	0.024	9

5) Headroom assessment (at nearest downstream WFD monitoring point), using notional clean figures:

Head Room mg/l = Cmax-C

Cmax = Max permissible conc (EQS) (mg/l)

C = Background upstream conc. (mg/l)

	mg/l
BOD Headroom =	1.24
MRP Headroom =	0.03
Ammonia N Headroom=	0.06

	conc (notional clean) (mg/l)	Final D/S Conc mg/l	Percentage Headroom utilised
BOD	0.260	0.283	2
MRP	0.005	0.006	3
NH4N	0.008	0.012	7

9.3 LAWPRO Certificate of Authorisation (CoA) assessment

Table 9-1 LAWPRO Certificate of Authorisation (CoA) assessment details – see full Briefing Note for more details.

LAWPRO Certificate of Authorisation (CoA) assessment Method Statement
Introduction The Protocol for upcoming EPA OEE & LAWPRO CoA joint site visits for May 2019, specifies that LAWPRO staff will outline to OEE inspectors the local catchment assessment methodology which LAWPRO catchment scientists will utilise to determine whether the CoAs which will be visited, are causing a significant impact or not, on the water body which receives discharge(s) from the CoAs.
SSIS Methodology Small Stream Impact Score (SSIS) is based on the Small Streams Risk Score methodology but the categories have been revised and additional taxa have been added. SSRS was a "*biological risk assessment system for detecting potential sources of pollution in 1st and 2nd order streams*", with the aim "*to support the programmes of measures for the Water Framework Directive (WFD)"*. The outcome was "*a score that assesses the risk of pollution on a watercourse*". "*The assessment is a standardised method that should enable surveyors to produce consistent results*." And based on the macroinvertebrate score, there were three categories of risk; "Probably not at risk", "Stream may be at risk" and "Stream at risk". These categories were used for characterisation for the first river basin management plan. These categories have been updated for the SSIS methodology as the terms At Risk and Not at Risk have been redefined for the 2nd cycle characterisation and are now 'Probably not significantly impacted', 'Indeterminate evidence of impact', and 'Probably impacted'. The 'score' obtained is based solely on the macroinvertebrates that are present at the sampling point. The field sheets used requires field chemistry and stream characteristics to be entered. Although this information is not used directly to derive the SSIS score, it can be used to interpret the possible reasons for obtaining a score. The list of indicator taxa has also been revised and further groups incorporated to help improve diagnostic value of the assessment and help with interpretation where multiple pressure effects are considered to be important.

9.4 Communications with Local Authorities

The Lingaun_050 was included because of pesticide issue that occurred at the drinking water abstraction recorded by Tipperary County Council: "MCPA issues which may also be present in the upstream waterbodies. Use the P susceptibility maps to identify high risk areas".