ATTACHMENT 7-1-3-2 - Land-spreading Impact Assessment Report

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1.0 Introduction

The European Court of Justice Decision (C-416/02 European Court of Justice 8 September 2005) found that pig manure generated on a pig farm is not a 'waste'. It is recognised by the European Court as a bye product fertiliser and this product (pig manure) is exported to farmers and used in a similar manner to any chemical fertiliser. Therefore this assessment takes cognisance of the fact that the pig manure is a fertiliser and that it is unlikely that farmers would waste this resource.

2.0 Land-spreading areas / study area

The location of the townlands where pig manure is being applied is presented in Table 1 and in Figure 6 (end of this report). This area is the 'study area' as assessed in the EIAR submitted in Attachment 6.3. The gross area of this study area is approx. 8,250ha. The area is reduced to approx. 5,543ha when the following areas are deducted;

- Areas identified as 'rock near surface' on GSI mapping are excluded;
- A 50m exclusion is allowed around rural dwellings to allow for unknown private water supplies;
- A mandatory 200m around public water supplies are excluded;
- Source protection zones and Zones of Contribution for public water supplies were excluded (using GSI data);
- 200m zones around schools is excluded (to reduce potential for nuisance);
- Mandatory buffer strips along watercourses are excluded (10+m allowed in this assessment),
- Peats
- In-eligible areas such as roads (public and private), farm yards, forestry, scrub and waterbodies are excluded; and,
- Wet lands with obvious rush growth are excluded.

The deduction of these areas show that there is adequate capacity for phosphorous within the study area, while abiding with exclusions as per SI 605 of 2017 (as amended) and minimising risk to groundwater (by excluding areas with rock near surface

Table 1 – Land-spreading areas and phosphorous requirement of the receiving environment

Townland	Gross Area (ha)	Net Area* (ha)	Total P Requirement for Study Area (kgs)
1. Killeenagarriff	113	84	842
2. Highpark	212	180	1796
3. Caherconlish	89	35	350
4. Fedamore	76	49	490
5. Ballybricken North	83	68	683
6. Ballybricken West	117	53	534
7. Ballybricken East	88	48	476
8. Ballybricken South	132	111	1114
9. Caherelly East	293	211	2114
10. Caherelly West	170	85	850
11. Kilteely	81	53	526
12. Monearmore	18	6	56
13. Cullen	26	15	148
14. Gortdrum	82	22	224
15. Ballyryan East	71	33	328
16. Milltown (ED Ballykisteen)	36	20	205
17. Bruff	159	74	737
18. Knockainy West	465	294	2942
19. Knockainy East	29	23	227
20. Kilfrush	324	249	2489
21. Knocklong	46	44	438
22. Knocklong West	285	212	2122
23. Knocklong East	223	107	1075
24. Ballycurrane	135	95	950
25. Bartoose	153	135	1348
26. Emly	82	43	430
27. Ballylooby	181	153	1525
28. Lattin North	108	94	938
29. Lattin West	74	66	657
30. Lattin East	84	62	620
31. Mooresfort	330	275	2753
32. Kilross	249	188	1876
33. Ballyfroota	198	173	1733
34. Galbally	96	74	741
35. Corderry	216	170	1701
36. Park (ed galbally)	186	131	1305
37. Spittle (ED Ballylanders)	245	199	1988
38. Curraghkilbran	114	108	1081
39. Curraghturk	325	103	1026
40. Ballyfauskeen	336	209	2093

Townland	Gross Area (ha)	Net Area* (ha)	Total P Requirement for Study Area (kgs)
41. Cullane North	258	149	1494
42. Ballyduff	204	93	935
43. Cullane Middle	200	166	1664
44. Cullane South	305	209	2086
45. Spittle (ED Darragh)	149	86	863
46. Kilglass	274	204	2038
47. Shanbally	144	110	1096
48. Kilcoran	389	178	1779
Totals =>	**8,250**	**5,543**	**55,430**
* Deductions as per section 5.9.			

3.0 Subsoils/bedrock

The study area overlies 36 rock formations which are classified as regionally important, locally important and poor aquifers. Locally important aquifers are the dominant rock types comprising approx. 79% of the study area and the site of the pig farm. The *Ballysteen (BA), Inchacoomb (IB), Ballygeana (BN)* and *Herbertsown Limestone (HE)* Formations are the main local important aquifers of the study area. These rock types are widespread across the study area. The regionally important aquifers are comprised of the *Kiltorcan (KT) (yellow sandstones), Kilsheelan (KS)* and *Waulsortian Limestones (WA)* bedrocks accounting for 16% of the study area. *Knockordan Limestone (KD), Johnstown Red Marble (JM)* and *Rathronan (RR)* formations are also regionally important aquifers that make up less than 1% of the study area. Approx. 16.6% of the study area is comprised of regionally important aquifers; occurring mainly in townlands 2, 3 and 4 in the north of the study area, in townlands 22, 23, 31 and 33 – 36 in the mid-section of the study area (Galbally/Knocklong) and in the southern townlands 16 and 48. Poor aquifers occur mainly in the mid-section of the study area in townlands 20 – 32. Regionally important aquifers are of higher importance/sensitivity than locally important aquifers, which in turn are more sensitive than poor aquifers. The bedrock geology is illustrated in Figures 1 and 2

Table 2 Bedrock Geology and Aquifer Status within the Study Area

ID	Occurrence within study area (%)	Rock Unit Name	Aquifer Status
Regionally Important Aquifers			
WA	9%	Waulsortian Limestones	Rkd Regionally Important Aquifer - Karstified (diffuse)
KT	4.6%	Kiltorcan Formation	Rf Regionally Important Aquifer - Fissured bedrock
KS	2.3%	Kilsheelan Formation	Rkd Regionally Important Aquifer - Karstified (diffuse)
KD, JM and RR (Knockordan Limestone Formation, Johnstown Red Marble Formation and Rathronan Formation) which comprise 0.7% of the study area			
Locally Important Aquifers			
BA	24.1%	Ballysteen Formation	Ll Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones

ID	Occurrence within study area (%)	Rock Unit Name	Aquifer Status
IB	15.1%	Inchacoomb Formation	Ll Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
BN	9.6%	Ballygeana Formation	Ll Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
HE	8.4%	Herbertstown Limestone Formation	Lm Locally Important Aquifer - Bedrock which is Generally Moderately Productive
IBas	3.6%	Assaroola Member	Ll Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
AT	3.6%	Athassel Limestone Formation	Ll Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
CA	2.7%	Cappagh White Sandstone Formation	Ll Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
VIS	1.8%	Visean Limestones (undifferentiated)	Ll Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
SM	1.7%	Slievenamuck Conglomerate Formation	Ll Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
LR	1.4%	Lough Gur Formation	Lm Locally Important Aquifer - Bedrock which is Generally Moderately Productive
PL	1.3%	Poulgrania Sandstone Formation	Ll Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
KRb	1.1%	Knockroe Basalt Lava Flow Member	Ll Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
KRv	1.1%	Knockroe Vitric-Lithic Tuff Member	Ll Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
KRI, FA, BT, KRt, AE, T, LK, SR, V, SH, NAM and CR (Knockroe Lithic Tuff Member, Farranacliff Formation, Ballymartin Formation, Knockroe Trachyte Lava Flow Member, Ardane Formation, Trachyte, Lackantedane Formation, Shrough Formation, Volcaniclastic Rocks, Slievereagh Conglomerate Formation, Namurian (undifferentiated) and Croane Formation) which make up 3.3% of the study area			
Poor Aquifers			
LLS	3.7%	Lower Limestone Shale	Pl Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones
RM and TB (Ringmoylan Formation, Trachyte Breccias Rocks) which make up 0.3% of the study area			

Groundwater vulnerability, as illustrated in Figures 1 and 2, is a term used to represent the natural ground characteristics that determine the ease with which groundwater may be contaminated by human activities. It is used to indicate the level of risk when assessed in combination the aquifer status. At the site of the pig farm the groundwater vulnerability is medium. The Groundwater vulnerability within the study area can be summarised as follows;

- Approx. 1 - 2% of the study area is comprised of extreme vulnerable land and rock over regionally important aquifers. This is a very high risk category in relation to land-spreading organic manures;
- Approx. 27% of the study area is extreme vulnerable land overlying locally important and poor aquifers; and high vulnerable land over regionally important aquifers. This is a high risk;
- Approx. 71% of the study area is high vulnerable land overlying locally important and poor aquifers and medium – low vulnerable land. This is a low - medium risk;

Table 3 : Groundwater Vulnerability and Aquifer Status within the Study Area

Groundwater Vulnerability	% of the Study area (Gross Area)	% of the study area (Gross Area)		
		Regionally Important Aquifer	Locally Important Aquifer	Poor Aquifers
Extreme	10	1.3	8.5	0.1
High	31	7.3	23.8	0.04
Medium	38	1.2	6.8	1.9
Low	10	6.3	28.8	2.5
Rock	11	0.6	10.9	0.3
Total	100	16.6%	78.6%	4.8%

Overall the risk to groundwater is mainly medium.

4.0 Soil types

The principle soil is a Luvisol type soil – *Elton (1000x)* which is a fine loamy drift with limestones. Luvisol soils are generally deep and fertile, with an accumulation of clay in the lower horizons. It is deep well drained soil type with infiltration rates exceeding 100mm per hour. A single application of pig manure may be up to 5mm / m^2 but generally will be 1.5 – 2.5 mm / m^2. This soil series accounts for approx. 39% of the study area and is associated with intensive grassland use and in some cases tillage – occurring mainly in the upper two thirds of the study area, in townlands 3 – 12, 14 – 18 and 22 - 32.

Approximately 23% of the study area is comprised of Surface and Groundwater Gleys. These soils are coarse clayey drift and described as deep poorly drained mineral soils with infiltration rates exceeding 30mm per hour. While heavy in nature, when drained for agriculture these soils make excellent quality grassland. The *Puckane* series *(0660c)* is the principle of these (16% of the study area) and is the soil type of pig farm site and occurs mainly across the southern parts of the study area (townlands 34 - 44), but also in townland No 1. The *Howardstown (0760c)* series which occurs mainly towards the middle of the study area and accounts for 5% of the study area, is a heavy type soil – a clayey drift with limestones (townlands 20 – 22). The remainder of these gleys are the *Kilrush (0700b)* and *Drumkeeran (0700c)* which tend to be poorly drained (townlands 2 and 32).

Approximately 21% of the study area is comprised of Brown Earth type soils consisting of series such as *Clonroche* (*1100a*), *Ballyvorheen* (*1100d*), *Ballylanders (1100e), Clashmore (1100n), Broomhill (1100s)* and *Baggotstown (1150a)* series. These are fine loamy soils with siliceous stones and classified as deep well drained mineral soils with infiltration rates exceeding 100mm per hour. They are typically associated with intensive grassland use and are also suitable for tillage. The soils occur mainly west of Tipperary Town (townlands 29, 31, 32) and in the southern parts of the study area (townlands 38 – 48).

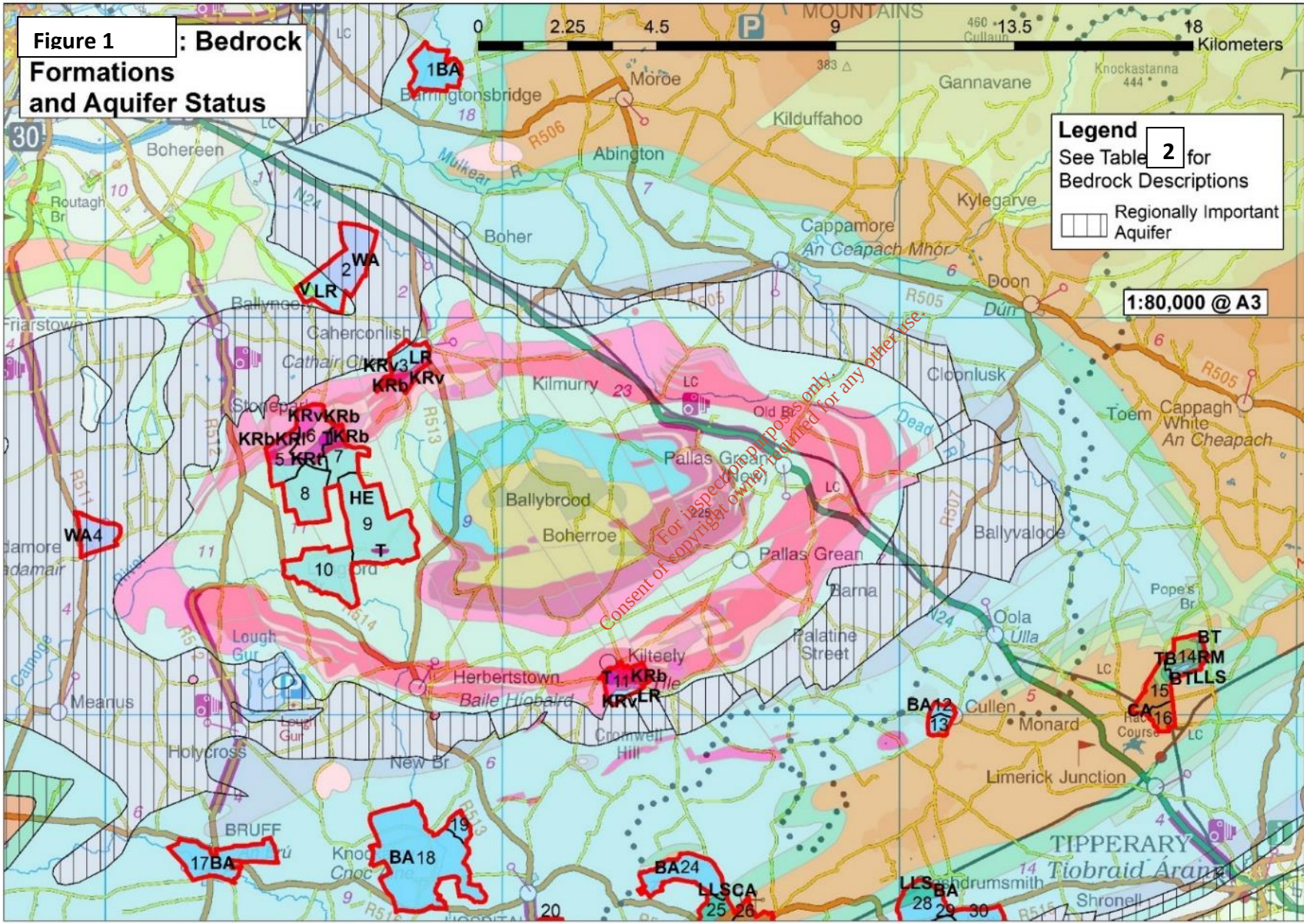
Alluvial Soil (Boyne - *05RIV*) occurs low in the landscape, throughout the study area, along streams and rivers, particularly where there is (or was in the past) an influence of flooding. This soil occupies approximately 11.5% of the study area. This is silty loam soil and classified as mineral alluvial with infiltration rates 5 - 30mm per hour. These soil types are deep and can be very productive where drained, however, typically they are seasonally restricted in terms of agricultural traffic.

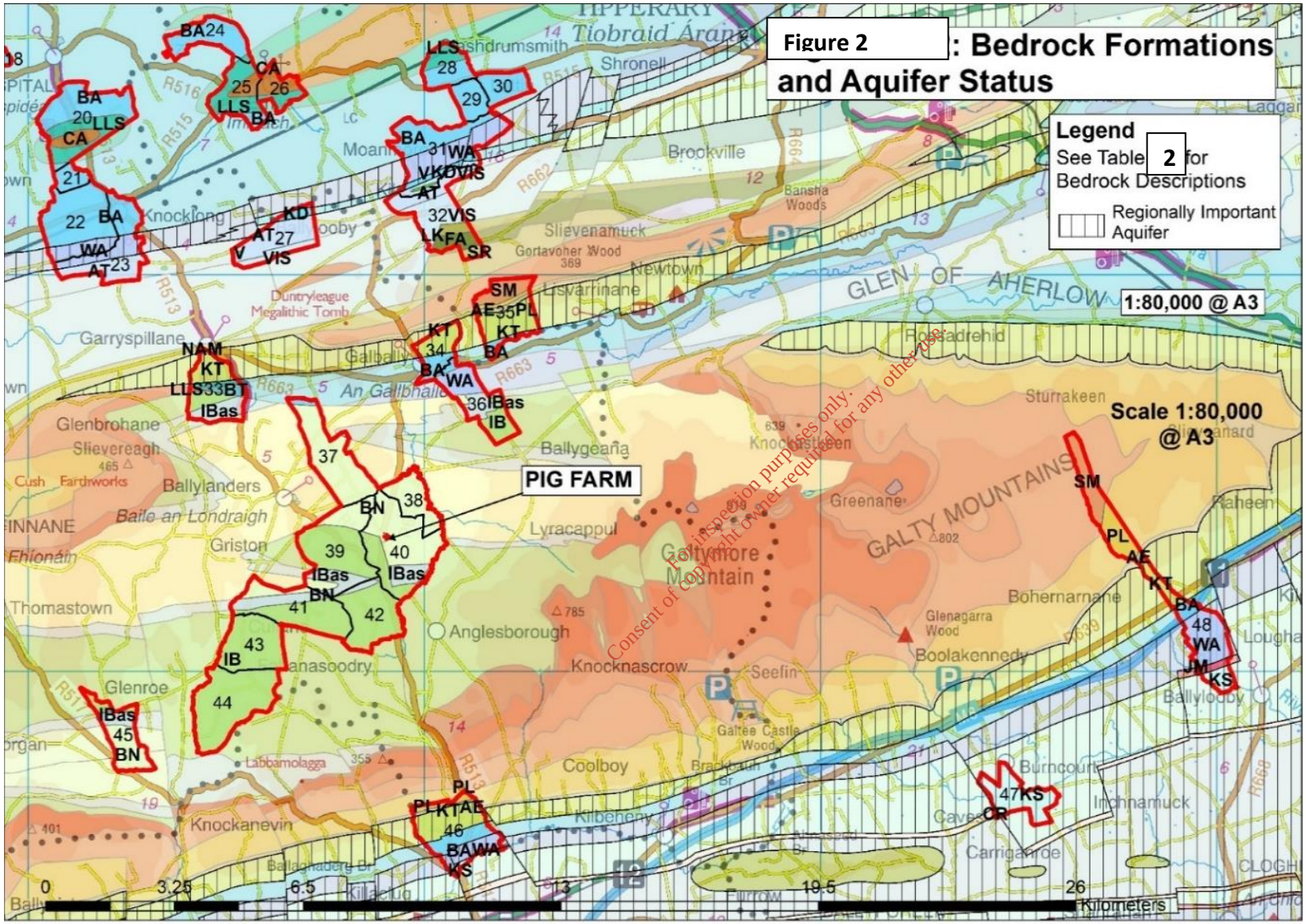
Podzols and Brown Podzols account for 5% of the study area. These soils usually occur higher in the landscape and have a leached upper layer and in some cases an iron pan lower in the soil profile. (Brown Podzols are not as leached as Podzols). *Ballycondon (0800c)* is a loamy drift with Siliceous stones which occurs mainly in the southern part of the study area (townlands 35 and 36). *Knockaceol (960d*) is located mainly south of the study area (townland 46). These are coarse loamy type soils which are mainly suited to grassland due to elevation, rainfall and topography. These soils are classified as a deep well drained mineral soils with infiltration rates exceeding 30mm per hour

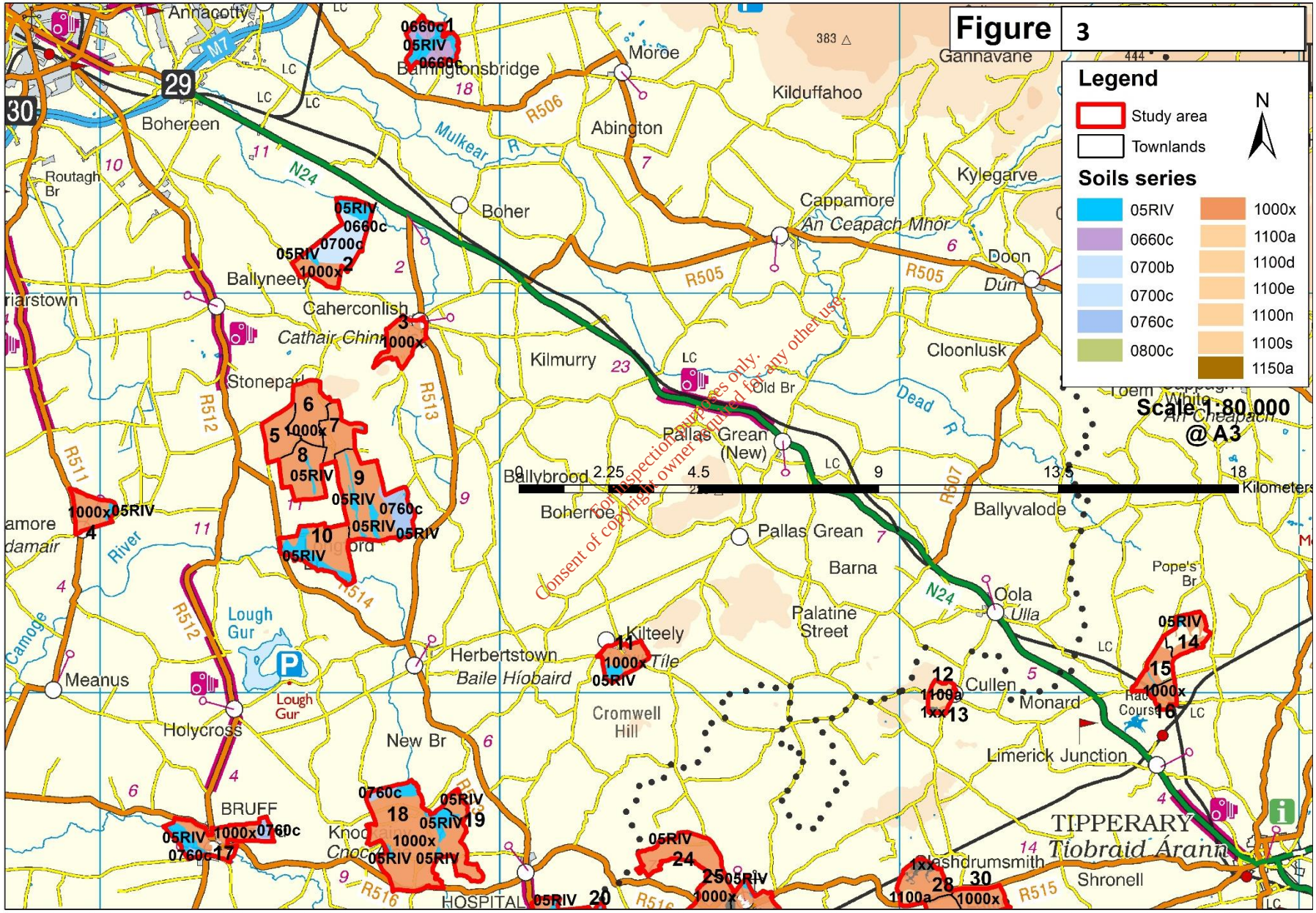
Peats (1xx) account for 1.5% of the study area. These are generally poor quality soils.

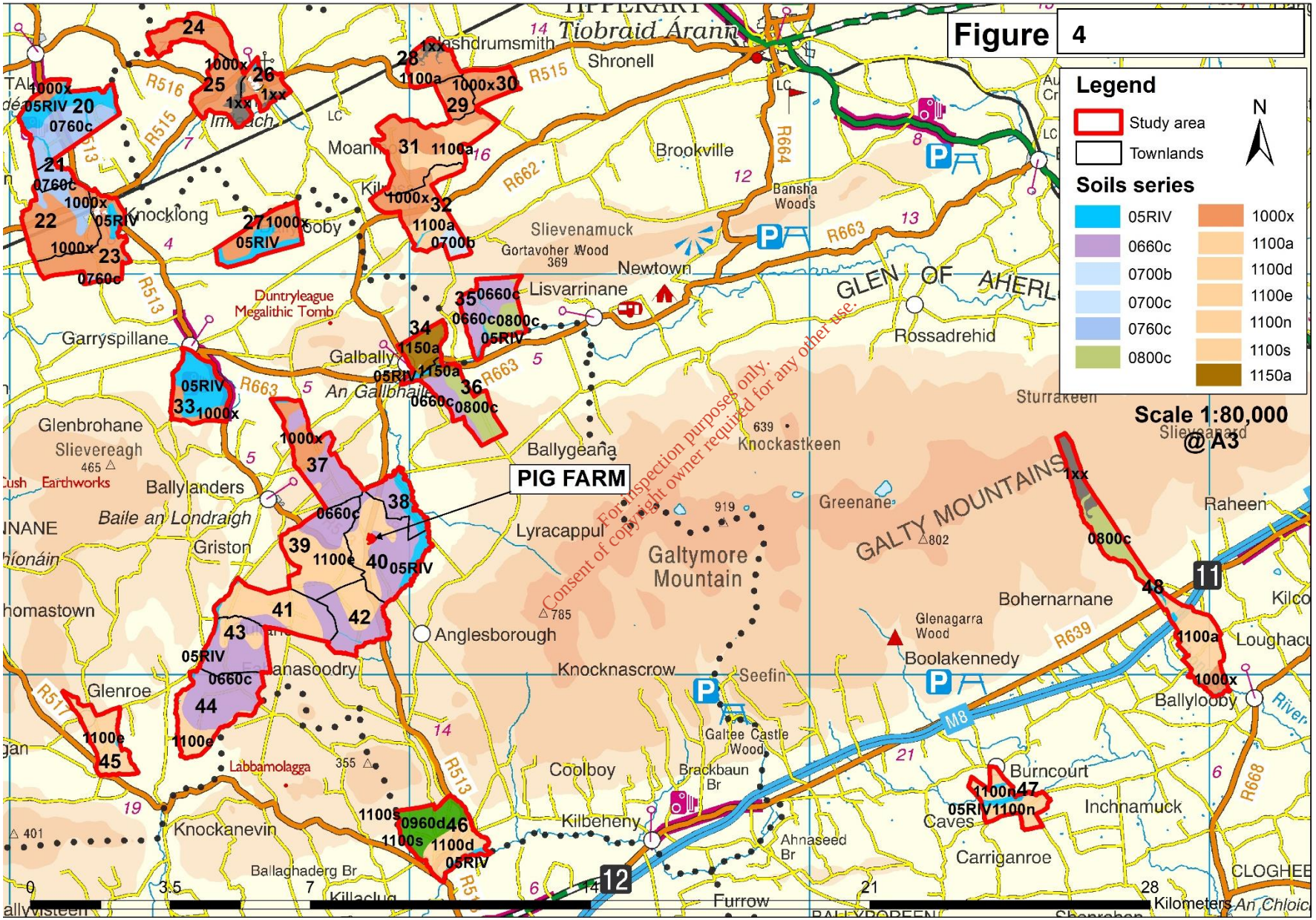
With the exception of peats and some poorly drained gleys (e.g. *Kilrush (0700b)* and *Drumkeeran (0700c)* all these soils with improved grassland are suitable for land-spreading, subject to weather and soil conditions. Luvisols and Brown Earths (59% of the study area) are generally well drained and are very suitable for land-spreading pig manure. Surface and Groundwater Gleys, Podzols, Brown Podzols and Alluvial soils (39.5% of the study area) are generally moderately well drained. The main restriction in terms of land-spreading of pig manure on moderately well drained soils is going to be at the shoulders of the season – requiring additional slurry storage to avoid waterlogged soils. Peats (1.5% of the study area) are poorly drained and generally unsuited to land-spreading pig manure.

Overall the soil types are good quality and suitable for the application of pig manure. The soil types are presented in Figures 3 and 4.





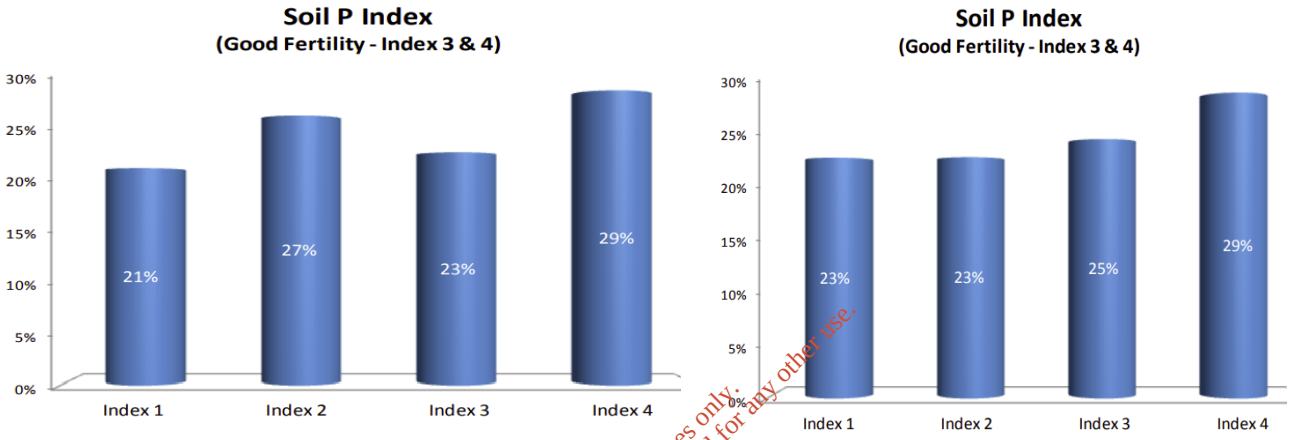




5.0 Nutrient Requirement

Figure 5 shows that 21%, 27%, 23% and 29% of the soil samples taken in County Limerick in 2019 were P index 1, 2, 3 and 4 respectively and 23%, 23%, 25% and 29% of the soil samples taken in County Tipperary in 2019 were P index 1, 2, 3 and 4 respectively. Based on these results, the average P requirement for grass is 14[1]kgs / ha and the requirement of the entire study area is at least 77,602kgs (5,543ha x 14kgs/ha).

Figure 5: 2019 Soil Analysis Results (5,630 samples)[2] for Counties Limerick (left) and Tipperary (right)



However adopting a conservative approach (P index 3 allowance 10kgs / ha) the 5,543ha of land (net area) within the study area can accommodate 55,430[3]kgs of P or 69,288m^3 of pig manure – the revised pig numbers will produce approx. 12,644kgs of P or 15,805m^3 of pig manure. The pig manure is supplying approx. 23% of the required P. This low contribution to the total P requirement indicates that the study area has sufficient capacity to take the pig manure from the revised pig numbers. Table 1 shows the available land and potential capacity of the study area.

According to Table 2 of the 2019 Pig Census (DAFM) there are approx. 4,071 breeding sows in County Limerick producing approx. 354,177kgs of organic nitrogen on an agricultural area of 206,690 hectares (Table 1 of 2010 Agricultural Census). There are approx. 13,868 breeding sows in County Tipperary producing approx. 1,206,516kgs of organic nitrogen on an agricultural area of 313,152 hectares. Therefore the rate of organic N is approx. 2.4kgs / ha which is not significant in the overall context of livestock farming within the counties – i.e. 2- 3% of total organic N within the environs of the study area.

[1] 73% of study area is in Limerick – [(21% @ 30kgs / ha, 27% @ 20kgs / ha and 23% @ 10kgs / ha) x 0.73 + (23% @ 30kgs / ha, 23% @ 20kgs / ha and 25% @ 10kgs / ha) x 0.27].

[2] https://www.teagasc.ie/media/website/crops/soil-and-soil-fertility/Teagasc-Soil-Fertility-Report-2020.pdf

[3] According to SI 605 of 2017 (as amended), which is lower than the soil results would indicate

Figure 6