Our Case Number: ABP-317560-23

An Bord Pleanála

Aine McCann
12 The Grove
Gort
Co. Galway
H91Y8P8

Date: 30 May 2024

Re: Proposed windfarm development including 13 no. wind turbines in Bunnyconnellan, Co. Mayo and hydrogen plant in Castleconnor, Co. Sligo.
Carrowleagh, Bunnyconnellan, Co. Mayo and Curraun, Castleconnor, Co. Sligo.

Dear Sir / Madam,

An Bord Pleanála has received your submission in relation to the above mentioned proposed development and will take it into consideration in its determination of the matter.

As this submission is a further information submission, no fee is required and therefor a refund will be issued to the debit/ credit card used to make payment in due course.

The Board will revert to you in due course in respect of this matter.

Please be advised that copies of all submissions / observations received in relation to the application will be made available for public inspection at the offices of the local authority and at the offices of An Bord Pleanála when they have been processed by the Board.

More detailed information in relation to strategic infrastructure development can be viewed on the Board's website: www.pleanala.ie.

If you have any queries in the meantime please contact the undersigned officer of the Board. Please quote the above mentioned An Bord Pleanála reference number in any correspondence or telephone contact with the Board.

Yours faithfully,

Lauren Murphy
Executive Officer
Direct Line: 01-8737275

PA09

Áine McCann. BSc (Hon) Environmental Science

12 The Grove. Gort. Co Galway. H91Y8P8.

Submission in relation to planning application by:

Mercury Renewables to An Bord Pleanála Dated November 2023 Regarding Application No; ABP-317560-23 (PA16.317560).

Windfarm and Hydrogen plant. Sligo/Mayo.

Document brief.

This document and intends to cover the following points with respect to the above planning application by Mercury Renewables.

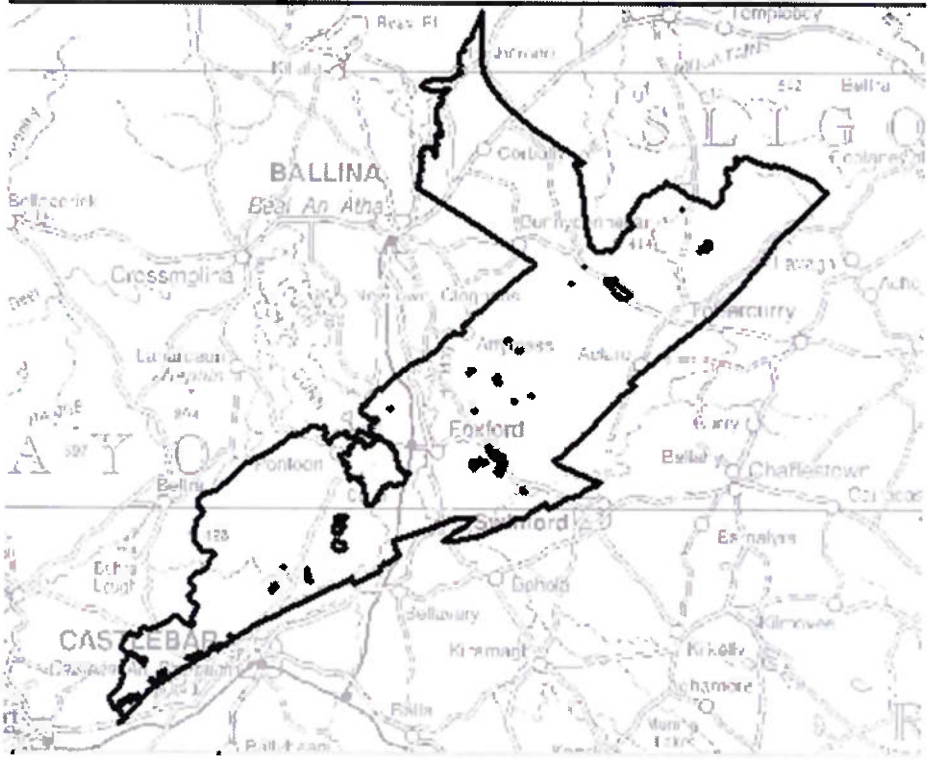
- Hydrology and water use at the proposed hydrogen & wind farm site.
- Hydrology and connections to SPA & SAC.
- CHOMA Directive and safety analysis and hydrogen production.

Hydrology of the proposed hydrogen production & wind farm site

Hydrogen (H_2) gas with respect to this project is to be generated via the electrolysis of water (H_2O) which will be drawn from the Water Framework Directive (WFD) area Leaffony_SC_010 (WFD catchment ID;34/ Sub-catchment 34_11) part of the wider Foxford aquifer which runs under the proposed site.

1st Draft Foxford GWB Description –July.200

Figure 1 Boundaries and location of Foxford GWB



The site has a hydrostatigraphy Rock Unit Group (RUG) of Dinantian upper impure limestone overlain with the lower Ballina limestone formation of dark fine-grained limestone and shale. Appendix A

While this limestone base effects the characteristics of the resulting water karstification is not a factor due to the shale. The limestone stone has a strong influence on the chemical profile of the local waster as we see in the chemical analysis carried out at the site by Minerex (groundwater assessment report) confirming a high calcium content with calcium deposits quickly covering the machinery. Chemical analysis by Minerex also confirms high presence of strong reducing conditions and high Ammonium Nitrate levels characteristic of application of fertilizers in a farming area.

According to the updated risk assessment it is proposed to deal with ionic deposits by way of electrolysis as part of the overall filtration system. However, this does not tally with the system proposed in Appendix F of the Minerex ground water report.

It is also noted that the filtration system included in appendix F of the Minerex groundwater supply assessment document does not relate to this site. It is a contract drawn up between the provider the service Whitewater limited, and the client Killen Castle golf services limited for a water purification system their premises at Dundrum in Dublin. The documents are part of a standard technical service report and do not relate to tests carried out at the proposed hydrogen site as evidenced by dates and location with the contract being signed for the service on the 28.9.22 and water treatment tests having been carried out on 2.2.23. Note that borehole drilling and long-term pumping testing did not begin at the proposed hydrogen site until 11.7.22 ending on 5.8.22. This systemin no way represents the complexity of the system that would be required, level of servicing due and cost to bring the extracted water given the chemical profiles of BH6 & BH7 to the standard of purity required to produce H_2 gas. It is questionable as to why it has been included.

In the interests of safety, the filtration system for this facility is of great importance due to the high levels of calcite deposits present in the water. Calcite precipitates faster under warm conditions blocking pipes and any leaking into the system used to produce H_2 gas would pose an added risk on top of hydrogen embrittlement.

Raised NH_3 (ammonia) levels were also detected at borehole 6 (BH6) and BH7, the proposed pumping well, that were above the accepted Ground Water Directives. This is of concern if this were to find its way into the attenuation system as part of accidental or normal release within the proposed plant the attenuation area unlaid with peat and not till, as to the West of the proposed site where BH6 is situated, the NH_3 water could make its way into the Dooyeahny river via side transmission from the aquifer or directly as part of discharge.

The proposed site is overlain mostly by peat on the East side in the areas where the boreholes that were least productive were drilled on the West side which is interspersed by till where BH6 & BH7 the two proposed productive boreholes are situated. Appendix B

The effect of having the attenuation area unlaid by peat has not been discussed in terms of its ability to absorb and percolate the discharged water without causing direct runoff.

If BH6, the only productive well, silts up there may be little chance of finding another productive borehole (BH7 is much less productive) on this site as 11 in total boreholes were drilled and space becomes limited due to building and roads.

This would leave the proposed plant to relay on rainwater and/or the local group water scheme which is itself extracted from a well and is untested as to its abilities to cope with this demand. It also adds a further level of contaminant of chlorine.

The availability of rainwater at the proposed site is delt with later in this submission.

Aquifer

With respect to the aquifer, Geological Survey of Ireland (GSI) have three classifications of aquifers in Ireland; Regionally Important (R), Locally Important (L), & Poor (P). They also have subsections in each category based on the bedrock type and while this area is limestone it is not karst as it is combined with shist which gives it resistance to dissolution.

This section of the Foxford aquifer gains the classification by GSI of a locally important with a bedrock that is **'moderately productive in local zones only'** denoted as, Ll. Appendix C

Water flow in these aquifers is generally by fractures, fissures, joints, or conduits. Folding is of importance and in this area folding of the rocks occurred in the Caledonian Orogeny demonstrating a folding of N.E. to S.W. this influences the direction of flow and as such recharge of aquifers in this area.

The Minerex Environmental Limited hydrological report Doc. Ref. 3131-043 Rev. 2. of the aquifer confirms a classification of a Ll aquifer as most of the wells drilled were not productive with only one of the wells being productive (BH6) and a second being slightly productive (BH7).

If we look at Minerex the graph of BH6, the productive well, based on the curve of the graph this aquifer suggests it can be one of three aquifer types: a confined aquifer, a leaky aquifer, or a recharge boundary.

REPORT TO
Firlough Hydrogen Plant,
Groundwater Supply Assessment

REPORT BY
Minerex Environmental Limited
Doc. Ref. 3131-043 Rev.2

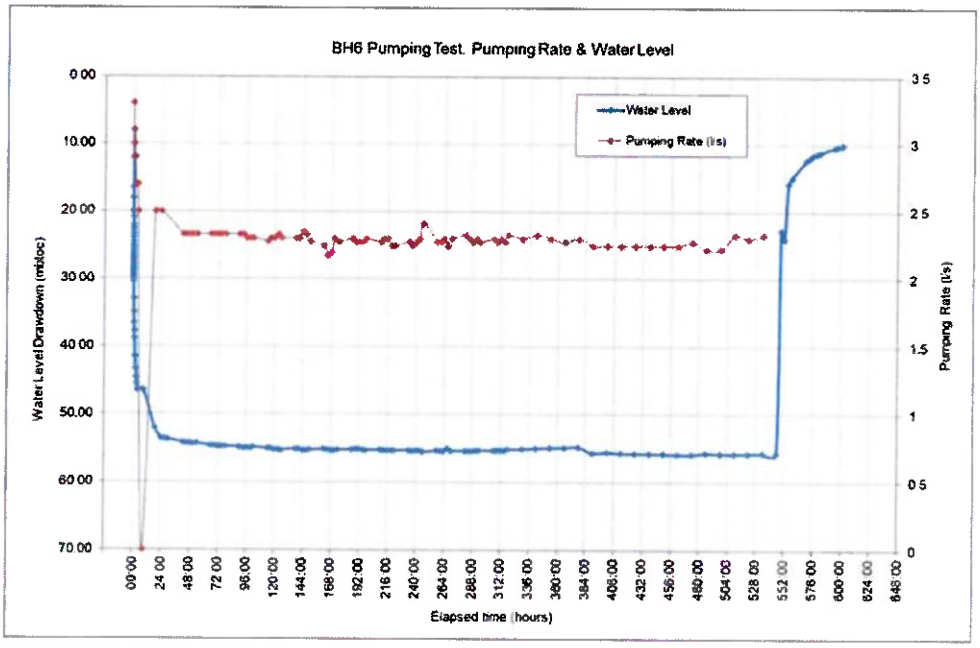


Figure 3.1. Borehole 6 pumping test data

10

2667 / 3719

Minerex have not defined which type it is and the implications of this clear for long term pumping. This is of importance in relation to recharge as we are also not aware if we are dealing with an aquitard or an aquiclude.

Aquifer recharge depends on three factors;

- effective rainfall.
- subsoil properties.
- zone of confinement.

(Ground Water Working Group GWWG 2004)

GSI state that an aquifer with the classification Ll has a limited recharge capacity being a bedrock aquifer coming into the same class as the three 'Poor' types of aquifers in this respect. GWWG state that <5% of annual rain fall becomes recharge, with the exception of sand and gravel aquifers, the other 95% is taken up by vegetation, transpiration.

Due to most of the proposed site having a sub-soil profile of peat the recharge capacity is inhibited, this inhibition of recharge will be further amplified to by the addition of buildings and hard surfaces. Annex

We are not given the depth of the soil or sub-soils for the drilled areas. No core samples were taken of the soil in the borehole area for transmissivity tests. This is of great concern as the plant is to be built within the recharge area/zone of confinement (ZOC) of BH6 & BH7 and rainwater, the only source of recharge to this limited bedrock aquifer is to harvest as part of the water management on site to feed the electrolyser.

The purpose of this project is to produce H_2 gas from water so as the main ingredient, the constant supply of water, is imperative to produce the product. If the availability of a constant uninterrupted supply of clean water is an issue this site is not a viable option.

Description of locally important aquifers of this type according to Ireland at Risk, Williams & Lee;

'Ll Locally Important Bedrock Aquifer, Moderately Productive only in Local Zones: Aquifer with a limited and relatively poorly connected network of fractures, fissures, and joints, giving a low fissure permeability which tends to decrease further with depth. A shallow zone of higher permeability may exist within the top few metres of more fractured/weathered rock, and higher permeability may also occur along fault zones. These zones may be able to provide larger 'locally important' supplies of water. In general, the lack of connection between the limited fissures results in relatively poor aquifer storage and flow paths that may only extend a few hundred metres. Due to the low permeability and poor storage capacity, the aquifer has a low 'recharge acceptance'. Some recharge in the upper, more fractured/weathered zone is likely to flow along the relatively short flow paths and rapidly discharge to streams, small springs and seeps. Groundwater discharge to streams ('baseflow') can significantly decrease in the drier summer months.'

Ireland at risk. Williams & Lee

Wider impacts of water extraction

Water extraction from BH6 has an impact on spring well 1 (SP1), Spring well 2 (SP2) and may the Dooyeaghny/Cloonloughan river over time, particularly at low rainfall periods. We have visual conformation that the pumping has influenced SP & SP2 to a great extent. Effects of pumping from BH7 on SP1, SP2 & FW1 were not given. Also, the effects of pumping both wells, BH6 & BH7 in combination on SP1, SP2 & FW1 are not measured or given.

REPORT TO
Firlough Hydrogen Plant,
Groundwater Supply Assessment

REPORT BY
Minerex Environmental Limited
Doc. Ref. 3131-043 Rev.2

3.3.6 Spring (SP1 & SP2)

A notable reduction in water level/flow was observed at SP1 and SP2 (Figures 3.8 and 3.9, respectively). Flow at SP2 was measured at 0.65 l/s before pumping, however, it had reduced to 0.3 l/s after 10 days of continuous pumping. Flow further reduced to 0.06 l/s on the 01/08/22 at 8.00, however, it increased to 0.2 l/s by 20.00 on the same day. This is consistent with a heavy rainfall event (approximately 17mm) (see Figure 3.6).

Flow at SP2 did not increase after the cessation of the pumping test. While flow is apparently somewhat correlated with rainfall, further work would be required to identify the impact of the groundwater abstraction.

Minerex cite rainfall of 17mm for a return of flow in SP2. The rain figures given are for Knock Airport 40Km to the south of the proposed site and are not reliable and accurate readings as it is drier at the proposed site. A closer rain station should have been used for accuracy. In Ireland micro-climates can occur affecting rainfall patterns. Rainfall will be discussed later.

Aquifers discharge sidewards into nearby streams and rivers proving 50% of the water content in normal flow periods and 90% during summer periods (DELG/EPA/GSI 1999). Springs are described by Fossit (2000) as being maintained by a continued upwelling from an underground source or along a seepage zone of an aquifer, SP1 & SP2 are examples of this.

There was a significant drop in the flow at SP2 after ten days of pumping. The Minerex report incorrectly identifies and attributes this significant drop in flow at SP2 as relating to the lowest rainfall since 1995 citing figures from Markree Castle some 40Km East of the prosed hydrogen development and not the fact that the spring is fed directly from the aquifer where the long-term pumping tests were being carried out. There have been low rainfall figures for this area in more recent times for example in August 2003 at Ballina (Shanaghy) 18.7mm was recorded and in September 2014 5mm was recorded also at Ballina (Shanaghy).

The spring SP2 showed signs of drying up with ten days pumping as can be noted from pictures contained in the Minerex report (see below). It should be noted that a Meter stick should have been in place when the pictures were taken as is best practice to gauge change in water depth. We can clearly the change in vegetation, watercress, growing taking over in this short space of time, the stream formed from this spring is flush with watercress from spring onward typical of this type of habitat which is also bryophyte dominant. We can clearly see elodea flowing in the water, this aquatic plant requires clear, slow flowing water all year round. Its strong growth here which signifies these conditions have been met on a regular basis to allow it to establish.

REPORT TO REPORT BY Firlough Hydrogen Plant, Groundwater Supply Assessment 3.3.6 Spring (SP1 & SP2) Minerex Environmental Limited Doc. Ref. 3131-043 Rev.2

Flow at SP2 did not increase after the cessation of the pumping test. While flow is apparently somewhat correlated with rainfall, further work would be required to identify the impact of the groundwater abstraction.

REPORT TO
Firlough Hydrogen Plant,
Groundwater Supply Assessment

REPORT BY
Minerex Environmental Limited
Doc. Ref. 3131-043 Rev.2

Figure 3.9. SP2 on the 11/07/22 i.e., pre-pumping (left) and after 10 days of pumping 22/07/22 (right).

SP2 pictures from Minerex groundwater assessment report.

SW2 02/05/2024

Note bryophyte covering the mouth of the water arch. If water levels fluctuated this bryophyte would not be able to maintain itself here. We can also see it in the pictures above in reaction to drier summer conditions.

Effects on SP2 from long term pumping.

Flow rate as measured by Minerex SP2:

Day 0............0.61 l/s (day prior to pumping)

Day 11.........0.31 l/s (10 days post pumping)

Total loss to spring = 50%

Day 7............0.06 l/s (5 days post pumping)

Drop to 10% of Day 0 flow. 90% loss of original flow.

(3.3.6 Minerex ground water assessment report)

SW2 22/05/2024

This picture is after heavy rainfall which shows that this spring is not influenced by rainfall but is fed by the aquifer.

Water levels remain constant.

Recharge of an aquifer is a slow process as it is by percolation through the subsoils and <5% of precipitation makes it into the aquifer.

Local people currently extract water from this well by walking down behind the pump and placing a bucket into the area visible in the picture.

Any contaminants from to the groundwater body of the proposed site will affect this spring well and possibly have health & safety concerns.

No ecology report is available for SW2 with regard to impacts of long-term pumping or identification of rare or endangered plant or aquatic species.

The Minerex report also notes another spring to the southwest of the proposed hydrogen site labelled SP1 and sites it as the likely source of the Corbally stream which feeds into the Dooyeaghny/Cloonloughan which flows into the May SAC. No ecology report has been carried out on the effects of pumping on this spring.

As with SP2 the habit has not been identified and there is the possibility of Annex 1 species such as *Saxifraga aizoides* (yellow saxifrage). Calcareous springs with tufa formation are Annex 1 habitats in Ireland.

Figure 3.8. SP1 on the 11/07/22 i.e., pre-pumping (left) and after 10 days of pumping 22/07/22 (right).

REPORT TO
Firlough Hydrogen Plant,
Groundwater Supply Assessment

REPORT BY
Minerex Environmental Limited
Doc Ref 3131-043 Rev 2

3.3.6 Spring (SP1 & SP2)

A notable reduction in water level/flow was observed at SP1 and SP2 (Figures 3.8 and 3.9, respectively) Flow at SP2 was measured at 0.65 l/s before pumping, however, it had reduced to 0.3 l/s after 10 days of continuous pumping. Flow further reduced to 0.06 l/s on the 01/08/22 at 8 00, however, it increased to 0.2 l/s by 20 00 on the same day. This is consistent with a heavy rainfall event (approximately 17mm) (see Figure 3.6).

Flow at SP2 did not increase after the cessation of the pumping test. While flow is apparently somewhat correlated with rainfall, further work would be required to identify the impact of the groundwater abstraction.

As cited by Inland Fisheries Ireland (IFI) (letter to ABP 1/9/2023 in relation to this proposed development, both wind farm and hydrogen plant, there are concerns as rivers linked to this project are already failing to meet their ecological objectives under the Water Framework Directive and Water Basin Management Plan of high and good ecological status. This spring forms part of a protected salmonoid and river trout river network and important spawning and nursery habitat for trout and salmon IFI are investing significantly and a habitat enrichment programme in the Dooyeaghny river to improve salmonoid spawning and protect water quality. According to IFI it is imperative that water quality in this shipment be protected to support the success of this programme.

The Dooyeaghny is also a tributary of the Brusna river, this river and its tributaries provide important salmon, sea trout and brown trout spawning and nursery habitats. The Brusna river is also part of the Moy SAC we're high ecological status must be maintained to protect Atlantic salmon, white-clawed crayfish and lamprey species.

Sedimentation causing silting is of concern particularly and relation to the wind farm and the denuding of peat soils irrespective of proposed mitigations in this area as it gives rise to the tributaries which feeds the Golan River which provides important salmon and trout spawning nursery habitat for the river Easky which is also home to the Annex 1 protected freshwater mussel.

The Easky river is also a valuable tourist resource in county Sligo and attracts anglers from all parts of the world to the area, it generates considerable revenue and employment to the area as well as being a source of research to universities.

'2 Section 2.1.

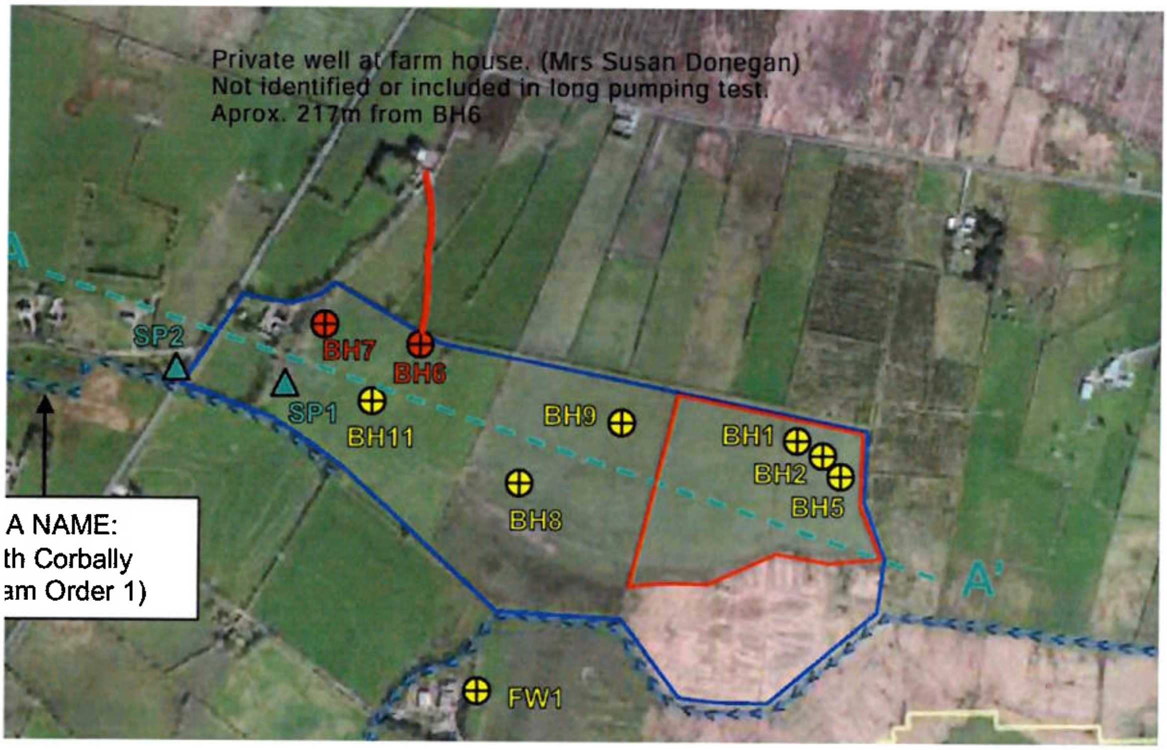
Hydrogen Plant Site

The receiving river (WFD) sub basin/ EPA Ref. Dooyeaghny_or_Cloonloughan_010 runs) parallel, 70 m at the closest point along the south of the Hydrogen Plant Site which forms the Co. Sligo/Mayo County boundary and Carraun (Sligo)/Dooyeaghny (Mayo) townland boundary.

(6129 Firlough Wind Farm & Hydrogen Plant EIAR 3 June 2023)'

Impacts of long-term pumping were not considered on a nearby well used for domestic purposes.

This well is 217m from BH6 the proposed main extraction point for this project.



Above: Red line from BH6 to well of Mrs Donegan. It is not marked where attempts were made to drill BH3 BH4 & BH10.

Mercury claims the nearest active well, other than FW1, to the proposed hydrogen site is 1.4 km North in proximity to a castle. Given as GSI1131NEW005. They also say there are no borehole with in 4km of the site but FW1 is within this distance.

The homeowner, Mrs Susan Donegan, was not consulted regarding the long-term pumping test. No readings were taken with respect to the possible impacts that the high levels of extraction will have on the family well and so no mitigation is in place for possible impacts. If two wells are used due the lower rainfall numbers placing a higher demand on the need to use the wells the likelihood of impact raises. It is noted that the domestic well above does not appear on GSI or EPA data sets the home is across the road from the site and within walking distance and Minerex should have called there so confirm if the owner was on the group water supply or not. Due to GDPR they would not have to be able to obtain a list of homes connected to the group waster scheme. It is good practice when carrying out a long-term pumping test such as this which might have negative consequences for a domestic water supply and the health status of the household and so reliance on water supply is unknown to physically call and check and make people aware of possible disruptions.

This demonstrates a lack of community awareness on behalf of this company as to the possible impacts their activities have on this community. The fact that planning was not sought from Sligo CoCo for these pumping tests in the first instance demonstrates disregard for planning law and proper procedure and if planning is granted it will then be incumbent on these very same people to ensure planning and environmental compliance by Mercury renewables who have as far acted to the contrary.

'1. Introduction (Page 2660 / 3719) Minerex groundwater report

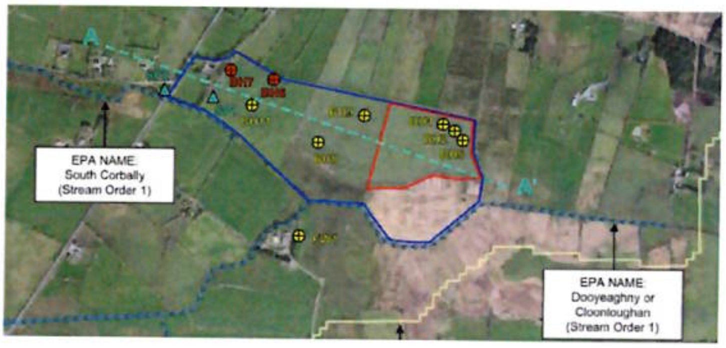
The assessment includes the completion of a pumping test on two boreholes located on the proposed site in order to identify their respective sustainable yields. Concurrent monitoring was carried out within a network of observation wells, proximal groundwater springs and a well supplying a local landowner (Appendix B). MEL visited the site on the 11th, 12th and 22nd of July 2022.'

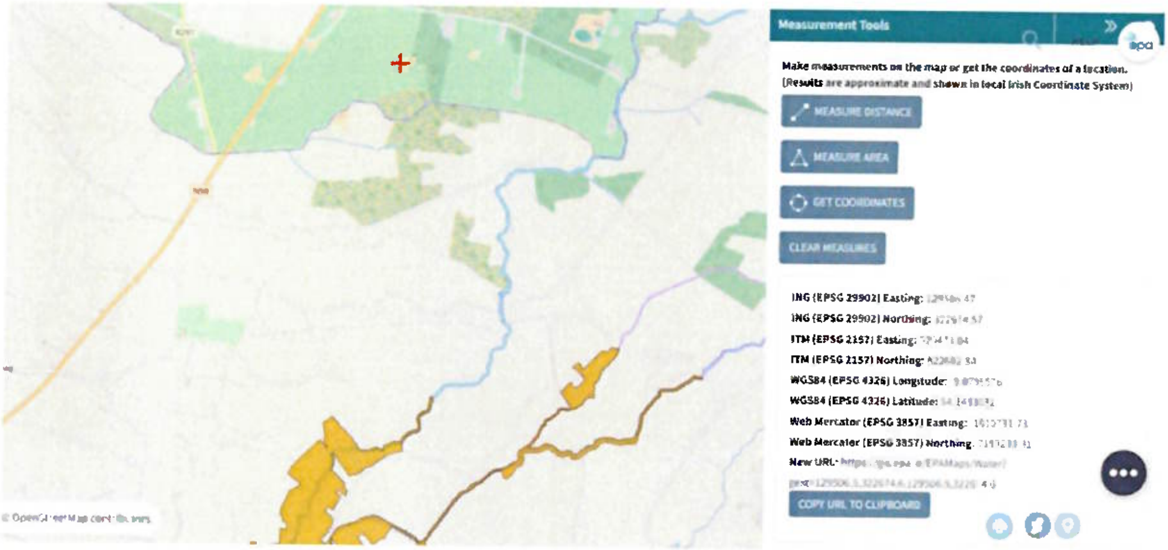
The observation wells in question were all onsite with the exception of FW1 which is Fox's well. A local man not employed by Minerex was taking readings from FW1 daily. This person was not qualified to do so as per BS ISO 14686 2003 and BS 5930:1999 standards. This invalidates the readings from this parameter.

Calibration certification of testing equipment for long term pumping tests.

No celebration certificates have been supplied for the testing equipment and meter reading as per BS ISO 14686 2003 and BS 5930:1999 requirements. We are not aware that the equipment used has met scientific or industry standard during the test period.


Potential Site
Three potential water sources have been identified through preliminary drilling. These will provide water to the proposed electrolyzer site to the south-east of the property
N59
Sites drilled as potential water sources
Proposed Electrolyzer Site


A
A'
EPA NAME:
South Corbally
(Stream Order 1)
EPA NAME:
Dooyeaghny or
Cloonloughan
(Stream Order 1)


Measurement Tools
Make measurements on the map or get the coordinates of a location.
(Results are approximate and shown in local Irish Coordinate System)
MEASURE DISTANCE
MEASURE AREA
GET COORDINATES
CLEAR MEASURES
ING (EPSG 29902) Easting:
ING (EPSG 29902) Northing:
ITM (EPSG 2157) Easting:
ITM (EPSG 2157) Northing:
WGS84 (EPSG 4326) Longitude:
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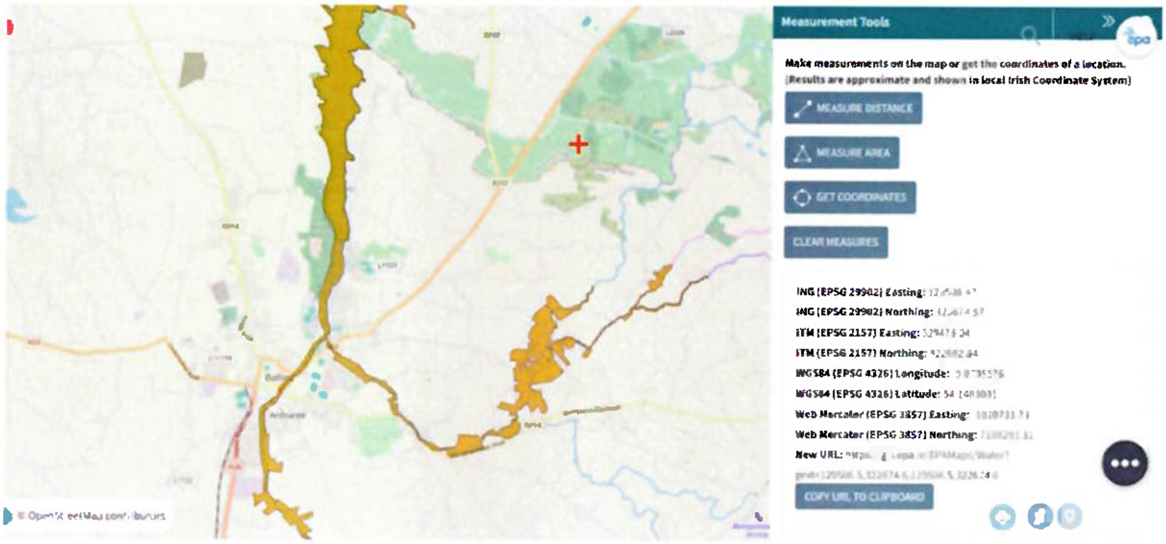
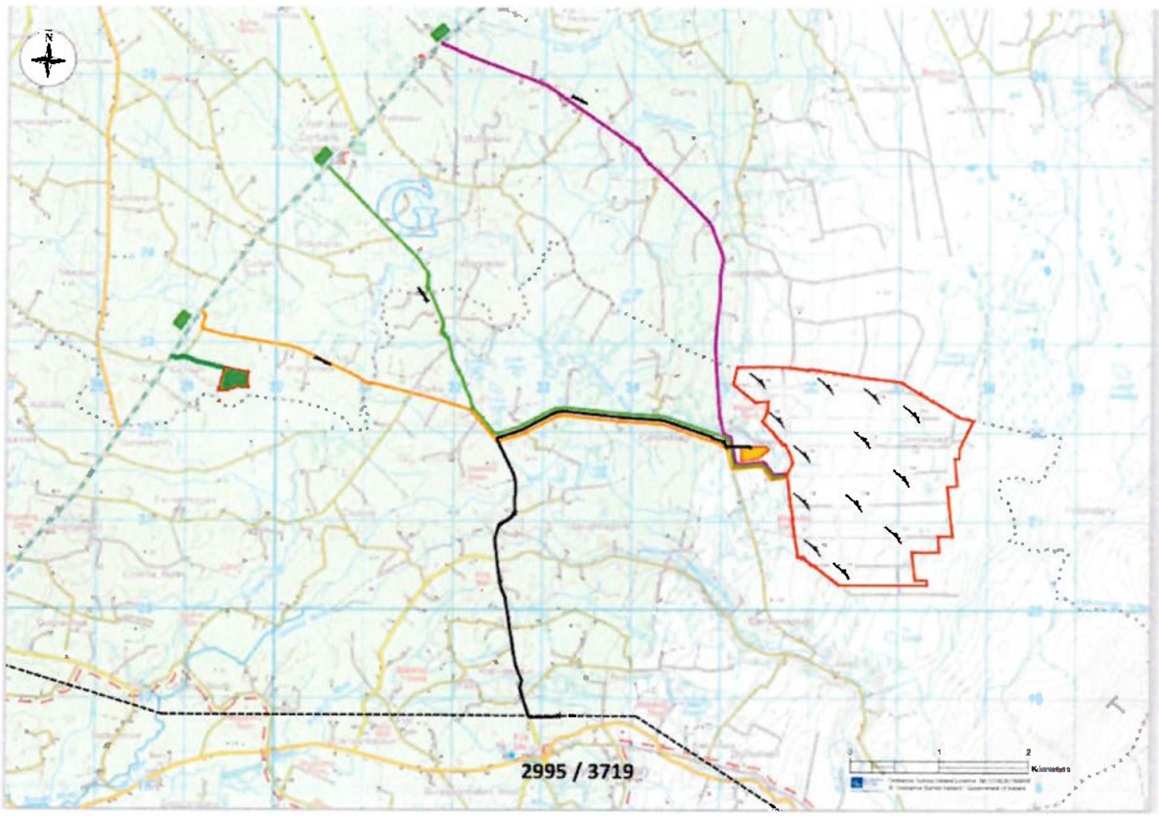
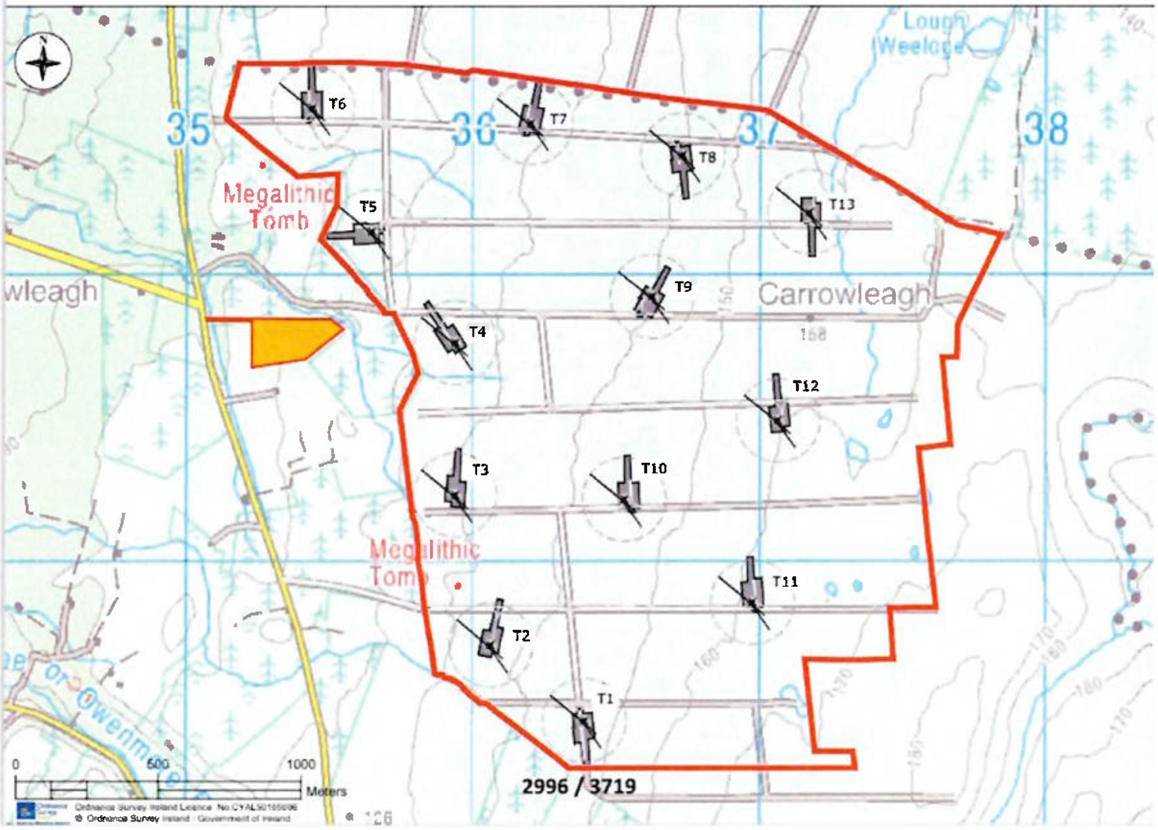


Maps showing direct hydrological connection of proposed hydrogen site via the Dooyeaghny river and to the river Brusna river which has high water status objective under The Water Framework Directive (WFD). Protection and restoration of these high-status water bodies is a priority under Irelands River Basin Management Plan (RBMP)

SPA's and SAC's have been highlighted together on these maps.





T1
T2
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Megalithic Tomb
Megalithic Tomb
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Lough Weelode
35
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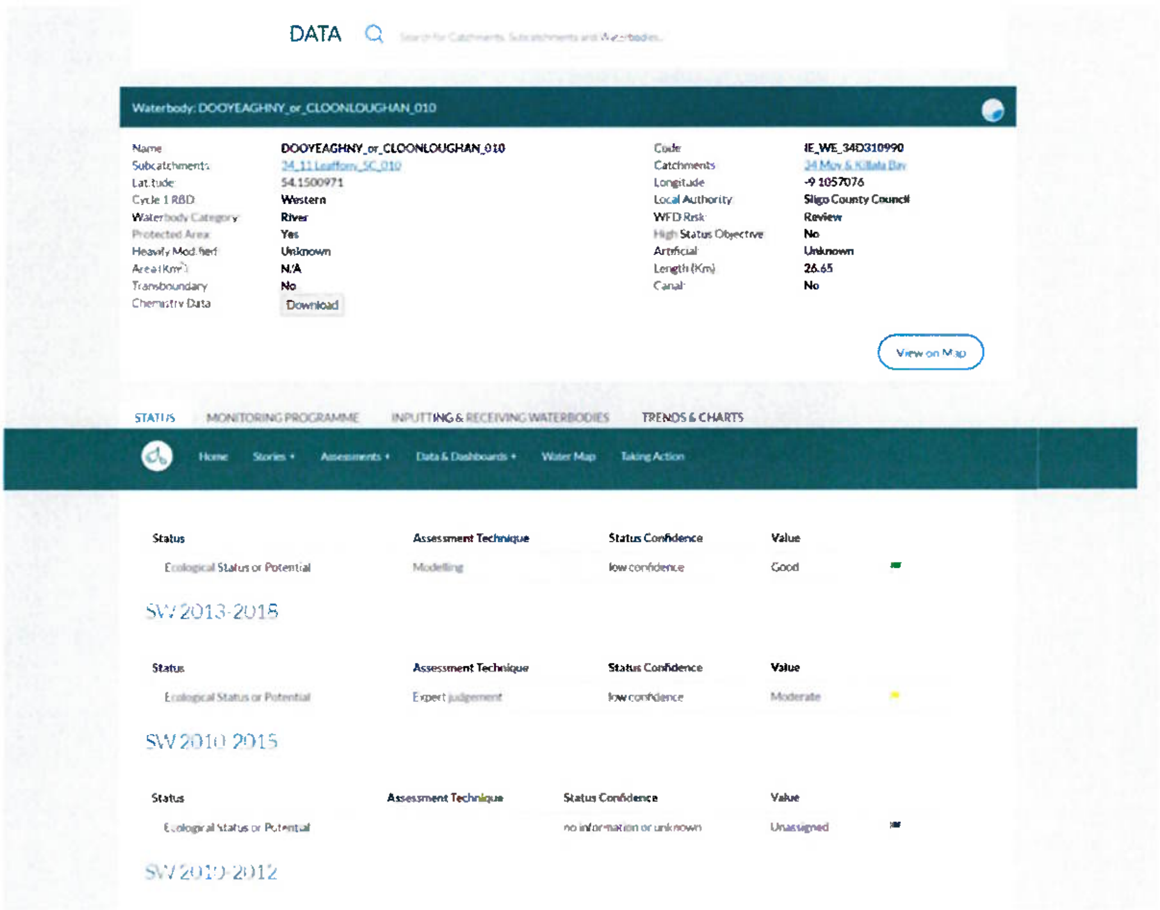
Meters
2996 / 3719



DATA

Waterbody: DOOYEAGHNY_or_CLOONLOUGHAN_010

Name	DOOYEAGHNY_or_CLOONLOUGHAN_010	Code	IE_WE_34D310990
Subcatchments	34_11 Leaffony_SC_010	Catchments	34 Moy & Killala Bay
Latitude	54.1500971	Longitude	-9.1057076
Cycle 1 RBD	Western	Local Authority	Sligo County Council
Waterbody Category	River	WFD Risk	Review
Protected Area	Yes	High Status Objective	No
Heavily Modified	Unknown	Artificial	Unknown
Area (Km²)	N/A	Length (Km)	26.65
Transboundary	No	Canal	No
Chemistry Data	Download		

View on Map

STATUS MONITORING PROGRAMME INPUTTING & RECEIVING WATERBODIES TRENDS & CHARTS

Home Stories Assessments Data & Dashboards Water Map Taking Action

Status	Assessment Technique	Status Confidence	Value
Ecological Status or Potential	Modelling	low confidence	Good

SW 2013-2018

Status	Assessment Technique	Status Confidence	Value
Ecological Status or Potential	Expert judgement	low confidence	Moderate

SW 2010-2015

Status	Assessment Technique	Status Confidence	Value
Ecological Status or Potential		no information or unknown	Unassigned

SW 2010-2012

Protected Areas intersecting River and Lake Waterbodies

The Protected Areas listed below intersect spatially with river and lake waterbodies in the subcatchment ...

Code	Name	Type	Waterbody Name	Association Type
IEPA1_WE_G_0034	Foxford	Drinking Water	BELLAWADDY_010	Within Protected Area
IEPA1_WE_G_0034	Foxford	Drinking Water	BELLAWADDY_020	Within Protected Area
IEPA1_WE_G_0034	Foxford	Drinking Water	DOOYEAGHNY_or_CLOONLOUGHAN_010	Within Protected Area
IEPA1_WE_G_0034	Foxford	Drinking Water	Quigabar_010	Within Protected Area
IEPA1_WE_G_0034	Foxford	Drinking Water	Scurmore_010	Within Protected Area
IEPA1_WE_G_0035	Ballina	Drinking Water	DOOYEAGHNY_or_CLOONLOUGHAN_010	Within Protected Area
IEPA1_WE_G_0049	Easky West	Drinking Water	BELLAWADDY_010	Within Protected Area
IEPA1_WE_G_0049	Easky West	Drinking Water	BELLAWADDY_020	Within Protected Area
IEPA1_WE_G_0049	Easky West	Drinking Water	LEAFFONY_010	Within Protected Area
IEPA1_WE_G_0049	Easky West	Drinking Water	LEAFFONY_020	Within Protected Area
IEPA1_WE_G_0049	Easky West	Drinking Water	Quigabar_010	Within Protected Area
IEPA1_WE_G_0113	Ballina Gravels Group 1	Drinking Water	DOOYEAGHNY_or_CLOONLOUGHAN_010	Within Protected Area

Further Characterisation Actions

The following further characterisation actions have been identified. These are necessary to help understand more fully issues in the subcatchment and their likely cause.

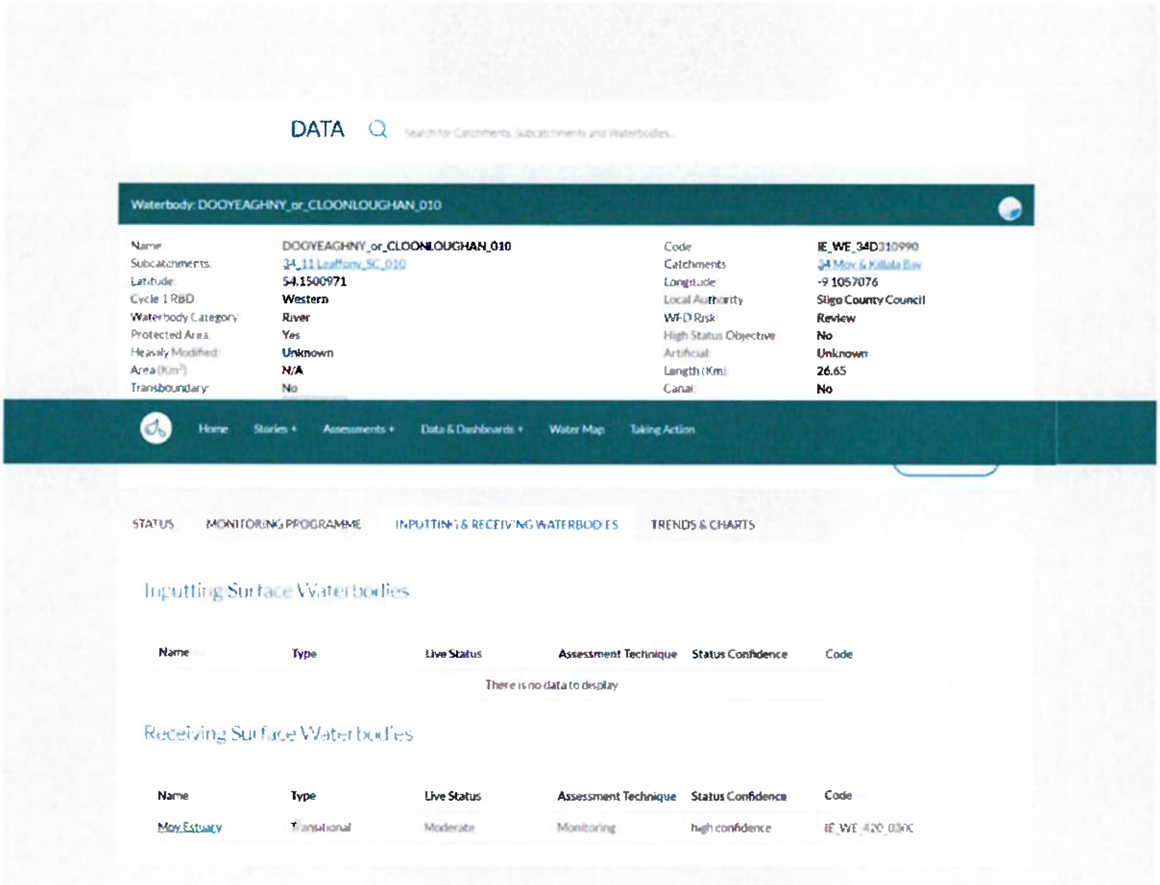
Code	Name	Action	Responsible Organisation	Created In
IE_WE_34S610980	Scurmore_010	IA3 Determination of Water Quality (unassigned waterbody)	Local Authority Waters Programme (LAWPRO)	WFD Cycle 2
IE_WE_34B050300	BELLAWADDY_020	IA7 Multiple Sources in Multiple Areas	Local Authority Waters Programme (LAWPRO)	WFD Cycle 2
IE_WE_34D310990	DOOYEAGHNY_or_CLOONLOUGHAN_010	IA3 Determination of Water Quality (unassigned waterbody)	Local Authority Waters Programme (LAWPRO)	WFD Cycle 2
IE_WE_34Q070710	Quigabar_010	IA3 Determination of Water Quality (unassigned waterbody)	Local Authority Waters Programme (LAWPRO)	WFD Cycle 2

WFD Cycle 2 Catchment Moy & Killala Bay Sub catchment Leaffony_SC_010 Generated on: 28 Feb 2020 Code 34_11

The EU Water Framework Directive (2000/60/EC) (WFD) establishes a framework for the protection, improvement and management of surface waters and groundwaters.

WFD Cycle 2 Catchment Moy & Killala Bay Sub catchment Leaffony_SC_010 Generated on: 28 Feb 2020 Code 34_11

The EU Water Framework Directive (2000/60/EC) (WFD) establishes a framework for the protection, improvement and management of surface waters and groundwaters.



Rainfall figures

Rainfall figures have been used to justify choosing the location for citing the hydrogen plant in the current proposed location as it is intended to use captured rainwater in conjunction with water extracted from the aquifer to produce the H_2 gas.

However, figures from 40 Km South of the proposed hydrogen plant have been used to predict rainfall in the area. It would have been more accurate to use figures from Easky-Bunowna 20Km North of the site as the data set ranges from 1994-2021.

If a regional picture is required, these datasets may be then combined with the data from Markree Castle for a more accurate regional picture, but regionality is not of importance in this instance as the rain affects, we are interested in are **very specific and local.**

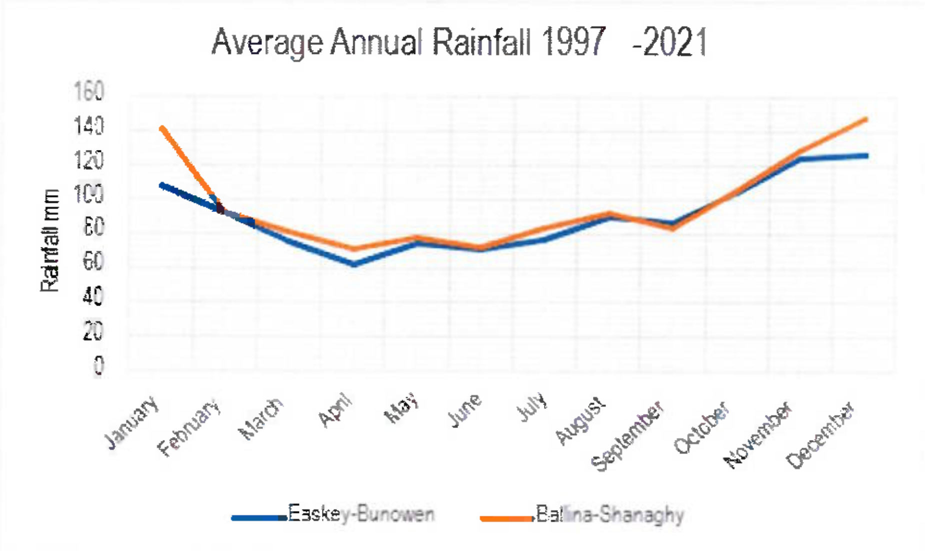
However, if this were done it would have shown that August 2022 was not indeed the driest since 1995 as is claimed in the Minerex groundwater assessment report. Markree Castle 40Km to the East of the proposed hydrogen site gives reading of 71.70mm for August 1995 whereas Easky-Bunowna records 88.32mm with the driest August being 2005 at 24.20mm. There are also five other periods between 1994-2021 when a reading of 49.0mm or below was recorded at this location.

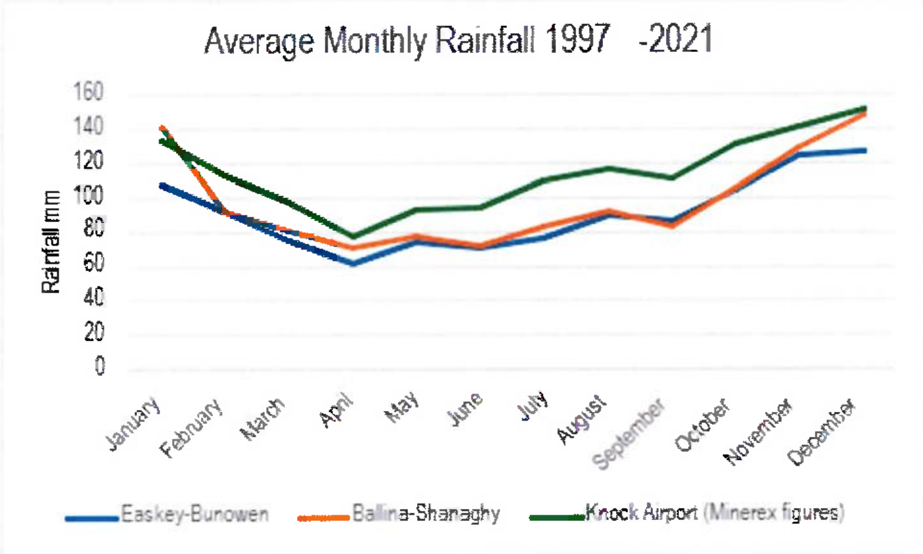
This brings into question the accuracy of the estimated rainfall catches at the proposed site itself (section 5 of Minerex groundwater supply assessment report) which is to be used as a supplement the aquifer in the production of H_2.

Local conditions appear to be drier East of the Ox Mountain range where the proposed site is located. This is a natural occurrence as water is released from clouds as it travels over the landmass and pressure increases due to elevation. Easky is at 23m above sea level, Ballina (Shanaghy) 24m while Markree Castle is 39m and Knock Airport is 94m above sea level. It is clear from precipitation figures that rain fall is higher in the latter two areas, knock, which has been used as the base figures.

Table 5.2 Summary statistics for monthly rainfall at Knock Airport (1997-2021).

	Monthly Rainfall (mm/yr)		
	Average	**Max.**	**Min.**
Jan	134	225	26
Feb	113	277	27
Mar	98	182	33
Apr	77	128	21
May	93	179	31
Jun	94	230	38
Jul	110	184	41
Aug	117	208	35
Sep	111	223	19
Oct	131	197	59
Nov	142	302	63
Dec	151	348	54





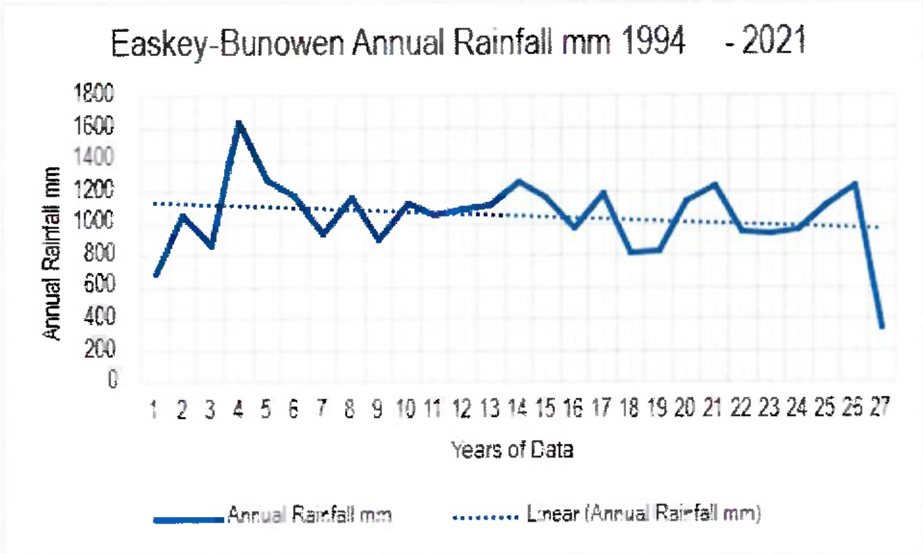
Average Monthly Rainfall mm 1997-2021	Easky	Ballina	Knock
Month	Rainfall mm		
January	108	141	134
February	92	92	113
March	75	81	98
April	62	71	77
May	74	78	93
June	71	72	94
July	76	83	110
August	90	92	117
September	86	83	111
October	104	106	131
November	125	129	142
December	127	148	151

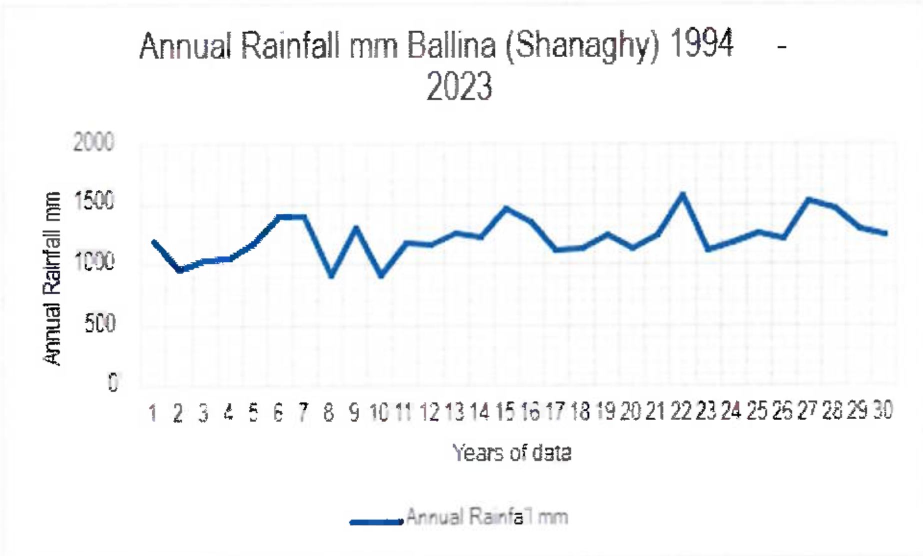
As can be seen from the graphs there is a stark difference in average monthly rainfall between the local sites of Ballina and Easky and the more regional further away Knock.

Total average monthly rainfall over the 25-year period for

- Easky 83.33mm

- Ballina 98mm
- Knock 114.25mm





Annual Rainfall mm Ballina (shanaghy)	Column1	
Year	Annual mm	Rainfall
1994	1196	
1995	956	
1996	1029	
1997	1045	
1998	1181	
1999	1407	
2000	1404	
2001	908	
2002	1301	
2003	914	
2004	1182	
2004	1169	
2006	1261	
2007	1229	
2008	1468	
2009	1346	
2010	1121	
2011	1124	
2012	1245	
2013	1136	
2014	1240	
2015	1579	
2016	1117	
2017	1185	
2018	1266	
2019	1206	

2020	1532
2021	1459
2022	1290
2023	1243
Total Ave	1224

Year	Annual Rainfall mm Easky-Bunowna
1995	677
1996	1062
1997	860
1998	1636
1999	1274
2000	1174
2001	939
2002	1162
2003	895
2004	1126
2005	1055
2006	1095
2007	1114
2008	1267
2009	1164
2010	975
2011	1192
2012	817
2013	823
2014	1142
2015	1232
2016	947
2017	933
2018	958
2019	1121
2020	1237
2021	338

Total	
Ave	1045

A recalculation of the possible available water available to produce H_2 gas via precipitation is urgently required as the figures put forward in the Minerex groundwater supply assessment report are no longer valid. Section 6 of Minerex ground water assessment.

In section 5 of the Minerex ground water assessment report, figures for knock airport are given for rainfall at the proposed site. Knock airport is 40Km South of the proposed site while, as pointed out, more accurate rainfall figures are available for closer 20Km North extending back to 1994 at Easky-Bunowna and for Ballina (Shanaghy) 7Km South of the proposed site. Figures for Markree Castle have also been used which is 40km to the East of the proposed site.

If a farmer wanted to grow crops in this area, they would look for local precipitation data not for regional data as it is of no use. A facility whose sole input is water needs to be very specific about its figures as if it runs out of water there is no gas.

The effects of needing to pump more water from the aquifer, requiring both wells, need to be addressed as due to the shortfall in rain available at the site. This will have implications for

- SP1, SP2, possible Annex 1 habitats.
- Mrs Donegan's well
- Dooyeaghny river and nursery habitat for trout and salmon further affecting the river Moy Estuary SAC and fishery tourism.
- Fox's well which showed signs of impact during pumping.
- This will inhibit any future development of family homes in the area should they wish or need to sink a well for a water supply.

(Page 2659 / 3719) Minerex groundwater assessment report

11. A strong hydrogen sulphide odour and reducing conditions were observed at BH6 and BH7 with visible limescale forming on equipment during the pumping test.

This will have an adverse effect on pumping equipment causing wear and tear on pump seals affecting performance. Strong acids may be used to clean the pump and lines which could end up in the ground water.

This will also push up the cost of production as equipment will need to be serviced more regularly and the ion exchange resin replenished more frequently in the water filtration system.

12. Reductions in flow at local springs (SP1 and SP2) were noted. However, further investigation would be required to ascertain whether this is due to pumping or low rainfall levels.

This should have been ascertained at the time of testing and assessing as any drop in water levels will have negative consequences for salmonoid and trout spawning as per the IFI letter to ABP as these springs are directly connected to the Dooeaghny river and further to the Moy SAC.

6. A reduction in zone of contribution (ZOC) for the boreholes as a result of rainwater harvesting means that the volume of water being abstracted from the system is not greater than the volume of water recharging the aquifer over the landowner property area.

These figures are no longer valid as they are based on rainfall datasets which are not local to the area presenting a false picture of precipitation. A micro-climate exists as this area is close to the sea and at a lower altitude resulting in lower rainfall as can be seen from the historic datasets. This brings into question the feasibility of locating the hydrogen plant in this location as the water required will not be in compliance with sustainable water use as per the water framework directive and with the needs of the local population and sustainable development of the area.

8. Continuous and manual water level measurements taken at a borehole (FW1) supplying a neighbouring dairy farm for the duration of the pumping test and recovery period are consistent with the pumping having little discernible impact on the well.

These measurements are no longer valid as daily meter readings were taken by a local man who is an unqualified person by ISO standards cited to carry out this test.

9. A monitor and mitigate approach is recommended for proximal sensitive receptors (e.g., springs and other abstraction boreholes) to ensure that any potential impacts are minimized.

No ecological or specific hydrological report available for Sp1 or Sp2.

No data is available for possible impacts of high extraction levels from BH6 & Bh7 on Mrs Donegan's well and no reliable figures are available for the impacts on FW1 Fox's well.

1.5 System Description

Firlough Windfarm Hydrogen Plant Hazard Log Report Black and Veatch

1.5.1.2 Water Source Two onsite boreholes and rainwater harvesting will provide a source of electrolyte feed water and cooling water. Raw water will be routed to a water purification plant; cooling water will only be required during top up of systems and will be mixed with glycol to provide a coolant solution capable of handling the generated heat and environmental temperature variations.

Assumption is to be made here that it is Ethylene glycol that is being discussed. Also known as anti-freeze this is a mildly toxic substance to humans. It has the capacity to retard plant growth and cause fish kills.

Lye (KOH) (Potassium Hydroxide) used in the electrolysis process to create an alkaline solution has the potential to cause shock to aquatic systems if released. While is a short-term effect it should be noted that if this were to occur the effect would be longer term on salmonoid, Trout and Brown Trout spawning beds in the protected streams hydrologically connected to the site.

1.3 General Aims and Principals of the Peat and Spoil Management Plan

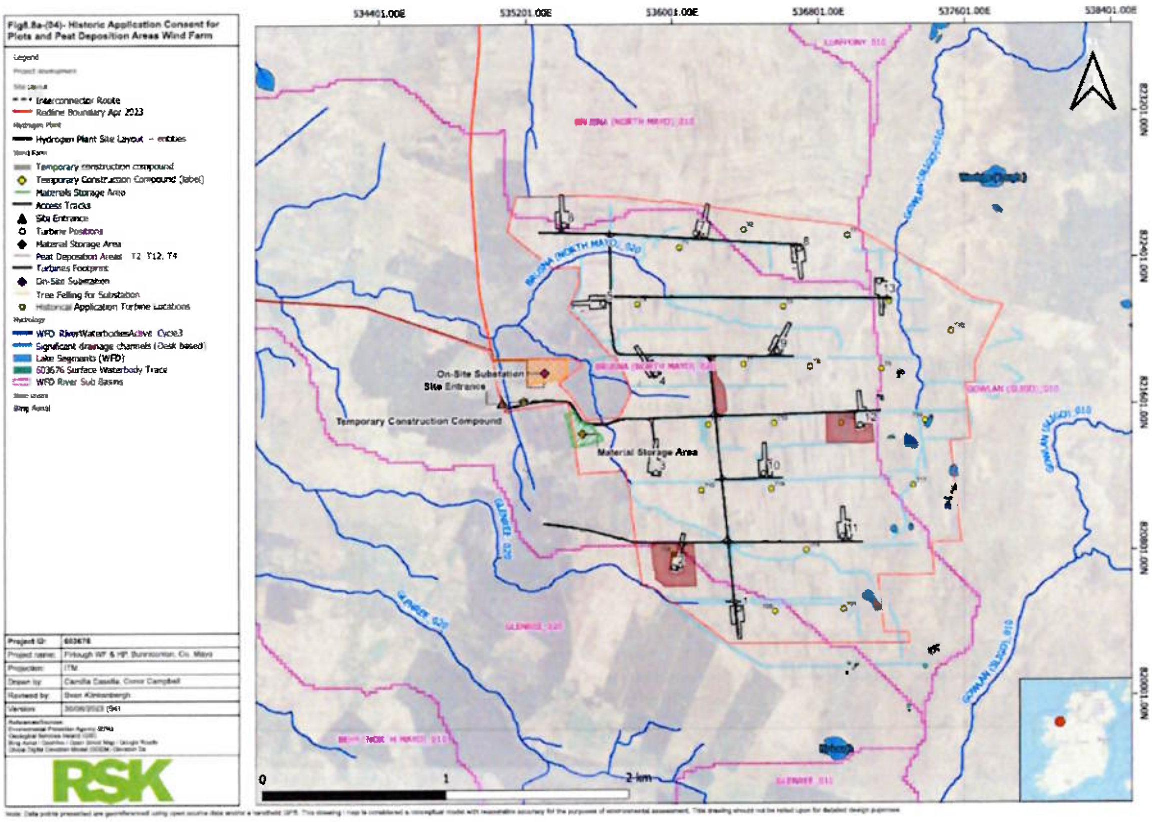
Excavated material is used in several ways:

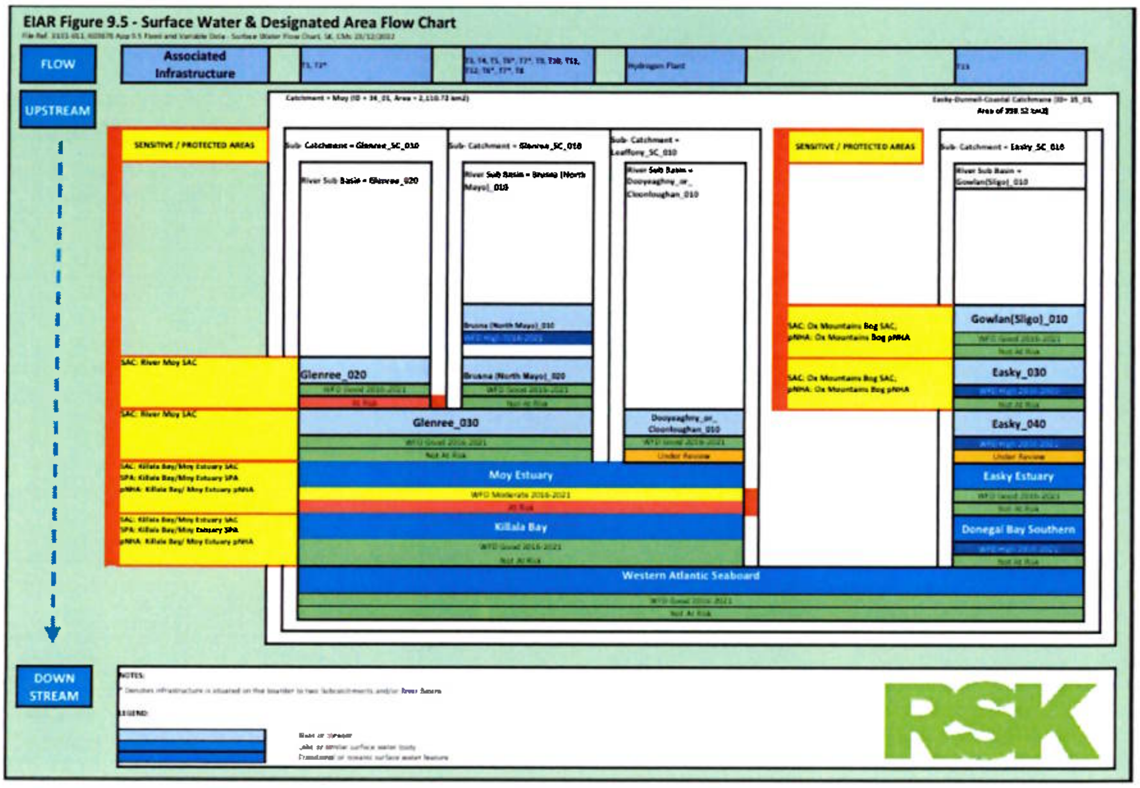
- Excavated sub-soil material will be used as fill material where suitable (e.g., back filling around and on top of Turbine Foundations) with any other sub-soil material to form berms around the turbine foundations.
- Excavated topsoil will be used to vegetate around the hydrogen plant infrastructure.
- All surplus peat material will be deposited in designated peat storage deposition areas.

Peat should not be moved from the proposed wind-farm site to the proposed hydrogen plant site as peat is not a suitable topsoil for planting sue to its lack of nutrient content, high acidity levels, lack of ability to retain water when exposed and in dry condition due to its composition, lacking in humus. As it dries out it can blow into the Dooyeahny river raising pH levels and creating suspended solids in the water column effecting fish stocks.

Landowners' permission to use turf plots for soil storage.

Some of the areas where the peat storage units are on the proposed wind farm site are locally owned turf plots and Mercury Renewables may not have permission to store the extracted peat on these active plots. The plots in question are at turbines T12 & T13. Turf plot owners were surprised to know their plots constituted part of this development.





Above is Mercury's own document demonstrating a clear flow path and impact risks to protected hydrogeological bodies downstream from both proposed sites.

Over extraction of water from BH6 & BH7 due to lower than calculated rainfall figures will not only affect a domestic well in the area not unidentified during the study but the identification of the drop in feed by 50-90% to springs SP1 & SP2 and the lack of awareness of the implications of this to the rivers they feed and to planed salmonid spawning beds and Trout in the vicinity of the hydrogen plant by IFI are concerning. As mentioned, no ecology work was carried out in these wells which may contain Annex 1 species.

Spawning salmonid, Trout and Brown Trout and the Annex 1 Protected Fresh Water Muscle by denuding and disturbance by peat creating silting from the proposed wind farm site and along the connector route.

COMAH Regulations 2015

Production system

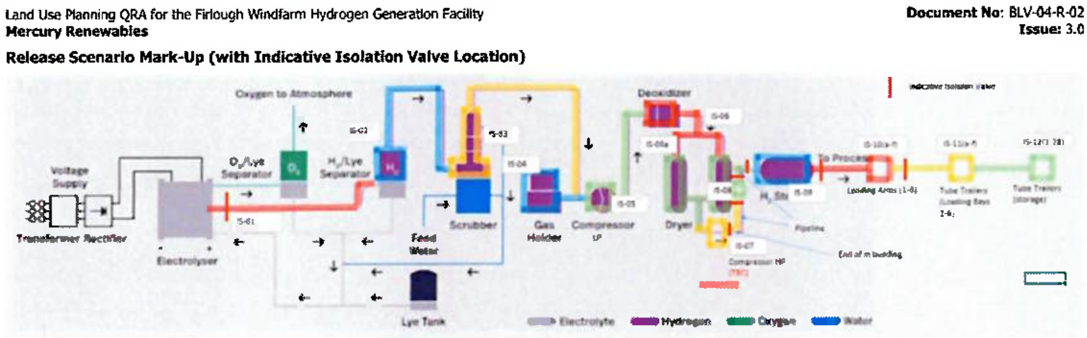
Mercury have not supplied ABP with the specifics of the equipment i.e. electrolysers to be used in the production process also the amount piping & diameter of all piping. Pipe diameter according to safety report Appendix C page C3 of C4 will be 10mm we are not given mm of hosepipes. Total amount of piping and hosepipes is not given.

This is of significant importance in relation to Health & Safety issues during production as a figure of 40 metric tonnes has been given as the maximum amount of H_2 gas that will be held on site at any one time. There is however some confusion and inaccuracies over this figure through the documentation.

However, and most importantly the figure of 40 metric tonnes does not include any H_2 gas that will be in the production equipment during operational phase (to include all machinery, piping leading to and from production equipment as well as to all storage vessels and distribution areas).

There is a possibility that this figure could amount to another 1000kg bringing this proposed facility into the tier 1 COMAH sphere.

This also has further implications for the safety of dwellings in the immediate area of the Proposed plant as the zone of



This is the only schematic available that demonstrates to any degree the amount of pipework involved in the plant that will contain H_2 gas during production. It does not though show 16 electrolysers and the pipework required to connect same to the system.

Confusion over amounts of Hydrogen to be stored at the site.

Firlough Windfarm Hydrogen Plant Hazard Log Report
Black and Veatch

Document No: BLV-03-R-03
Issue: 2.0

Aspect	Detail
Size of footprint	< 6.5 hectares
Annual quantity of raw water required	65021 m^3/year
Quality of water required	The electrolyser manufacturer has defined approx. requirements of a conductivity level of < 5 micro Siemens/cm and a resistivity level of > 10MΩ/cm.
Annual H_2 Production	4567 Tonnes
Max daily H_2 Production	31.2 Tonnes
Onsite hydrogen storage (Buffer Tank Capacity + Total Tube Trailer Capacity)*	Buffer Tank Capacity (0.528 Tonnes) + Total Tube Trailer Capacity, incl. filling stations (39.6 Tonnes) = 40.1 Tonnes
Transportation from site, i.e. number of vehicles per day	26 x 12m tube trailers
Working pressure	500Bar

1.3 SUMMARY OF THE PROJECT DESCRIPTION

The physical infrastructure of the entire Hydrogen Plant, (i.e. buildings, roads, water treatment, cooling and fuelling, etc) will be built during a single construction phase with the modular electrolyser system installed in 5 MW batches. In terms of the split of electricity going to the grid and the Hydrogen Plant, the smallest initial batch of electrolyser capacity will be 10 MW (using 12-15% of electricity produced at the Wind Farm) and will produce a maximum of 4,000 kg of green hydrogen per day leaving 55 to 68 MW (84-87% and based on a turbine range of between 5 and 6 MW) of installed capacity of the Wind Farm dispatching to the electricity grid. This will be phased up to an 80 MW electrolyser producing a maximum of 31,200 kg of green hydrogen per day and consuming the whole output of the Wind Farm. The green hydrogen will be transported in tube trailers, at the lowest installed capacity the maximum number of tube trailers daily will be 11, at the maximum capacity this will be 26 (see section 2.6.6.12).
(6129 Firlough Wind Farm & Hydrogen Plant EIAR 8 June 2023)

16.3.2.3 Industrial Accident

The European Union's Seveso-III (Directive 2012/18/EU) outlines rules and regulations aimed at preventing the occurrence of major accidents involving dangerous substances. This is implemented in Ireland through the Chemicals Act (Control of Major Accident Hazards involving Dangerous Substances) Regulations, 2015 (the "COMAH Regulations") which outlines various requirements covering the notification of on-site storage of dangerous substances and the Proposed Development of safety policies, reports and emergency plans. There are two tiers of establishment, which are related to the quantities of dangerous substances present. Depending on quantity, an establishment may be upper tier or lower-tier. Upper-tier establishments have greater quantities of dangerous substances present and therefore are obliged to comply with additional requirements specified in the Regulations. Hydrogen is outlined as having a lower-tier requirement of 5 tonnes and an upper tier value of 50 tonnes. The Hydrogen Plant is expected to be designated a lower-tier COMAH site due to the provision of 26 tube trailer bays onsite, which based on current tube trailer technology could store a total of 31.2 tonnes of hydrogen at any one point in time. Maximum onsite capacity to store hydrogen is 40.128 tonnes, with 26 filled tube trailers occupying the tube trailer bays, plus 7 filled tube trailers at each of the filling stations plus buffer tank capacity of 528 kg. The upper-tier threshold is 50 tonnes.

(6129 Firlough Wind Farm & Hydrogen Plant EIAR 34 June 2023)

4.2.2

Page 64 EIR

'The Hydrogen Plant electrolyser will be built in phases to match the growth of demand for hydrogen in Ireland. Initially a 10 MW electrolyser will be installed, with a maximum daily hydrogen production of 4,000 kg of Hydrogen. Tube trailers currently in operation in the U.K. can hold 384 kg of hydrogen at 380 bar, this gives a maximum daily number of hydrogen trailers, filled with hydrogen, leaving the Hydrogen Plant Site of 11 during this initial phase.

The H_2 on site will be pressurized to 500bar so the use of these tube trailers is invalid as decompression would add further cost to the process.

The capacity of the hydrogen tube trailers currently offered by vendors but are not common in the UK and Irish market at the time of writing is 1,200 kg of hydrogen at 380 bar pressure.

It is a working assumption that as the hydrogen market develops, the tube trailer market will also evolve. This results in a maximum predicted number of tube trailers filled with hydrogen leaving the Hydrogen Plant Site per day of 26 when the full capacity of 80 MW is installed.'

The above tube trailer size of 1'200kg is the size that will be used and has resulted in the storage figure of 31'200kg being given. The hazard log report gives a combined figure of 39.6 Tonnes for trailer tube capacity and filling stations.

39.6 – 31.2 = 8.4 Tonnes of residual H_2 gas in the filling stations.

This begs the question, how much residual H_2 remains in the rest of the production system?

The facility only requires another 1.6 Tonnes to reach the Tier 1 COMAH limit.

We have also not factored in any damaged tube trailers which may be partially filled and be resting at the site.

We have also not included, as we must, the hydrocarbon fuel in the HGV's and cars on the site as per schedule 1 part 3 of COMAH. See below.

EIAR 15.5.14

'There will be a maximum of 26 tube trailers filled with gaseous hydrogen and then transported away from the plant everyday (see Section 15.7.2).

Therefore, at any given point in time there may be up to 26 tube trailers waiting to be removed from the site. This leaves scope for human error or oversight on the volume of gas accumulating. The shutdown of production to keep the proposed plant below the COMAH threshold of 50 tonnes is a manual action not an automated process.

It would take a delay for any vails reason, puncture, mechanical failure or illness of a driver to send this facility quickly over the edge because as it has been pointed out we do not know how much H_2 gas is held within the production system on top of what is stored.

What is also not accounted for is the hydrocarbon fuel (diesel) in the 26 HGV's and 10 light vehicles on sight which comes under schedule part 2 No 34 of the regulations.

An HGV will at least have a half full tank when it arrives on site. This would equate to 250lt per HGV. An average SUV tank holds 45-50lt.

26 *250 = 6'600lt (6.6 Tonnes) 10*25=250lt (0.25 Tonne) 6.6+0.25= 6.85 Tonnes maximum hydrocarbon load at proposed hydrogen site.

In schedule 1 part three of the COMAH directive we must use two equations to determine if a facility is Tier 1 or 2 based on the accumulation of scheduled 1 & 2 materials.

Based on the current figures above and being aware that we are missing H_2 contained within production units and pipping the equation for a Tier 1 site is only out by 0.19.

40.1/50 + 6.85/250000 =

0.802 + 0.000274= .8023 a score of =/> 1 is a Teir 1 site

This would then require a different set of safety parameters as the risk increases and may deem this site unsuitable as it is too near residential dwellings.

Estimation of possible amount of hydrogen gas in electrolyser system at 1 hr of production

As no data was given a scientific search was carried out for technical data on alkaline electrolysis electrolysers.

Table 2. Comparison of the available water electrolyzer technologies.

Specification	Alkaline [48, 60]	PEM [48, 60]	SOEC [7]	AEM [8,9]
Technology maturity	Mature	Commercial	R&D	R&D
Cell temperature, °C	65–100	70–90	900–1000	50–70
Cell pressure, bar	25–30	30–80	<30	~30
Current density, mA/cm²	200–500	800–2500	300–1000	200–500
Cell voltage, V	1.8–2.4	1.8–2.2	0.95–1.3	1.8–2.2
Voltage efficiency, %	50–70.8	48.5–65.5	81–86	39.7
Specific system energy consumption, kWh/Nm³	4.5–7.5	5.8–7.5	2.5–3.5	4.8–5.2
Hydrogen production, Nm³/hr	<760	0.265–30	–	0.25–1
Stack lifetime, hr	10,000	<20,000	<40,000	NA
Electrolyte	20–30% KOH	Perfluorosulfonated	Yttria-	DVB polymer ... or NaHCO₃
Separator	Asbestos, NiO, ZrO₂-stabilized with PPS mesh	PFSA (e.g., Nafion)	Solid electrolyte	quaternary ammonia polysulfone (QAPS)
Charge carrier	OH⁻	H⁺	O₂⁻	OH⁻
OER catalyst	Ni-coated perforated stainless steel	Ir/Ru oxide	Perovskite-type	Co₃O₄
HER catalyst	Ni	Platinum	Ni/YSZ	Ni
Hydrogen purity, (vol%)	99.3–99.9	99.999	–	99.99
Capital cost (€/kW_el)	1000–1200	1860–2320	>2000	NA

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Abbreviations.

OER: oxygen evolution reaction.

HER: hydrogen evolution reaction.

NA: not available.

(Hydrogen production by water electrolysis technologies: A review - ScienceDirect)

The proposed hydrogen plant will have 16 electrolysers at 80MW. These calculations are for 80kw based on 5kw electrolyser as in example above as there are 16 units. Therefore, in principle each industrial unit will be 50kw.

1kilowatt = 1000 watts
1Megawatt = 1000 kilowatts

H_2 production capacity: <760 Nm³/h

760*16=12'160m³ H_2 gas present in the electrolyser system at any one hour.

Density of H_2 is required to convert it to Tonnes.

As Density is a function of both temperature (T) and pressure (p) it will increase across the production system as the gas moves from the electrolysers and is cooled by the fin fans and compressed to 500bar.

At the electrolysers it will be at its hottest and lightest point. We must choose a point at which to calculate the amount of H_2 gas in the system and as I do not have the pipe lengths and diameters connecting the system components, I will use the point at which the gas will be at its least dense point.
This will result in la lower weight figure.

Assuming:
Pressure = 1 bar
Temperature = 99^{oc}
Density of H_2 gas = 0.0651kg/m^3

Pressure in electrolyser system = 30bar

0.0651*30= 1.95 Kg/m^3

Density of H_2 gas in system = 1.95 Kg/m^3

Conversion:
Liters*Density*0.001= Tonnes

760m^3= 760000 Produced per hour by 5Kw electrolyser.

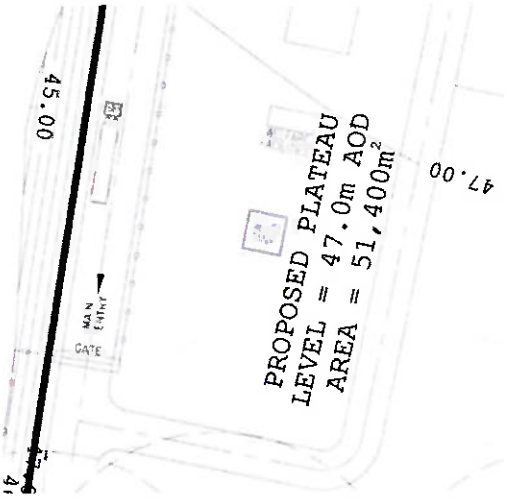
760000*1.95*0.001= 1'482

1'482 Tonnes H_2 gas in electrolyser system at 30 bar 99^{oc} alone not including pipe work.

This must be added to the hazard analysis for the calculation of Teir status and LUP.

It is negligent to allow this application to proceed on the basis of the figures they have submitted as it poses a serious health and safety risk to local residents.

Diesel tank on site not identified in hazard risk report.
Volume needs to be identified and included in the above calculations as per COMAH directive.



PART 3

Notes to Parts 1 and 2

1. Substances and mixtures are classified in accordance with the CLP Regulation.

2. Mixtures must be treated in the same way as pure substances provided they remain within concentration limits set according to their properties under the CLP Regulation, unless a percentage composition or other description is specifically given.

3. The qualifying quantities set out in Parts 1 and 2 of this Schedule relate to each establishment.

The quantities to be considered for the application of these Regulations are the maximum quantities which are present or are likely to be present at any one time. Dangerous substances present at an establishment only in quantities equal to or less than 2% of the relevant qualifying quantity must be ignored for the purposes of calculating the total quantity present if their location within an establishment is such that it cannot act as an initiator of a major accident elsewhere at that establishment.

4. The following rules governing the addition of dangerous substances, or categories of dangerous substances, apply where appropriate.

In the case of an establishment where no individual dangerous substance is present in a quantity above or equal to the relevant qualifying quantity, the following rule must be applied to determine whether these Regulations apply to the establishment.

An establishment is an upper tier establishment if the sum:

$q_1/Q_{U1} + q_2/Q_{U2} + q_3/Q_{U3} + q_4/Q_{U4} + q_5/Q_{U5} + \ldots$ is greater than or equal to 1,

where q_x = the quantity of dangerous substance x (or category of dangerous substances) falling within Part 1 or Part 2 of this Schedule,

and Q_{UX} = the relevant qualifying quantity of dangerous substance or category x from Column 3 of Part 1 or from Column 3 of Part 2 of this Schedule.

An establishment is a lower tier establishment if the sum:

$q_1/Q_{L1} + q_2/Q_{L2} + q_3/Q_{L3} + q_4/Q_{L4} + q_5/Q_{L5} + \ldots$ is greater than or equal to 1,

where q_x = the quantity of dangerous substance x (or category of dangerous substances) falling within Part 1 or Part 2 of this Schedule,

and Q_{LX} = the relevant qualifying quantity for dangerous substance or category x from Column 2 of Part 1 or from Column 2 of Part 2 of this Schedule.

This rule must be used to assess the health hazards, physical hazards and environmental hazards. It must therefore be applied three times—

(a) for the addition of dangerous substances listed in Part 2 that fall within acute toxicity category 1, 2 or 3 (inhalation route) or STOT SE category 1, together with dangerous substances falling within section H, entries H1 to H3 of Part 1;

(b) for the addition of dangerous substances listed in Part 2 that are explosives, flammable gases, flammable aerosols, oxidising gases, flammable liquids, self-reactive substances and mixtures, organic peroxides, pyrophoric liquids and solids, oxidising liquids and solids, together with dangerous substances falling within section P, entries P1 to P8 of Part 1;

(c) for the addition of dangerous substances listed in Part 2 that fall within hazardous to the aquatic environment acute category 1, chronic category 1 or chronic category 2, together with dangerous substances falling within section E, entries E1 and E2 of Part 1.

These Regulations apply where any of the sums obtained by (a), (b) or (c) is greater than or equal to 1.

As per article 7.4 (a) the operator shall inform the competent authority in advance of any significant increase or decrease in the nature or physical forms of any dangerous substance or substances present as pursuant to paragraph one of the COMAH directive.

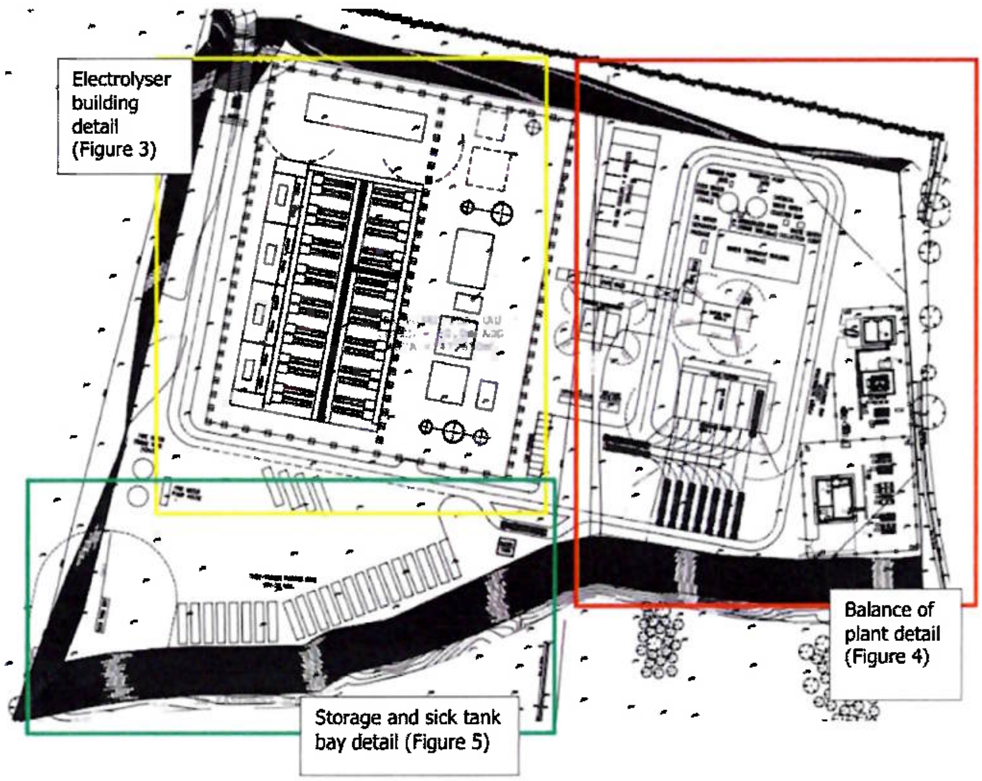
1.5 System Description

Firlough Windfarm Hydrogen Plant Hazard Log Report Black and Veatch

1.5.1.4 Electrolyser The electrolyser uses electrical energy to convert the water-based electrolyte to hydrogen and oxygen. The current design conservatively assumes an Alkaline Electrolyser as it has the largest footprint and is more commercially mature. The low-pressure hydrogen produced will be routed to the multistage compressor for compression to suitable pressure for storage or distribution. The produced oxygen will be vented to atmosphere via the oxygen vent. The block diagram in Figure 1Figure 1 shows a single electrolyser, but an option exists, as presented in Figure 6, for 16 electrolysers in total. For the purpose of the preliminary hazard analysis (PHA), a single electrolyser 'stage' has been considered.

1.7 Layout

Figure 2 Hydrogen Plant Plan*



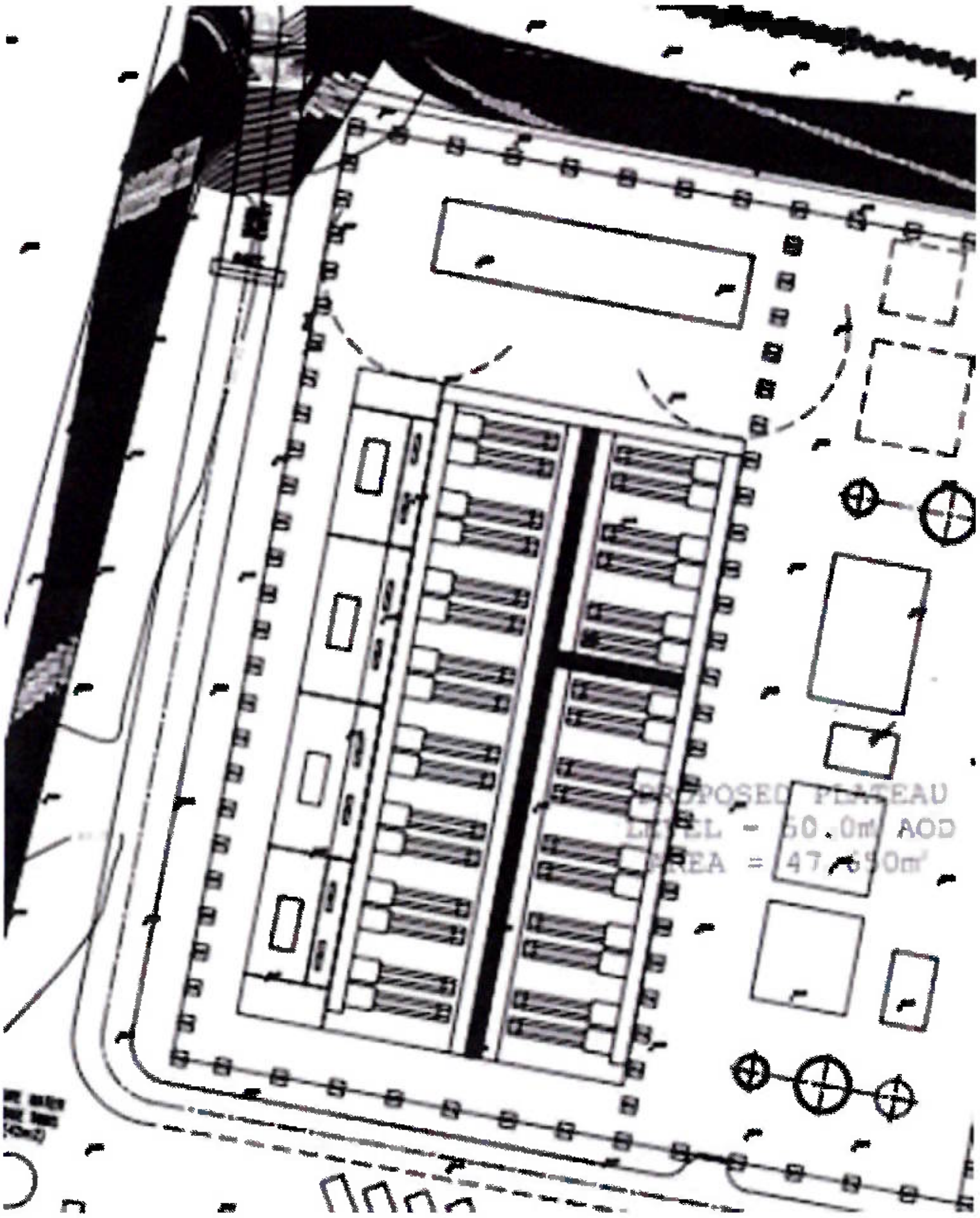
*Note the original analysis was carried out on an earlier version of the plant layout, however the layout shown here is similar and so the findings in this report remain valid.

2.3 Layout

A plot plan of the Hydrogen Plant is shown in Figure 2-3, with key hydrogen processing and storage locations marked.

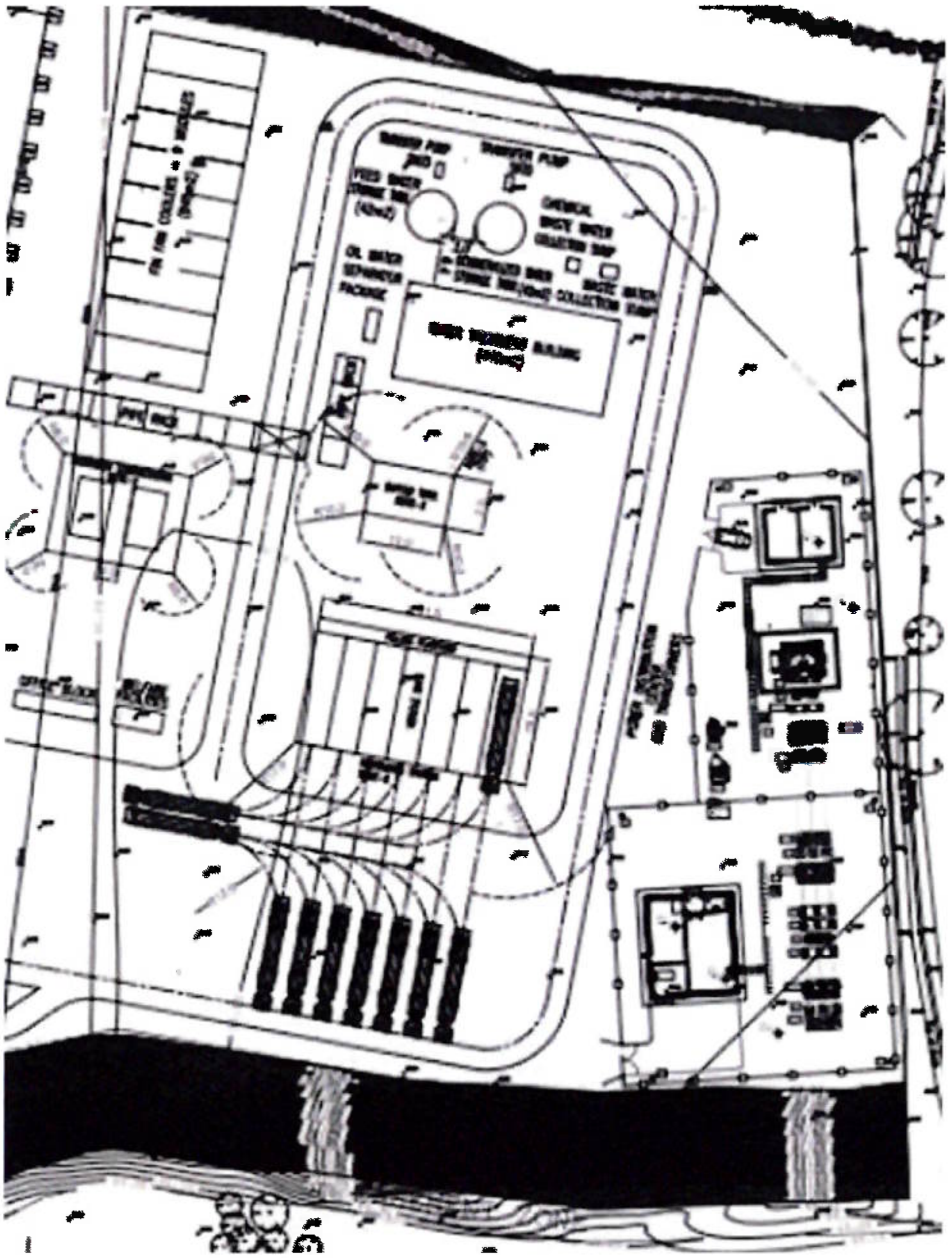
Figure 2-3: Plot Plan Showing Hydrogen Processing and Storage Areas

Figure 3 Electrolyser Building Detail



No pipework shown in diagram between electrolysers or to storage area for H_2 gas. Compression of H_2 gas to 500bar is a stepwise process requiring more pipework.

Figure 4 Balance of Plant Detail



Only pipework to HGV's shown here

15.7.2 Operational Phase

The Hydrogen Plant will have a total of 26 HGV and 10 light vehicles entering and leaving the Hydrogen Plant Site on a daily basis.

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Black and Veatch

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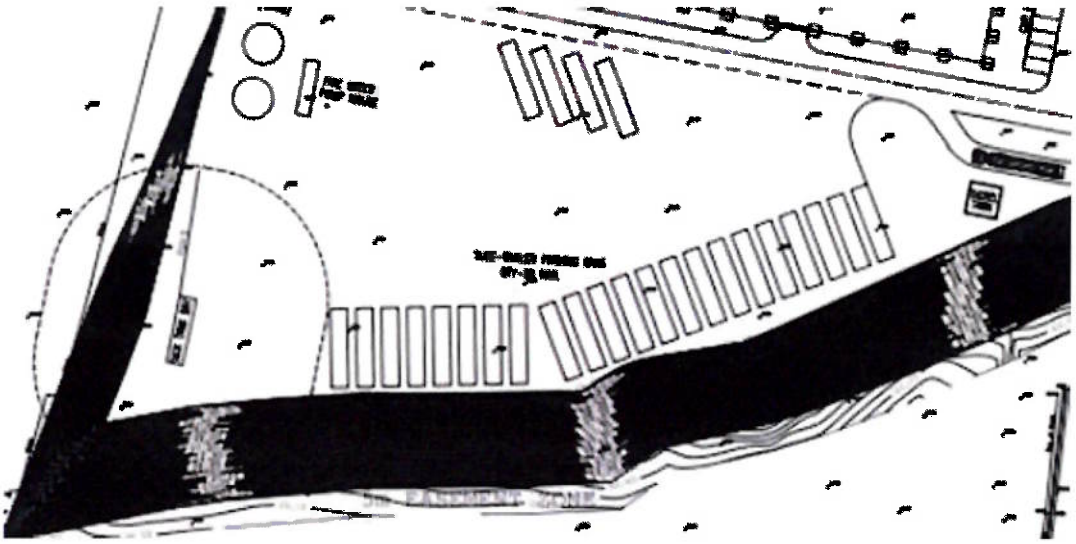
Issue: 2.0

Figure 5 Storage and sick tank bay detail



Resting and/or damaged filled/part filled tube trailers can rest here before retrieval.

1.5 System Description

Firlough Windfarm Hydrogen Plant Hazard Log Report Black and Veatch

1.5.1.4 Electrolyser The electrolyser uses electrical energy to convert the water-based electrolyte to hydrogen and oxygen. The current design conservatively assumes an Alkaline Electrolyser as it has the largest footprint and is more commercially mature. The low-pressure hydrogen produced will be routed to the multistage compressor for compression to suitable pressure for storage or distribution. The produced oxygen will be vented to atmosphere via the oxygen vent. The block diagram in Figure 1Figure 1 shows a single electrolyser, but an option exists, as presented in Figure 6, for 16 electrolysers in total. For the purpose of the preliminary hazard analysis (PHA), a single electrolyser 'stage' has been considered.

The proposed plant will be eventually brought up to capacity of 80MW. All calculations need to assume the plant is operational at full capacity.

2

1.5.1.7 Compressor The compressor receives hydrogen from the electrolyser and compresses it to a pressure of up to 500bar for storage and distribution. The type of compressor is yet to be confirmed. The high-pressure hydrogen will be routed from the output of the compressor to an intermediate "buffer" vessel for short term storage.

Calculations on amount of H_2 in system and not be made due to this information not being made available.

1.5.1.9 Dispensing Multiple Road vehicle dispensing units have been included in the current design. The dispensing units consist of a number of gas control devices, a gas receiver and hose work to dispense hydrogen to road approved tube trailers. Specific details of the dispensing system are not yet available but are expected to follow standard good practice for road tanker loading bays.

1'200kg tube trailers have been cited for usage.

1.5.1.10 Tube Trailer Storage Compressed hydrogen is stored onsite and distributed offsite via road tube trailers. Maximum onsite storage is currently 26 x 12m tube trailers, plus potential for one full trailer in each of the 7 filling bays, providing a total storage capacity of 39,600kg + 528kg buffer for a total of 40,128kg.

This figure is incorrect as the tube trailers hols 1'200kg*26= 31'200kg

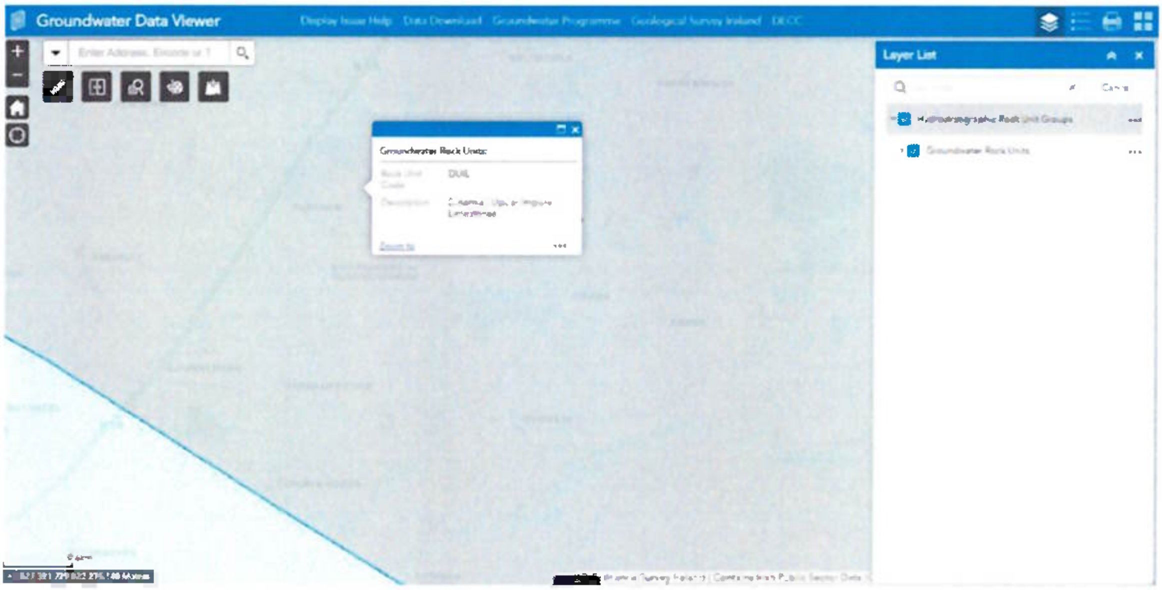
The residual 8'400kg is H_2 stored in the dispensing/loading system as per the hazard log figures.

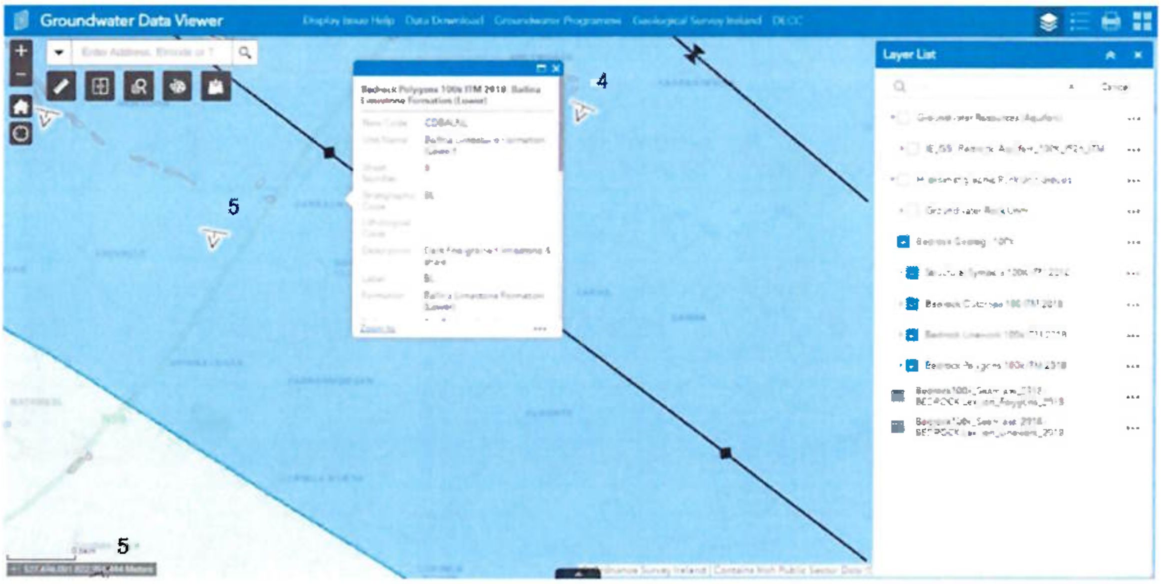
However, it is planned that tube trailers will only be onsite for short periods of time following loading before being dispatched to client facilities. In order to remain within the threshold for consideration as a 'Lower Tier' COMAH site, Mercury shall calculate the total onsite quantity of H2 at any given time. Furthermore, Mercury shall limit the total onsite quantity of H2 to be beneath the lower tier COMAH threshold for H2.

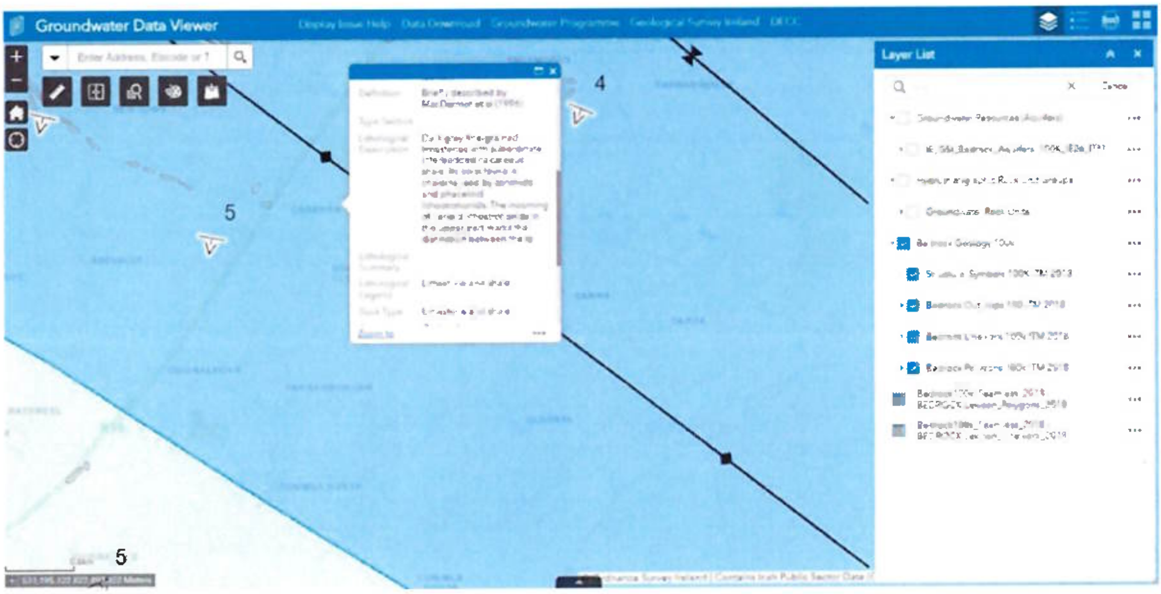
Áine McCann.

24/05/2024.

Appendix A



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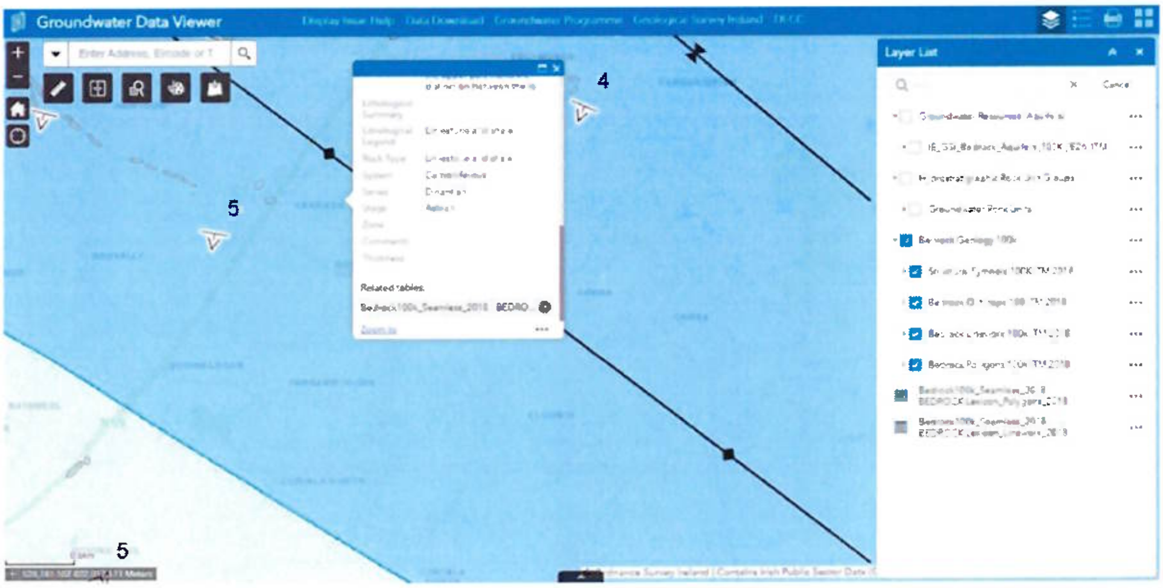
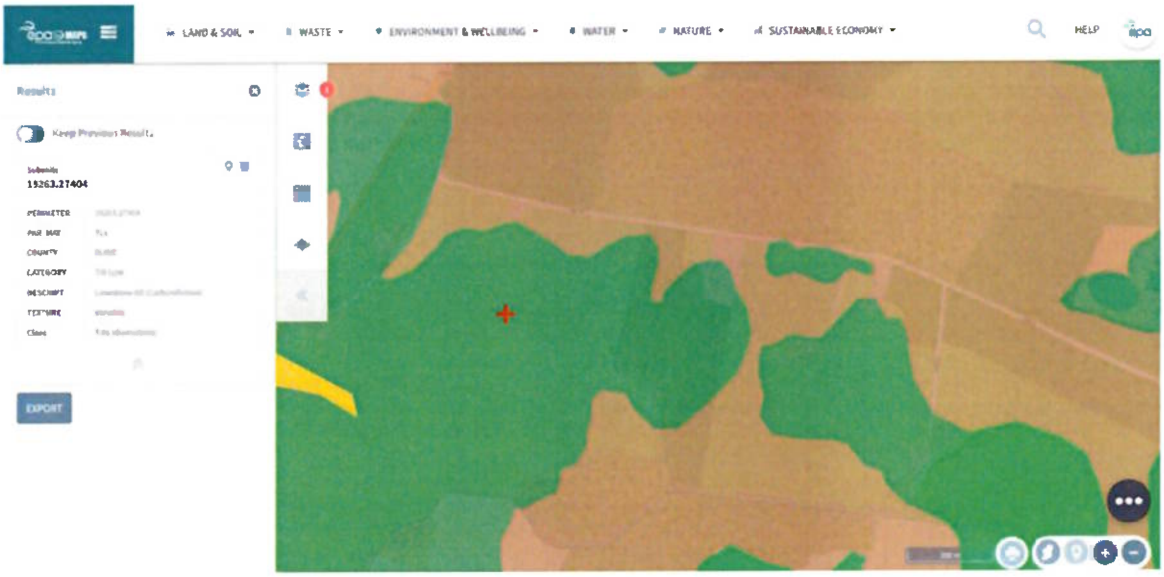
4
5
5

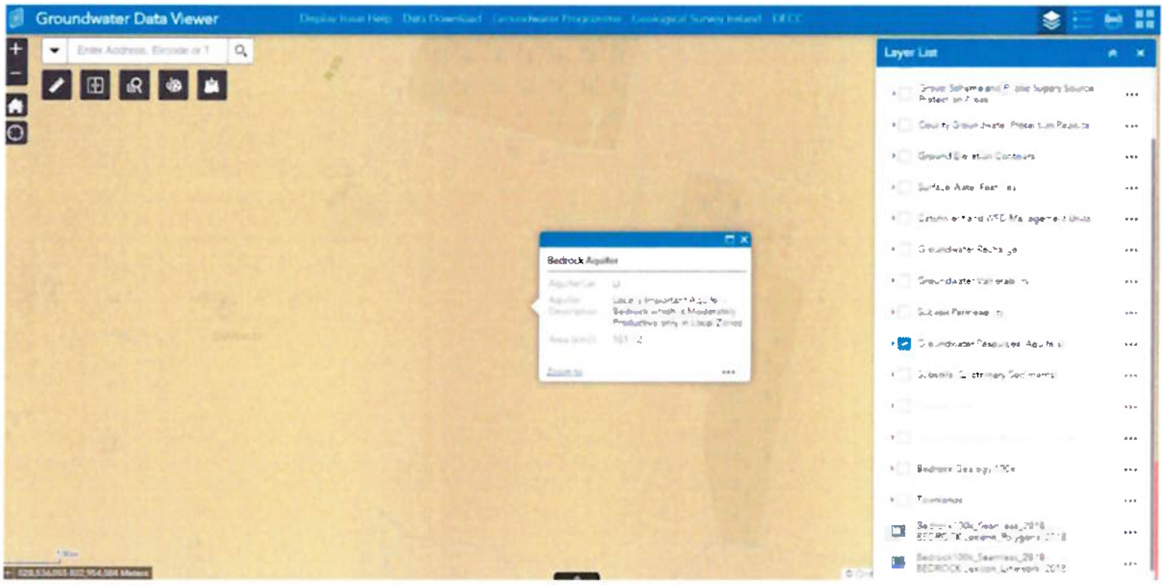

Groundwater Data Viewer
Layer List
4
5
5
Related tables

Appendix B


LAND & SOIL
WASTE
ENVIRONMENT & WELLBEING
WATER
NATURE
SUSTAINABLE ECONOMY
HELP
Results
19263.27404
EXPORT

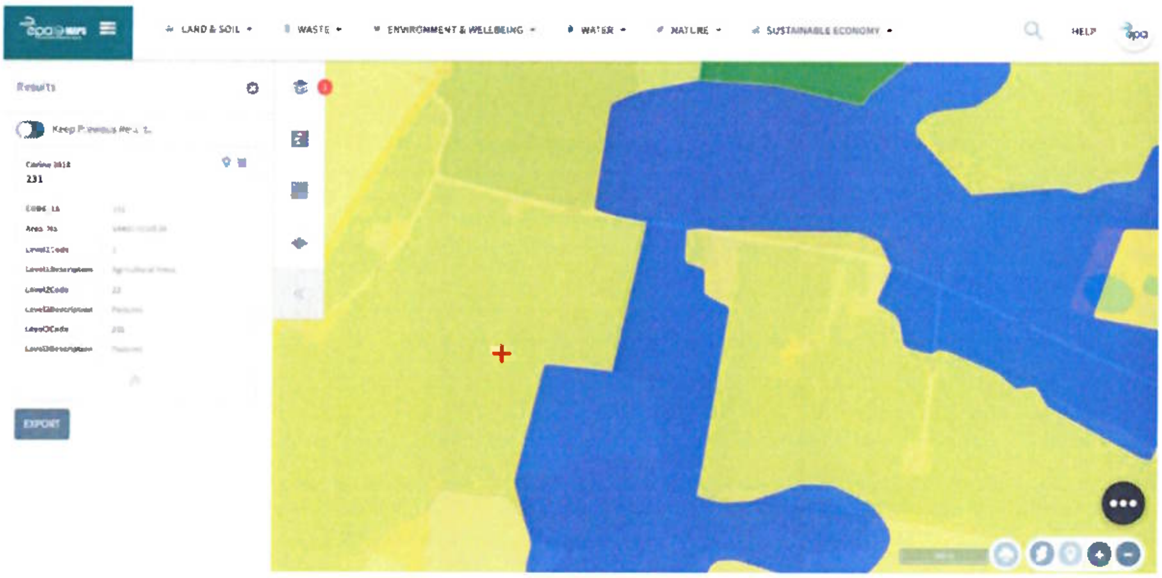

LAND & SOIL
WASTE
ENVIRONMENT & WELLBEING
WATER
NATURE
SUSTAINABLE ECONOMY
HELP
Results
EXPORT


Groundwater Data Viewer
Bedrock Aquifer
Layer List


Groundwater Data Viewer
Layer List
Bedrock Aquifer


Cranfield
Soil association.
Peat
Soil association composition:


Adjust transparency
Cranfield
COUNTY SLIGO
COUNTY MAYO
Soil association.
Coarse loamy drift with limestones
Soil association composition:
1. Mullabane (1100MB)
Modern definition: Coarse loamy drift with limestones
Texture: Coarse loamy
Substrate type: drift with limestones
Substrate 1: drift
Substrate 2: limestones
2. Burren (0360BU)
Modern definition: Fine loamy over limestone bedrock
Texture: Fine loamy
Substrate type: over limestone bedrock
Substrate 1: bedrock
Substrate 2: limestone
3. Crush (0360CS)
Modern definition: Coarse loamy over calcareous gravels
Texture: Coarse loamy
Substrate type: over calcareous gravels
Substrate 1: bedrock
Substrate 2: calcareous gravels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ENVIRONMENT & WELLBEING
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SUSTAINABLE ECONOMY
HELP
Results
231
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LAND & SOIL
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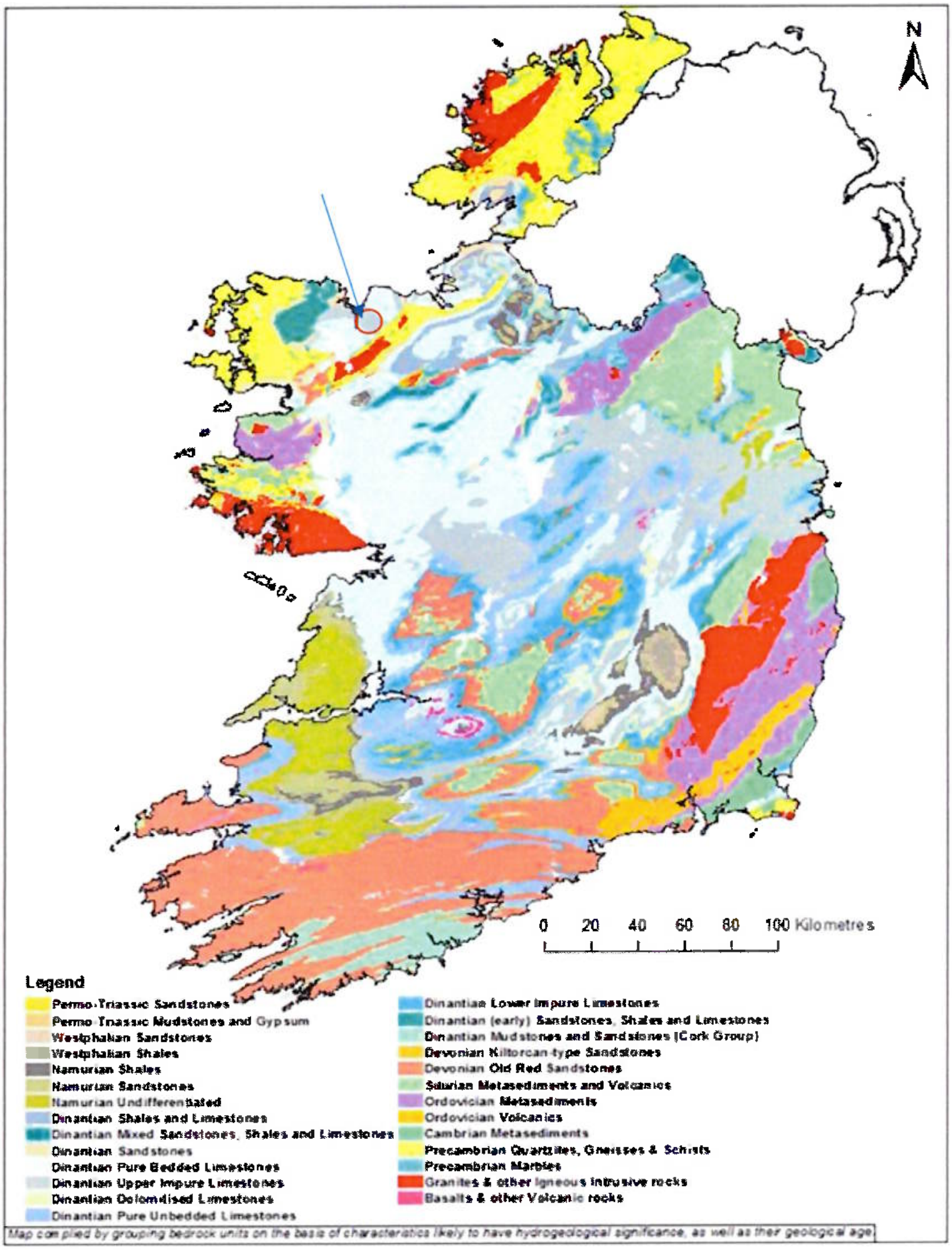
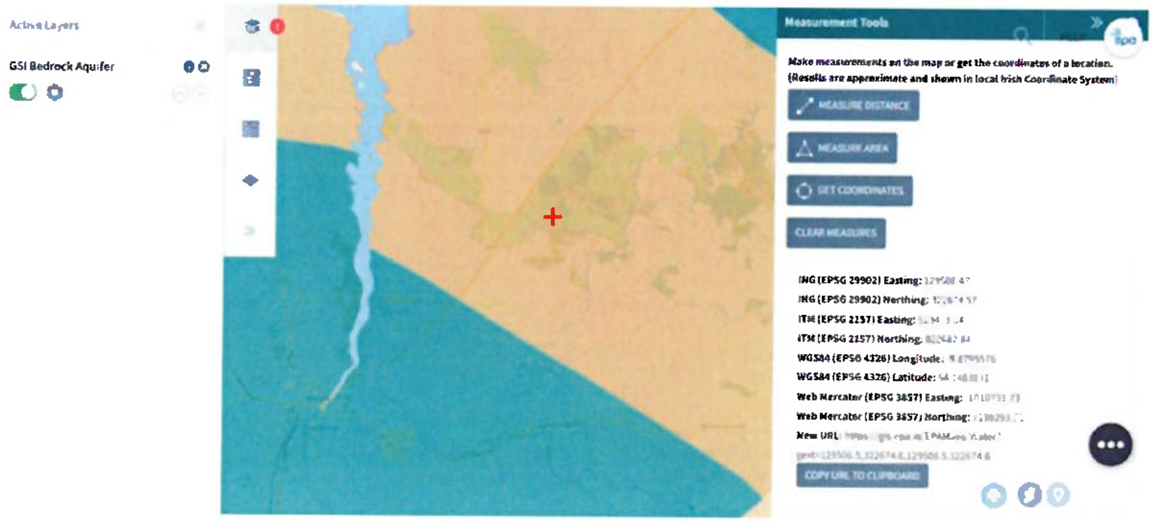
HELP
Results
EXPORT

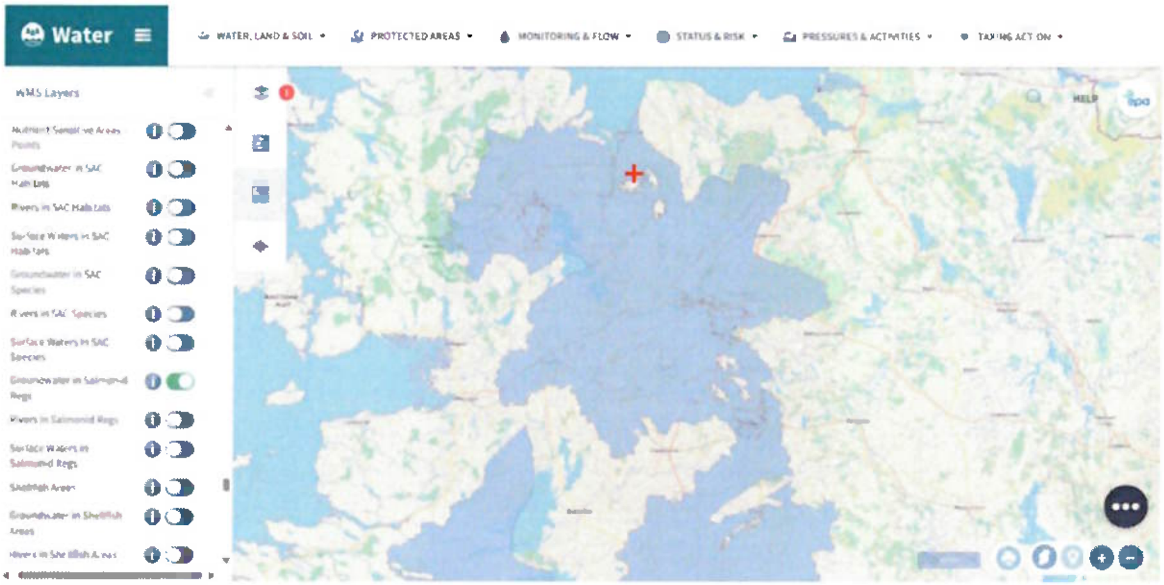


Map from Geological Survey of Ireland (GSI) showing bedrock units of hydrological significance in Ireland. Note arrow and circle marking area of aquifer in Dinantian Upper Impure Limestones.


Active Layers
GSI Bedrock Aquifer
Measurement Tools
Make measurements on the map or get the coordinates of a location.
(Results are approximate and shown in local Irish Coordinate System)
MEASURE DISTANCE
MEASURE AREA
GET COORDINATES
CLEAR MEASURES
ING (EPSG 29902) Easting:
ING (EPSG 29902) Northing:
ITM (EPSG 2157) Easting:
ITM (EPSG 2157) Northing:
WGS84 (EPSG 4326) Longitude:
WGS84 (EPSG 4326) Latitude:
Web Mercator (EPSG 3857) Easting:
Web Mercator (EPSG 3857) Northing:
New URL:
COPY URL TO CLIPBOARD

Appendix C


Water
WATER, LAND & SOIL
PROTECTED AREAS
MONITORING & FLOW
STATUS & RISK
PRESSURES & ACTIVITIES
TAKING ACTION
WMS Layers
HELP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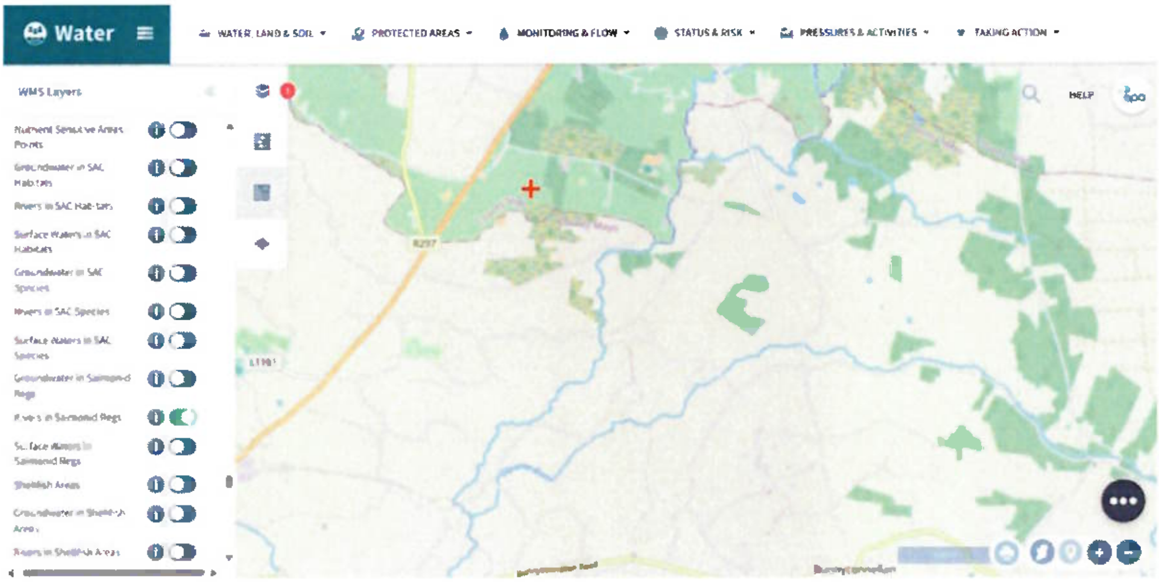
WATER, LAND & SOIL
PROTECTED AREAS
MONITORING & FLOW
STATUS & RISK
WMS Layers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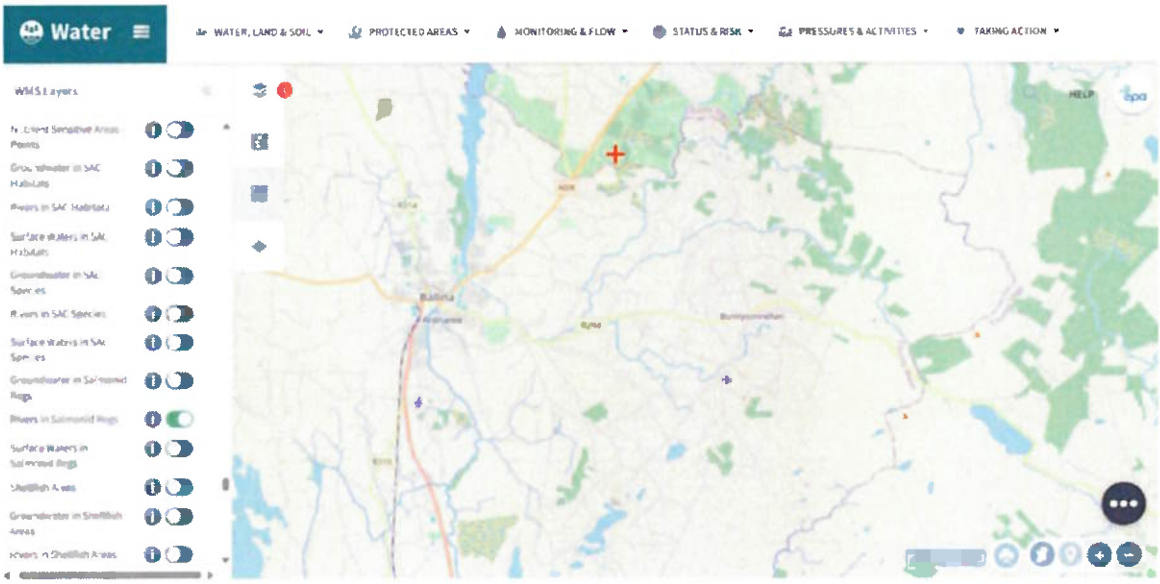
PROTECTED AREAS
MONITORING & FLOW
STATUS & RISK
PRESSURES & ACTIVITIES
TAKING ACTION
WMS Layers
HELP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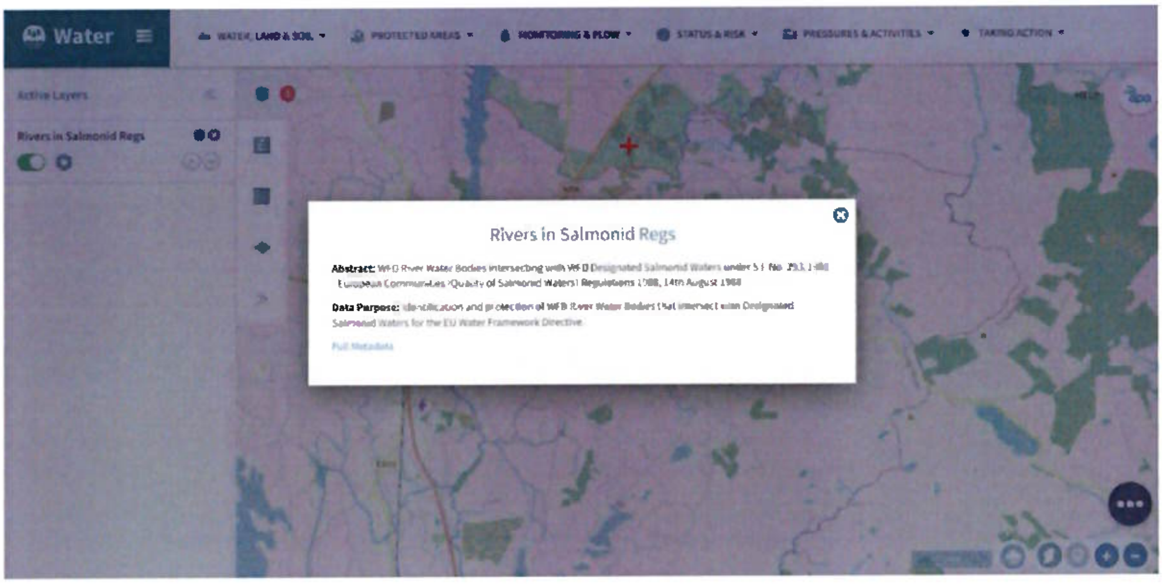
WATER, LAND & SOIL
PROTECTED AREAS
MONITORING & FLOW
STATUS & RISK
PRESSURES & ACTIVITIES
TAKING ACTION
WMS Layers
HELP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WATER, LAND & SOIL
PROTECTED AREAS
MONITORING & FLOW
STATUS & RISK
PRESSURES & ACTIVITIES
TAKING ACTION
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Rivers in Salmonid Regs
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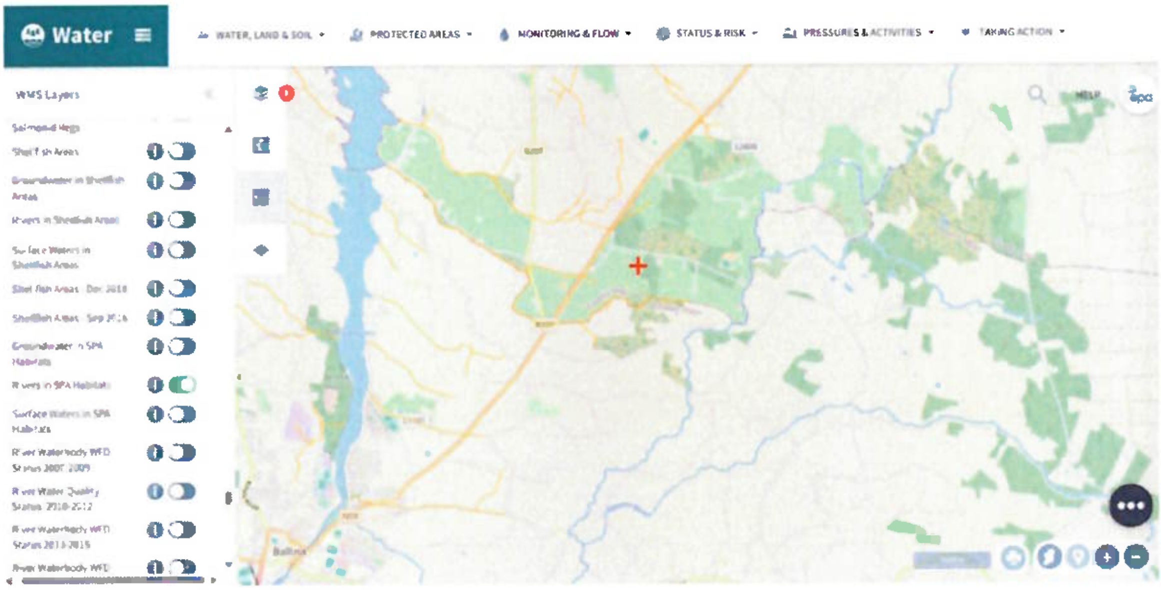
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PROTECTED AREAS
MONITORING & FLOW
STATUS & RISK
PRESSURES & ACTIVITIES
TAKING ACTION
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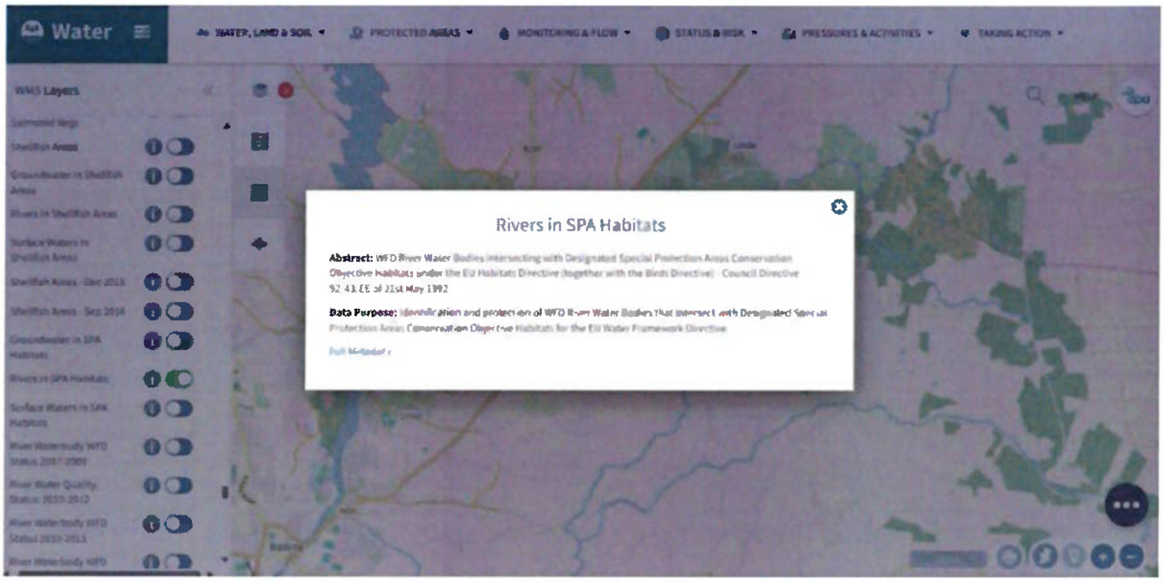
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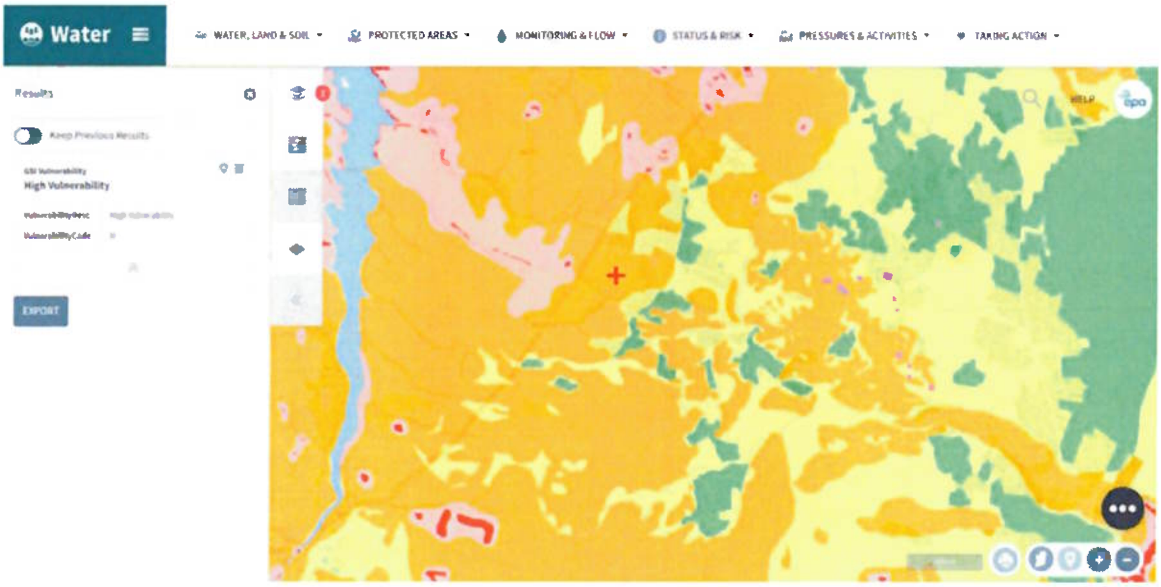
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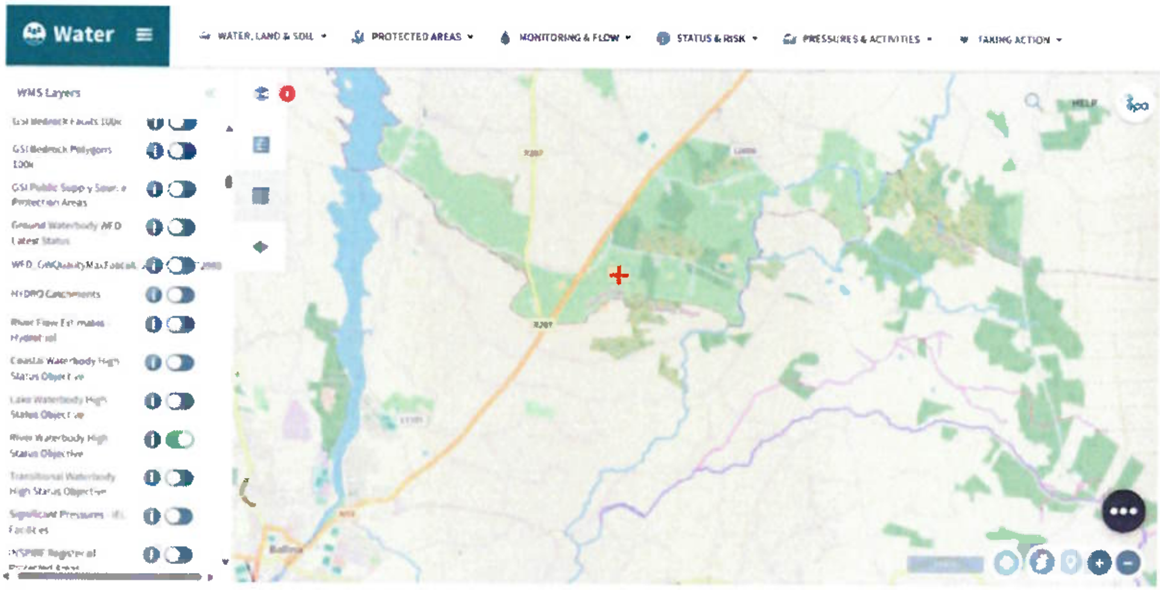
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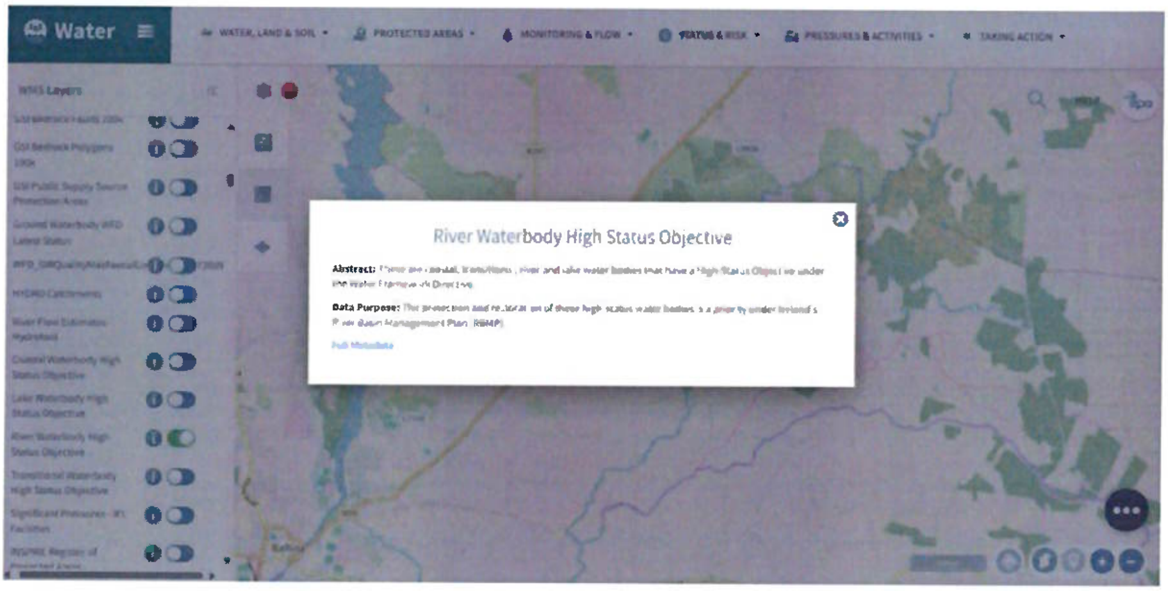
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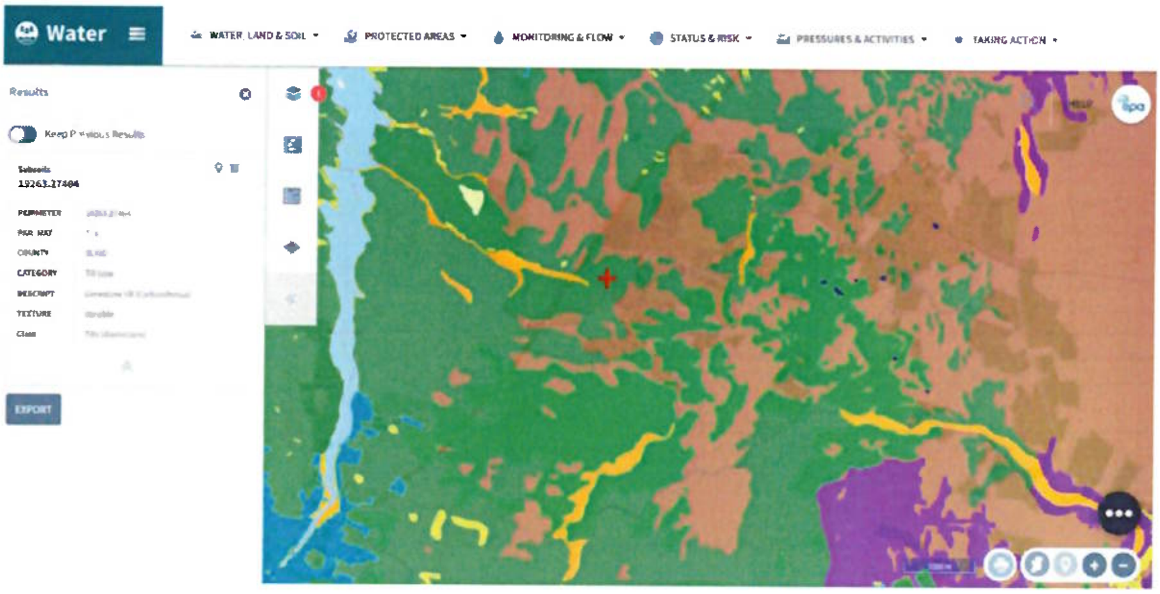
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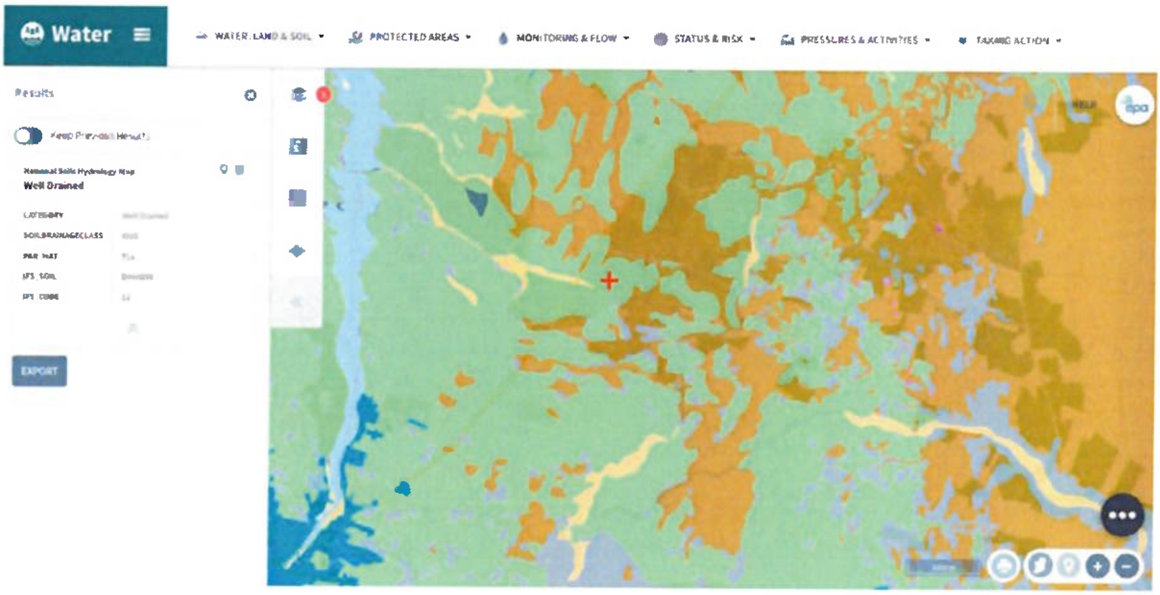
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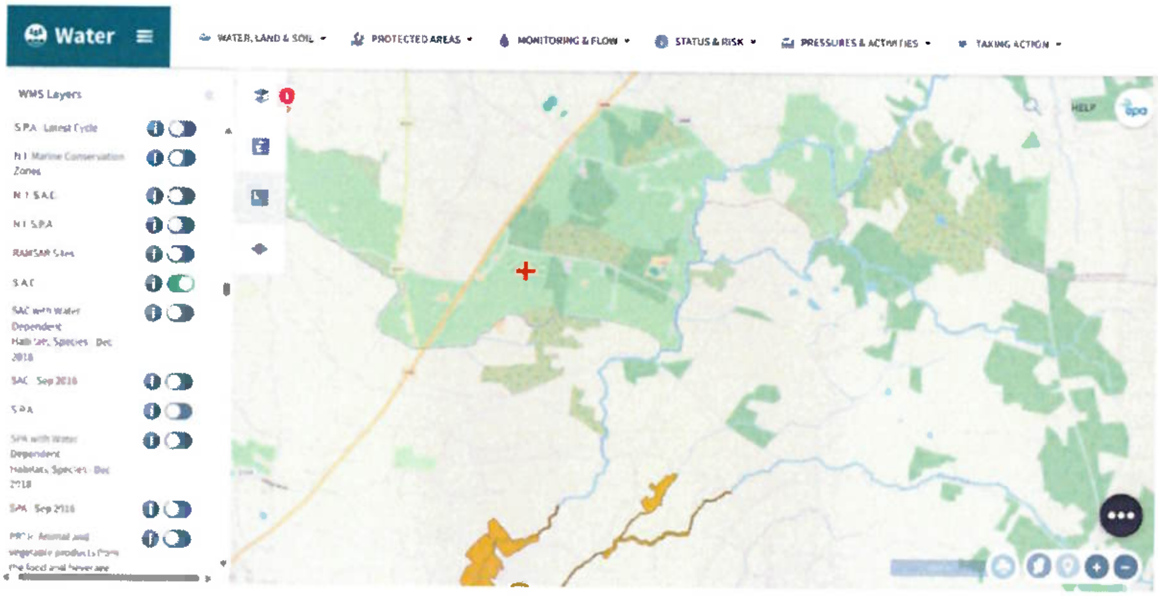

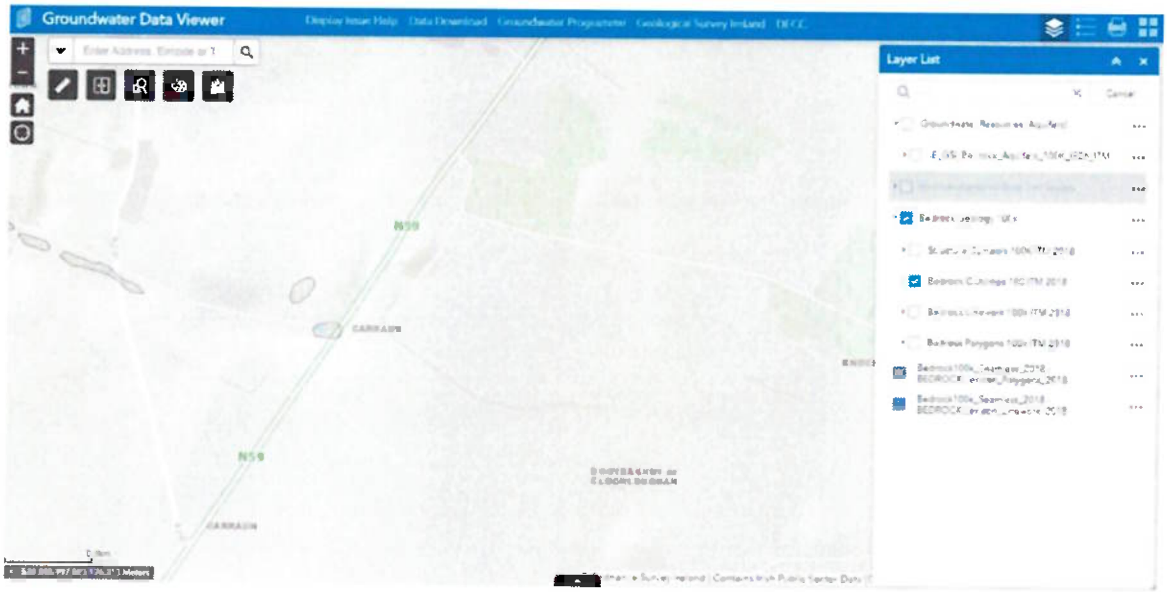

References

Ben Taher L.S. Estimating Groundwater Aquifer Transmissivity using well specific capacity for tazerbo well field SE-Libya. Gharyan Journal of Hydrology. High institute of Science & Technology Gharyan. Issue (4). December 2018.

EPA. GSI. Irish Aquifer Properties. A Reference Manual & Guide. Version 1. March 2015

Moore. J.P. Analysis of Fracture Systems and their impact on flow pathways in Irish bedrock Aquifers. Groundwater Newsletter. Issue 51. PP28-33.

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