

Appendix A.10.1

Well Condition Report 2014 & 2023

A.10.1 Well Condition Report 2014 & 2023

Galway County Council

N6 Galway City Ring Road

Updated Environmental Impact Assessment Report

Reference: Appendix A.10.1A

Issue 2 | 28 March 2025

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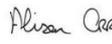
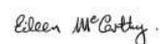
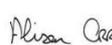
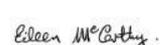
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1. Introduction

This report is updated to inform the hydrogeology assessment as part of the response to the request by ABP for further information in December 2023 where they requested Galway County Council to “*Update the Environmental Impact Assessment Report*” (EIAR) submitted to An Bord Pleanála in October 2018 as part of the application for approval of the proposed N6 GCRR pursuant to Section 51 of the Roads Act 1993 (as amended). The updates to this report only relate to corrections and clarifications to differentiate this early work in 2014 from the more recent work in 2023/2024 and do not relate to any new material.

This report provides a summary of work undertaken at the commencement of the Project in 2014 whereby investigative surveys were undertaken to establish the potential reuse of boreholes which were installed as part of the 2006 Galway City Outer Bypass (2006 GCOB) project in the east and west of the scheme study area.

These 2006 GCOB boreholes were visited in between August and November 2014 and their condition assessed to establish if they could be used for further groundwater monitoring during the course of the proposed N6 GCRR project.

2. 2006 GCOB well monitoring network

52 No. potential existing 2006 GCOB borehole locations were visited in 2014 during the well condition survey. The results of the borehole condition survey are summarised in Table 1. A number of boreholes were missing or in an unsatisfactory state preventing further use as a groundwater monitoring wells.

Table 1 Borehole characteristics, current conditions and the rationale for including or excluding in further groundwater monitoring

Borehole ID	Total Depth Drilled (m)	Top of response zone (mbgl)	Base of response zone (mbgl)	Response zone lithology	Piezometer Diameter (mm)	Depth to the base of well measured in field (mbgl)	Borehole condition, rehabilitation required and further comments	Inclusion in groundwater monitoring survey and rationale
BH107	5.23	1	5.23	Peat	50	3.73	Insufficient concrete surround, headworks corroded	Do not include Response zone in peat
BH358	3.2	1	3.2	-	-	-	Cannot locate	Cannot locate
LQMW1	-	-	-	-	100	21.8	No cover, standpipe requires cap. No logs currently available	Do not include Similar location to LQMW4
LQMW2	-	-	-	-	100	24.11	Insufficient concrete surround, headworks broken, standpipe requires cap. No logs currently available	Do not include Similar location to LQMW4
LQMW3	-	-	-	-	100	23.55	No cover, standpipe requires cap. No logs currently available	Do not include Similar location to LQMW4
LQMW4	-	-	-	-	100	24.25	No cover, standpipe requires cap. No logs currently available	Include Located between Ballindooley Lough and Coolagh Lakes.
LQMW5	-	-	-	-	100	-	No cover, standpipe requires cap. No logs currently available	Include Located between Ballindooley Lough and Coolagh Lakes.
LQMW6	-	-	-	-	100	11.33	No cover, standpipe requires cap. No logs currently available	Include Located between Ballindooley Lough and Coolagh Lakes.

Borehole ID	Total Depth Drilled (m)	Top of response zone (mbgl)	Base of response zone (mbgl)	Response zone lithology	Piezometer Diameter (mm)	Depth to the base of well measured in field (mbgl)	Borehole condition, rehabilitation required and further comments	Inclusion in groundwater monitoring survey and rational
MW01	13.8	4.9	13.8	Limestone	50	13.6	Headworks in good condition, standpipe requires cap.	Include Located up gradient of Coolagh Lakes.
MW02	15.2	6	15	Limestone	50	13.25	Concrete plinth cracked; Insufficient concrete surround;	Include Located up gradient of Coolagh Lakes. Suitable for groundwater level logger
MW03	12.1	3	12	Limestone	50	11.82	Concrete plinth shallow; Insufficient concrete surround; standpipe is at ground level	Include Located up gradient of Coolagh Lakes. Suitable for groundwater level logger
N6GCOB-14	-	-	-	-	-	-	Area approx. 3 m diameter where groundwater intercepts ground depression	Do not include Not a borehole and only seasonally active
RC127	3	1	3	-	-	-	Cannot locate	Cannot locate
RC129	14	2	14	Limestone	50	3.18	Insufficient concrete surround, headworks was lying beside standpipe	Do not include Similar location and borehole condition as RC133, do not require both
RC133	10.4	7.4	10.4	Limestone	50	8.97	Insufficient concrete surround, headworks are not secure and easily removed	Include Located up gradient of Coolagh Lakes. Suitable for groundwater level logger
RC138	10	7	10	-	-	-	Cannot locate	Cannot locate
RC206	14.26	1	14.26	Limestone	50	11.18	Insufficient concrete surround; Possible ground	Include

Borehole ID	Total Depth Drilled (m)	Top of response zone (mbgl)	Base of response zone (mbgl)	Response zone lithology	Piezometer Diameter (mm)	Depth to the base of well measured in field (mbgl)	Borehole condition, rehabilitation required and further comments	Inclusion in groundwater monitoring survey and rational
							water seepage; headworks not straight and rusty	Located up gradient of Ballindooley Lough Suitable for groundwater level logger
RC394A	6	3	6	Granite	50	6.46	Missing headworks; no cap on standpipe; no cement only bentonite	Do not include Monitoring well not in sufficient state
RC402	15.5	13.5	15.5	Granite	50	13.41	Flooded inside casing; loose headworks; Unusable	Do not include Monitoring well, not in usable state and not in WDTE
RC404	14	12	14	Granite	-	-	Cannot locate	Cannot locate
RC407	10	8	10	Granite	-	-	Cannot locate	Cannot locate
RC422	7	4	7	Granite	35	7.1	Good condition	Include Within 80m of all options except blue
RC428A	8	6	8	Granite	-	-	Cannot locate	Cannot locate
RC435	7.5	5.5	7.5	Granite	19	7.8	Headworks loose	Include Within WDTE EC20
RC442A	4.5	1	4.5	Granite	-	-	Cannot locate	Cannot locate
RC451A	10	7	10	Granite	50	10.31	Insufficient concrete surround, headwork rusty and needs painting	Include Within WDTE EC22 (Tonabrocky bog)
RC455A	10	8	10	Granite	-	-	Cannot locate	Cannot locate
RC469	4.8	1	4.8	Diorite	19	0.57	Pipe damaged and well blocked – not usable	Do not include Monitoring well, not in usable state

Borehole ID	Total Depth Drilled (m)	Top of response zone (mbgl)	Base of response zone (mbgl)	Response zone lithology	Piezometer Diameter (mm)	Depth to the base of well measured in field (mbgl)	Borehole condition, rehabilitation required and further comments	Inclusion in groundwater monitoring survey and rational
RC507	8.1	7.8	8.1	Biotite granite	50	8.04	Concrete plinth cracked	Do not include Not near and WDTEs
RC511	7.2	3.2	7.2	Biotite granite	-	-	Standpipe damaged – not usable	Do not include Not near and WDTEs
RC515	5	1	5	Granite over biotite granite	-	-	Corroded locked Concrete plinth cracked and easily removed.	Do not include Close to RC548 with similar properties
RC548	8	7.7	8	Biotite granite	19	8.05	Cap required on standpipe	Include Within WDTE EC11
RC595	8	7	8	Biotite granite	50	8.38	Concrete plinth cracked; Insufficient concrete	Do not include Close to RC548 with similar properties
RC638	6	3	6	Biotite granite	-	-	Standpipe in ditch with no headworks or cap - Unusable	Do not include Monitoring well, not in usable state
RC671	6.8	2	6.8	Granite	-	-	Cannot locate	Cannot locate
RC687	11	10.7	11	Biotite granite	50	10.84	Concrete plinth cracked; Insufficient concrete; headworks not straight	Include Within WDTE EC16
RC707	6.4	1	6.4	Biotite granite	50	5.92	Insufficient concrete surround;	Do not include Not within WDTE
RC712	6	3	6	Biotite granite	50	5.98	Good	Do not include Not within WDTE
RC733A	10	9.7	10	Microgranite	-	-	Cannot locate	Cannot locate

Borehole ID	Total Depth Drilled (m)	Top of response zone (mbgl)	Base of response zone (mbgl)	Response zone lithology	Piezometer Diameter (mm)	Depth to the base of well measured in field (mbgl)	Borehole condition, rehabilitation required and further comments	Inclusion in groundwater monitoring survey and rational
RC739	8	2	8	Microgranite	50	7.3	Headworks loose	Include Within WDTE EC20
RC741	8	2	8	Biotite granite	-	-	Cannot locate	Cannot locate
RC755	7	4	7	Microgranite	-	-	Cannot locate	Cannot locate
RC800	8.3	8	8.3	Microgranite	19	8.39	Insufficient concrete surround; inclined headworks	Do not include Not within WDTE
RC804	8	4	8	Peat over granite	50	8.81	Insufficient concrete surround;	Do not include Not within WDTE
RC808	6	2	6	Biotite granite	50	5.62	Headworks missing	Do not include Not within WDTE
RC936	69	14	28	Silt/clay with sub angular limestone boulders and cobbles over sand imbedded with silt	50	26.55	Concrete plinth cracked; Insufficient concrete surround; top of standpipe is below ground level	Do not include Inflow from surface possible as top of standpipe is below ground level
RC942	20	17	20	Limestone	50	18.85	Concrete plinth cracked; Insufficient concrete surround; Possible ground water seepage; water level is above ground level	Do not include Groundwater above ground level
RC954	10	8.5	8.8	Limestone	19	8.59	concrete overgrown	Do not include

Borehole ID	Total Depth Drilled (m)	Top of response zone (mbgl)	Base of response zone (mbgl)	Response zone lithology	Piezometer Diameter (mm)	Depth to the base of well measured in field (mbgl)	Borehole condition, rehabilitation required and further comments	Inclusion in groundwater monitoring survey and rational
								Very similar location and borehole condition MW02, don't require both 19 mm standpipe will not allow a logger to be installed
RC972	7.4	1.5	7.4	Gravel and cobbles over limestone	50	7.42	Loose; Concrete plinth shallow; Insufficient concrete surround;	Do not include Screened through overburden and bedrock
RC973	7.1	6.7	7	Limestone	-	-	Cannot locate	Cannot locate
RC977	6.7	3.8	6.7	Limestone	-	-	Cannot locate	Cannot locate
RC1104	20	19.4	19.7	Limestone	19	-	-	Include when access is possible Located beside Ballindooley Lough 19 mm standpipe will not allow a logger to be installed
RC1206	11.5	8.5	11.5	Limestone	50	10.79	Headworks loose; Insufficient concrete surround;	Include Located up gradient of Ballindooley Lough Suitable for groundwater level logger
RC1211	7	6.7	7	Limestone	19	5.5	Loose; Concrete plinth shallow; not straight and blue pipe above casing	Include Located up gradient of Ballindooley Lough 19 mm standpipe will not allow a logger to be installed

3. Proposed well monitoring network

Eleven of these existing 2006 GCOB wells were identified as suitable for further groundwater monitoring in the east of the scheme study area underlain by limestone bedrock. Six monitoring wells have been identified as suitable for further monitoring in the west of the scheme study area underlain by granites and orthogenesis. Table 2 summarises the findings of Table 1 and outlines this proposed groundwater monitoring network as well as the rationale for choosing the boreholes. Boreholes to be included in the groundwater monitoring regime were chosen based on the condition of the borehole, the response zone lithology and the proximity to other boreholes with similar conditions and lithologies. Figure 1 and Figure 2 show the locations of the existing wells to be included in further groundwater monitoring in the east and west of the scheme study area respectively.

Based on the condition of the wells they are in a suitable condition for groundwater monitoring. As required, caps and locks were replaced as part of the commissioning. Due to the age of these monitoring wells, these are nearing end of life and if they are to be used after this project then their condition should be reassessed prior to use. If they are not to be used after this project, then they should be decommissioned.

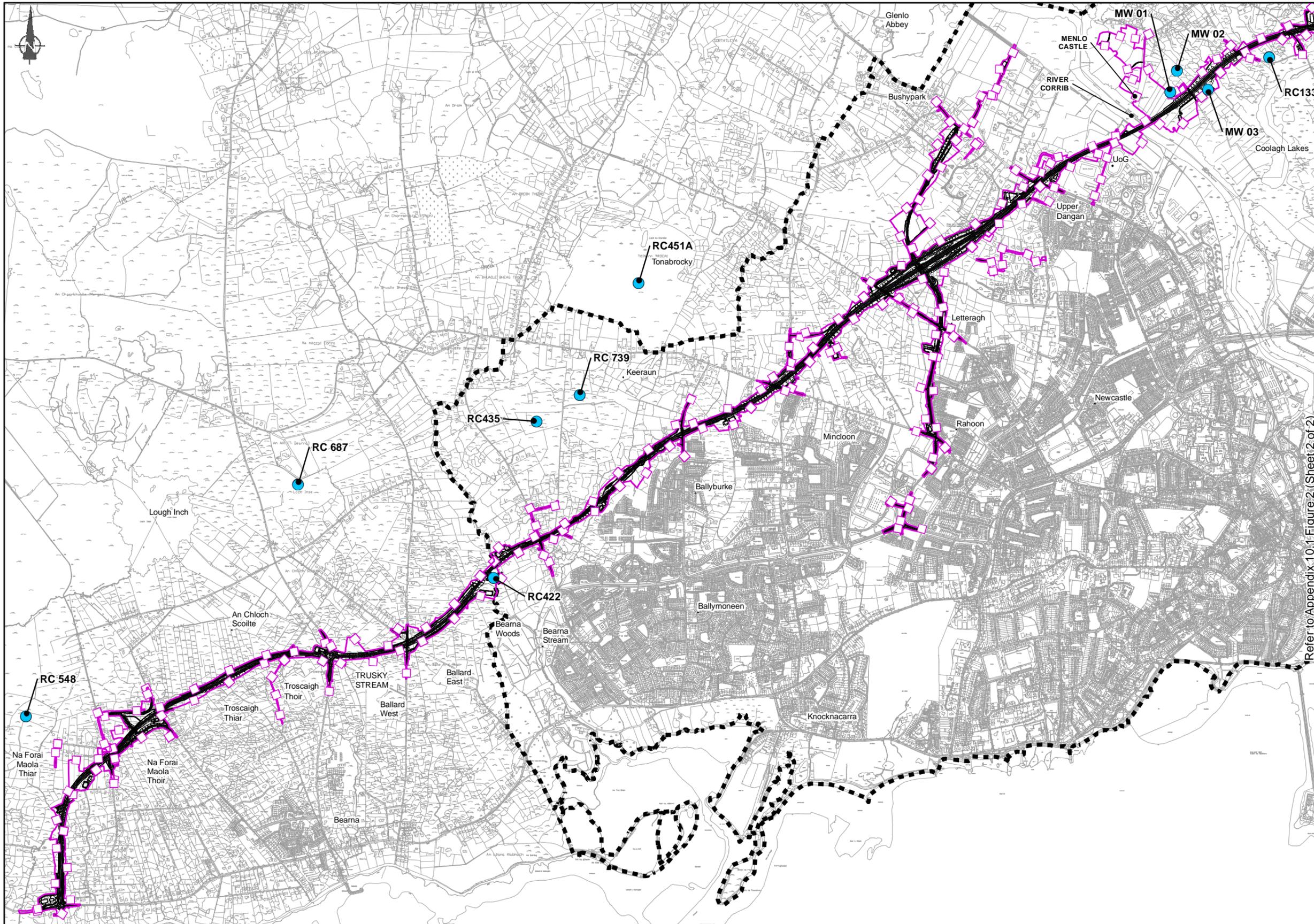
Table 2 Summary of the boreholes to be included in further groundwater monitoring

	Borehole ID	Location	Response zone lithology	Depth to the base of well (mbgl)	Diameter (mm)
East of Scheme Study Area	LQMW4	Between Ballindooley Lough and Coolagh Lakes	Depth indicates in bedrock but no logs available	24.25	200
	LQMW5	Between Ballindooley Lough and Coolagh Lakes	Depth indicates in bedrock but no logs available		200
	LQMW6	Between Ballindooley Lough and Coolagh Lakes	Depth indicates in bedrock but no logs available	11:33	200
	MW01	Coolagh Lakes	Limestone	13.6	50
	MW02	Coolagh Lakes	Limestone	13.25	50
	MW03	Coolagh Lakes.	Limestone	11.82	50
	RC133	Coolagh Lakes	Limestone	8.97	50
	RC206	Ballindooley Lough	Limestone	11.18	50
	RC1104	Ballindooley Lough	Limestone		19
	RC1206	Ballindooley Lough	Limestone	10.79	50
RC1211	Ballindooley Lough	Limestone	5.5	19	
West of Scheme Study Area	RC422	Within 170 m of all route options	Granite	7.1	35
	RC435	EC20 Heath / bog	Granite	7.8	19
	RC451A	EC22 Tonabrocky Bog	Granite	10.31	50
	RC548	EC11 Bog	Biotite granite	8.05	19
	RC687	EC16 Wet grassland / Heath / bog	Biotite granite	10.84	50

	Borehole ID	Location	Response zone lithology	Depth to the base of well (mbgl)	Diameter (mm)
	RC739	EC20 Heath/bog	Microgranite	7.3	50

Annex 1

Figures



Legend

- City Boundary
- Assessment Boundary
- Proposed N6 GCRR
- Groundwater Monitoring Locations

Refer to Appendix 10.1 Figure 2 (Sheet 2 of 2)

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Key Plan

Sheet 1

Sheet 2

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Scale: 1: 25000 @A3

Date: February 2025

Issue	Date	By	Chkd	Appd
I 1	28/02/2025	AG	EC	MH

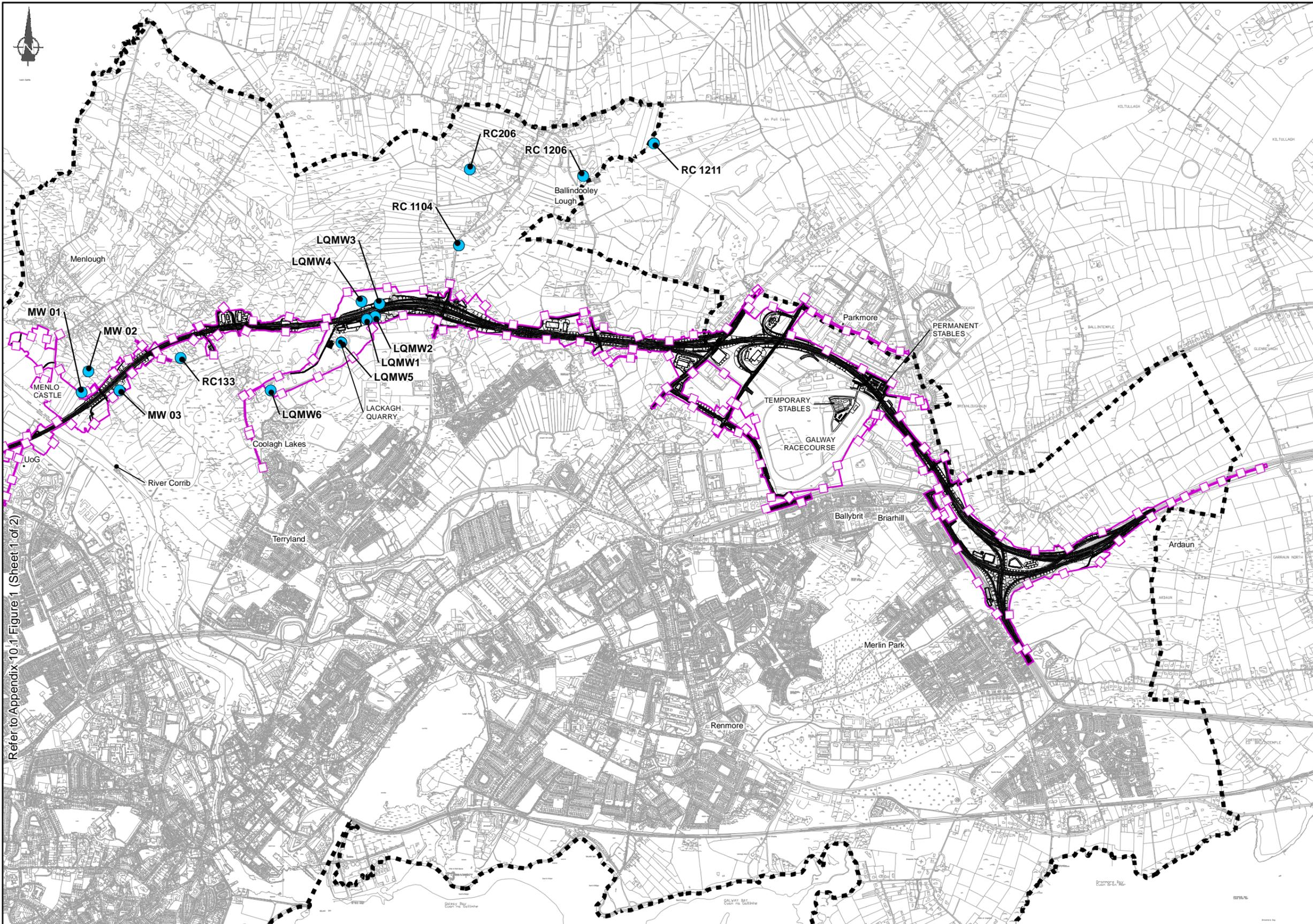
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Appendix 10.1
Groundwater Monitoring Location
Sheet 1 of 2

Drawing Status

For Information

Job No	Drawing No	Issue
233985	Figure 1	11



- Legend**
- City Boundary
 - - - Assessment Boundary
 - █ Proposed N6 GCRR
 - Groundwater Monitoring Locations

Refer to Appendix 10.1 Figure 1 (Sheet 1 of 2)

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Sheet 1 Sheet 2

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I1	28/02/2025	AG	EC	MH

Drawing Title

Appendix 10.1
Groundwater Monitoring Location
Sheet 2 of 2

Drawing Status

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233985	Figure 2	11

Galway County Council

N6 Galway City Ring Road

Updated Environmental Impact Assessment Report

Reference: Appendix A.10.1 B

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1. Introduction

This report is prepared to inform the hydrogeology assessment as part of the response to the request by ABP for further information in December 2023 where they requested Galway County Council to “*Update the Environmental Impact Assessment Report*” (EIAR) submitted to An Bord Pleanála in October 2018 as part of the application for approval of the proposed N6 GCRR pursuant to Section 51 of the Roads Act 1993 (as amended).

Information on the groundwater monitoring boreholes of the 2018 N6 Galway City Ring Road project were reviewed in 2023 in order to identify those key locations representative of the groundwater bodies that the Project crosses. Boreholes were then visited in November 2023 so that their condition could be assessed to establish their suitability for continued monitoring during late 2023 and early 2024.

2. Summary of 2018 N6 GCRR well monitoring network

54 (No.) boreholes formed the groundwater level monitoring network of the 2018 N6 GCRR project and of these monitoring wells a total of 17 (No.) were also used for groundwater sampling. The rationale to use 17 (No.) of the 54 (No.) monitoring wells for groundwater sampling was based on their location with respect to local groundwater bodies, their proximity to the Project and their proximity to sensitive hydrogeological receptors. The groundwater monitoring network of 2018 N6 GCRR project is shown in Figure 1.

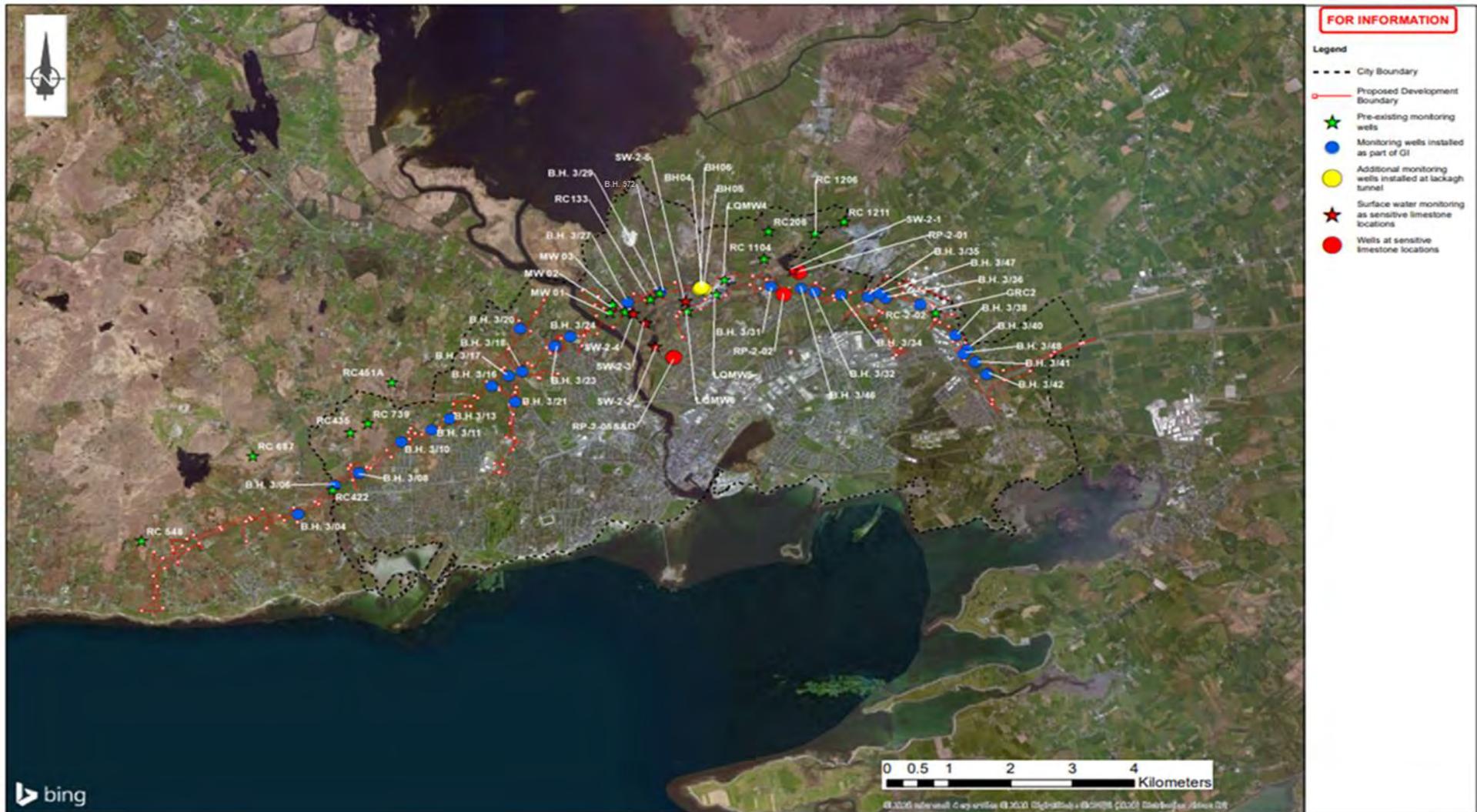


Figure 1 2018 GCRR Groundwater level and surface water monitoring locations

3. 2023 Well condition survey

The 17 groundwater monitoring wells that had been used for water quality sampling in the 2018 N6 GCR monitoring network were identified for water level monitoring and water quality sampling during 2023-2024. The results of the borehole condition survey of these wells are summarised below in Table 1. The 2023 well condition survey noted concerns with two wells, which are described below (these wells are highlighted in Table 1 for clarity).

- It is noted that B.H. 3/06R was discounted from use for the 2023-2024 monitoring due to the well condition and that the depth of water in the well had become too slight for sampling.
- In the 2018 N6 GCR monitoring network, one monitoring location is a groundwater supply system at the Galway Racecourse stables which was used for water quality sampling (not for water level monitoring). This groundwater supply system comprises of two adjacent wells (GRC1 and GRC2). Note in the 2018 EIAR the well is listed as GRC2 as this was the well bore that was sampled, which is referred to as W50-13 in the EIAR section on groundwater supplies. For the N6 GCR 2023-2024 monitoring network due to obstructions in the GRC2 well the adjacent well was used, which is GRC1 and is referred to as W50-14 in the EIAR section on groundwater supplies. Based on review of these wells it is assessed that these wells draw from the same aquifer and groundwater. For completeness this report lists either GRC1 or GRC2 depending on which bore was accessible at the time of sampling. However, for this project it is considered that the wells abstract from the same aquifer and the same groundwater. It remains the case that these are pumping wells and that the water level in each well is not representative of the natural groundwater level. As such, neither GRC1 nor GRC2 should be used in the water level monitoring network but can be used for water quality monitoring.

On the basis of the above, 16 wells are used for water quality monitoring and 15 wells are used for water level monitoring.

Table 1 2023 Groundwater monitoring borehole condition survey

Borehole ID	Total Depth Drilled (m)	Measured height of casing (magl)	Measured depth to water (mbtoc)	Depth to the base of well measured in field (mbgl)	Borehole condition and further comments
B.H. 3/04R	5.6	0.31	0.78	5.39	50mm inner diameter (ID) standpipe, no tubing Good headworks with steel cover
B.H. 3/06R	7.5	0.3	1.8	2.61	50mm ID standpipe, no tubing Good headworks, no steel casing cover It is not possible to sample BH3/06R due to the limited depth of water in this shallow borehole.
B.H. 3/17R	10.2	0.2	2.46	10.02	50mm ID standpipe, no tubing Good headworks with steel casing cover
B.H. 3/18R	24.5	0.3	2.81	4.14	50mm ID standpipe, no tubing Good headworks with steel casing cover
RP-2-01	35	0.84	12.39	34.14	50mm ID standpipe, no tubing Good headworks, steel casing cover
RP-2-05D	45	0.49	13.26	47.75	50mm ID standpipe, no tubing

Borehole ID	Total Depth Drilled (m)	Measured height of casing (magl)	Measured depth to water (mbtoc)	Depth to the base of well measured in field (mbgl)	Borehole condition and further comments
					Good headworks, no steel casing cover
RP-2-05S	12	0.85	9.44	13.13	50mm ID standpipe, no tubing Good headworks, no steel casing cover
RC133	10.4	0.31	4.28	9.00	50mm ID standpipe, no tubing Good headworks
RP-2-03	35	0.7	13.91	30.00	50mm ID standpipe, no tubing Good headworks with steel casing cover
LQMW4		1	3.93	8.20	100mm ID PVC, no tubing Situated in a concrete chamber with no cover
LQMW6		1	3.8	9.80	100mm ID PVC, no tubing Situated in a concrete chamber with no cover Not certain whether that's the EOH, or the dipper was obstructed from penetrating further
MW 03	12.1	0.19	0.69	11.91	50mm ID standpipe, no tubing Good headworks with steel casing cover
Galway Racecourse stable supply wells (GRC1 & GRC2)	Unknown	(in chamber)	42.85	(Pump is in the well and blocks depth measurement)	Note there are two adjacent wells at the Galway Racecourse stables: GRC1 and GRC2. These wells are part of the same pumping system. GRC2 was used in 2018 GRC1 used for 2023-2024 Both wells are in below ground chambers and have similar depth into the same aquifer. Both wells tap into the same groundwater source. Both GRC1 and GRC2 are production wells, with pump installations. Groundwater level in both wells is not representative of the natural groundwater level. Not to be used for water level monitoring.
B.H. 3/38R	10.3	0.28	3.04	8.32	50mm ID standpipe, no tubing Good headworks, no steel casing cover
B.H. 3/41R	7.5	0.24	3.46	6.18	50mm ID standpipe, no tubing Good headworks with steel casing cover
B.H. 3/42R	9.85	0.4	3.86	17.18	No borehole was located at the mapped location in the field.

Borehole ID	Total Depth Drilled (m)	Measured height of casing (magl)	Measured depth to water (mbtoc)	Depth to the base of well measured in field (mbgl)	Borehole condition and further comments
					Large borehole, 200mm outer diameter, was located. Differs from the borehole log of B.H 3/42 that shows a 50mm standpipe was installed.
B.H. 3/48R	20.3	0.35	1.76	20.11	50mm ID standpipe, no tubing Good headworks with steel casing cover

magl = metres above ground level

mbtoc = metres below top of casing

mbgl = metres below ground level

4. Proposed well monitoring network

The proposed 2023 to 2024 groundwater monitoring network comprises of 16 groundwater monitoring wells, of which 16 wells are used for water quality monitoring and 15 wells are used for water level monitoring.

A total of 13 (No.) wells were selected for further groundwater monitoring in the east of the scheme study area underlain by limestone bedrock. Three monitoring wells have been identified as suitable for further monitoring in the west of the scheme study area underlain by granite. Table 2 summarises the proposed groundwater monitoring network.

Based on this 2023 condition survey, these 16 monitoring wells are considered fit for purpose to be used for groundwater sampling as part of this project in 2023/2024. Of these 16 wells one well is pumping system with two boreholes (GRC1 and GRC2). It shall not be used to measure natural groundwater levels (as was the case with GRC2 from the 2018 GCRR).

If these groundwater monitoring wells are to be used after this Project then they will need to be re-surveyed and assessed to determine their state prior to being commissioned for any future monitoring. If they are not to be used after this Project, then they should be decommissioned.

For the groundwater level monitoring data and maps refer to Appendix 10.3 and for groundwater quality monitoring data and maps refer to Appendix 10.4. Monitoring for the 2023-2024 monitoring period groundwater level monitoring began in November 2023 to measure groundwater levels and quality during peak winter groundwater levels and continued until July 2024 so that representative summer conditions could also be considered.

Table 2 Summary of the boreholes included in 2023/2024 groundwater monitoring

Location	Geology	Ground water body	Easting ITM	Northing ITM	Ground level m AOD	Casing stickup (magl)
B.H. 3/04R	Granite	Spiddal	523646	724287	36.82	0.31
B.H. 3/17R	Granite	Maam-Clonbur	527021	726805	65.33	0.20
B.H. 3/18R	Granite	Maam-Clonbur	527254	726894	70.64	0.30
RP-2-01	Limestone	Clare Corrib	531726	728689	21.38	0.84
RP-2-05D	Limestone	Lough Corrib Fen 1	529701	727145	19.96	0.49
RP-2-05S	Limestone	Lough Corrib Fen 1	529704	727141	20.22	0.85
RC133	Limestone	Lough Corrib Fen 1	529325	728185	11.66	0.31
RP-2-03	Limestone	Clare Corrib	531478	728278	22.44	0.70
LQMW4	Limestone	Clare Corrib	530522	728557	16.76	1.00
LQMW6	Limestone	Clare Corrib	529919	727971	15.40	1.00
MW 03	Limestone	Clare Corrib	528920	727970	6.70	0.19
GRC1	Limestone	Clarinbridge	533934	727949	53.22	N/A
B.H. 3/38R	Limestone	Clarinbridge	534249	727541	45.17	0.28
B.H. 3/41R	Limestone	Clarinbridge	534756	726840	32.60	0.24
B.H. 3/42R	Limestone	Clarinbridge	534756	726840	32.60	0.40
B.H. 3/48R	Limestone	Clarinbridge	534397	727197	40.48	0.35