Appendix A.10.1

Well Commissioning Report

A.10.1

1 Introduction

Boreholes installed as part of the 2006 Galway City Outer Bypass project in the east and west of the scheme study area were visited and their condition assessed to establish if they could be used for further groundwater monitoring.

2 Exiting well monitoring network

52 No. potential borehole locations were visited during the 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 rational 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 rational
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

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
								Located between Ballindooley Lough and Coolagh Lakes.
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

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
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 water seepage; headworks not straight and rusty	Include 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

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
								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
RC507	8.1	7.8	8.1	Biotite granite	50	8.04	Concrete plinth cracked	Do not include Not near and WDTEs

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
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

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
								Not within WDTE
RC733A	10	9.7	10	Microgranite	-	-	Cannot locate	Cannot locate
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

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
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 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

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
								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

Ten 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 rational 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 where replaced as part of the commissioning. Due to the age of these monitoring wells, these are considered to be nearing end of life and if they are to be used after this project then they should be remediated with new concrete surround and a number will require new head works. 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

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

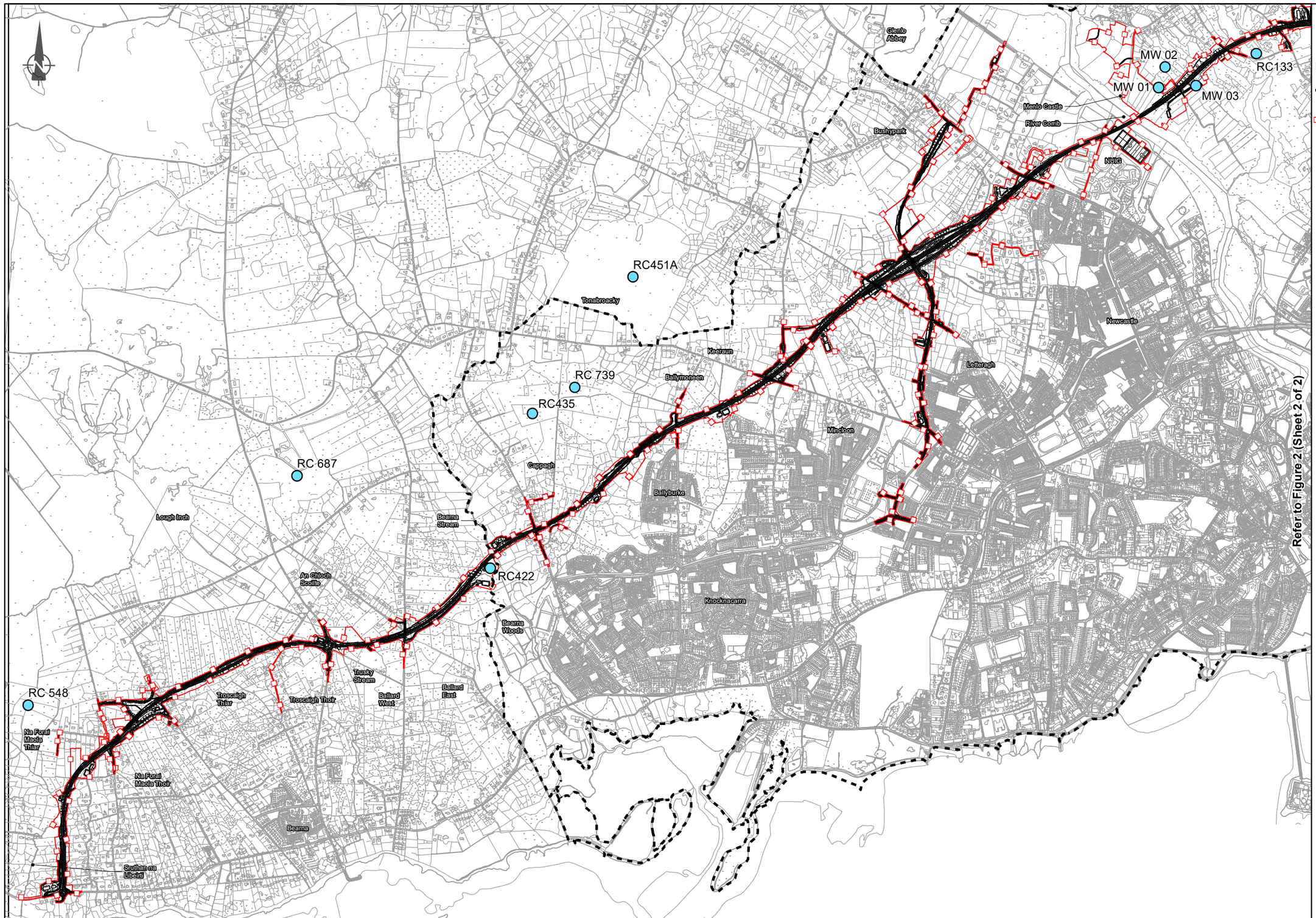
4 Proposed Monitoring Schedule

Groundwater and surface water monitoring was undertaken on a monthly basis. This involved:

- Measuring water levels in the 16 existing monitoring wells (**Table 2**) and 5 proposed monitoring wells when drilled
- Downloading groundwater and surface water level loggers
- Taking readings of surface water gauge boards

Annex 1
Figures

A3



EIA REPORT

Legend

- City Boundary
- Proposed Development Boundary
- Proposed Road Development
- Groundwater Monitoring Locations

Clients

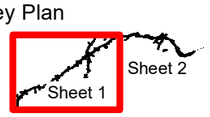
Comhairle Chontae na Gaillimhe
Galway County Council

Galway City Transport Project

An Roinn Iompair Turasóireachta agus Spóirt
Department Transport, Tourism and Sport

Transport Infrastructure Ireland

Key Plan



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Date: **July 2018**

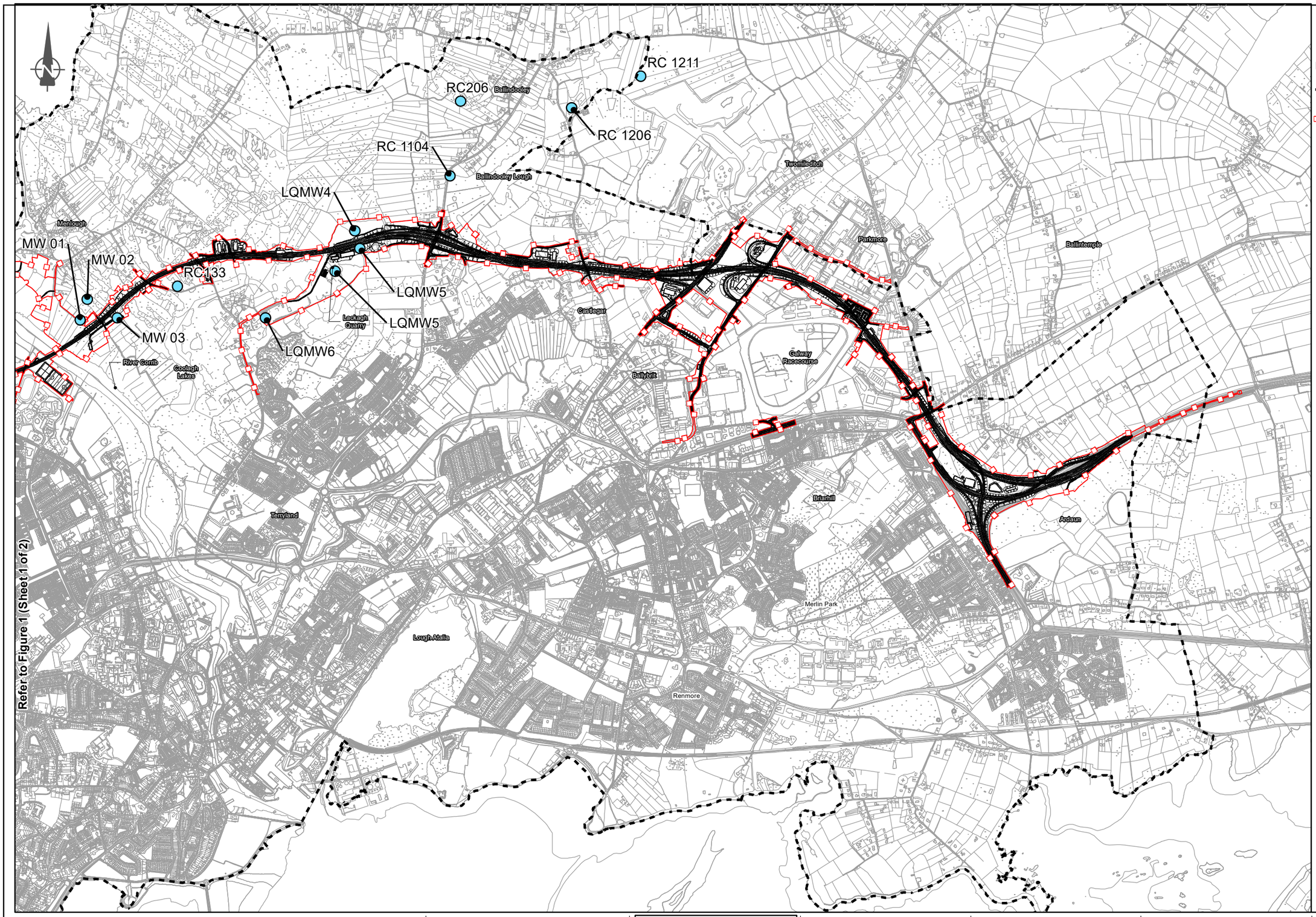
Issue	Date	By	Chkd	Appd
I2	26/07/2018	AG	LB	EMC
I1	22/02/2018	AG	LB	EMC

Drawing Title
Appendix 10.1
Groundwater Monitoring Locations (Sheet 1 of 2)

Drawing Status
For Information

Job No	Drawing No	Issue
233985-00	Figure 1	I2

A3



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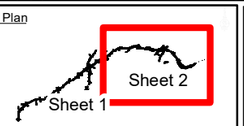
Department Transport, Tourism and Sport

TII Transport Infrastructure Ireland

Key Plan



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Issue	Date	By	Chkd	Appd
I1	26/07/2018	AG	LB	EMC

Drawing Title
Appendix 10.1
Groundwater Monitoring Locations (Sheet 2 of 2)

Drawing Status
For Information

Job No	Drawing No	Issue
233985-00	Figure 2	I1