

ESB Water Quality Monitoring – Coolnabackv Substation

Groundwater Sampling

Water quality sampling was undertaken on 14/12/2021 by an IE Consulting hydrogeologist. Four groundwater wells across the site were sampled. In addition to the three drilled boreholes BH04 (drilled as part of a ground investigation by Causeway Geotech) was also sampled. The borehole is located further south than the other three. It is 9.5m deep and does not reach bedrock.

The location of the boreholes is shown in Figure 1 below.

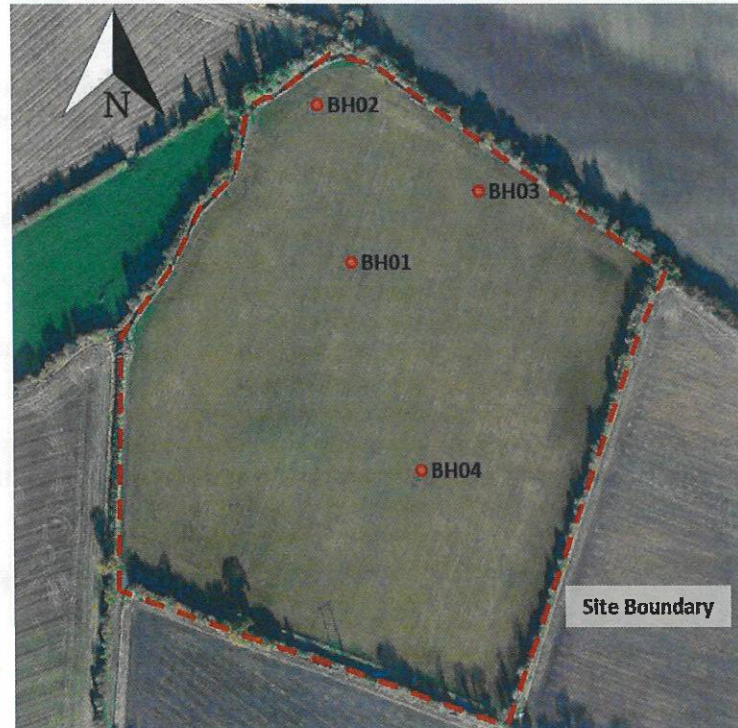


Figure 1 – Groundwater Sampling Locations

Data from the four wells was compared to:

- S. I. No. 366/2016 – European Union Environmental Objectives (Groundwater) (Amendment) Regulations 2016.
- EPA Guideline Values (EPA, 2003).

Sampling Data shown in Table 1 below.

Interpretation

pH is between 6.97 (BH03) and 7.72 (BH02). The reading from BH03 is considered to be anomalous when compared with the other values

Electrical conductivity is generally indicative of good quality water, between 516 uS/cm (BH02) and 976 uS/cm (BH01) – only rising above the lower GTV in BH01. This may be due to a localised naturally elevated sulphate and sodium concentration, or a residual of borehole drilling.

Nitrate as NO_3 ranges from <0.2 mg/l (BH02, BH03, BH04) to 1.1 mg/l (BH01). These values are very low and safely below the EPA IGTV (25 mg/l) and GTV (37.5 mg/l) and do not indicate any issues with excess nitrogen in the system.

Orthophosphate as PO_4 ranges from <0.03 mg/l (BH02, BH03, BH04) to 0.04 mg/l (BH01). BH01 is the only well to rise above guideline values and breaches both the GTV (0.03 mg/l) and EPA IGTV (0.035 mg/l). The slight exceedance at BH1 is an anomaly when compared to the other values and overall there is no indication of excess nutrients in the shallow groundwater environment that would impact the Tufa deposits.

Ammoniacal nitrogen as NH_4 ranges from 0.04 mg/l (BH02) to 0.36 mg/l (BH03). Well BH04 (0.12 mg/l) surpasses the GTV (0.084 mg/l) and BH03 (0.36 mg/l) surpasses the GTV and EPA IGTV (0.15 mg/l). The occasional anomaly such as at BH4 would warrant further assessment with monitoring, but generally the values show no sign of organic contamination.

Chloride ranges from 3.7 mg/l (BH02) to 9.6 mg/l (BH04) in the wells. These values are generally low for groundwater and may suggest rapid throughput of rainfall and limited sources of contamination. This remains well below the GTV of 24 mg/l and EPA IGTV of 30 mg/l.

Potassium is between 0.9 mg/l (BH04) and 1.2 mg/l (BH02). This is low and does not surpass the EPA IGTV of 5 mg/l, again suggesting little impact from farmyard/agricultural activities.

Sodium ranges between 4.3 mg/l (BH02) and 14.9 mg/l (BH01). This is well below the EPA IGTV of 150 mg/l.

Sodium Potassium ratio is less than 10:1, suggesting no influence from pollution sources such as septic tanks or farmyards

Calcium is between 191.9 mg/l (BH01) and 102.1 mg/l (BH02). These levels are elevated, but consistent with the limestone provenance of the subsoils, and supports some connectivity with the Tufa deposits along the adjoining stream.

The monitoring data indicates good water quality with low values of nutrients and significant calcium mineralisation suggestive of rapid throughput of rainfall recharge.

Groundwater Quality Data							
	Units	S.I. 366/2016 (Groundwater)	EPA IGV 2003	BH01	BH02	BH03	BH04
Dissolved Calcium	mg/l	-	200	191.9	102.1	114.5	111.2
Dissolved Magnesium	mg/l	-	50	6.6	2.2	10.8	10.0
Dissolved Potassium	mg/l	-	5	1.1	1.2	1.0	0.9
Dissolved Sodium	mg/l	-	150	14.9	4.3	6.3	7.3
Sulphate as SO ₄	mg/l	187.50	200	245.0	4.2	6.7	13.3
Chloride	mg/l	24	30	6.9	3.7	6.0	9.6
Nitrate as NO ₃	mg/l	37.5	25	1.1	<0.2	<0.2	<0.2
Orthophosphate as PO ₄	mg/l	0.035	0.03	0.04	<0.03	<0.03	<0.03
Ammoniacal Nitrogen as NH ₄	mg/l	0.084	0.15	0.06	0.04	0.36	0.12
Dissolved Alkalinity as CaCO ₃	mg/l	-	-	-	-	372	-
Total Alkalinity CaCO ₃	mg/l	-	-	846	3050	17580	2922
Electrical Conductivity @ 25C	µS/cm	800-1875	1000	976	516	638	629
pH			≥ 6.5 and ≤ 9.5	7.71	7.72	6.97	7.65

Table 1 – Groundwater Sampling Data

Surface Water Sampling

Water quality sampling was undertaken on 30/03/2022 by an IE Consulting hydrogeologist. Three of the four surface water locations (SW1, SW2 & SW4) across the site were sampled.

The samples were analysed at Element Laboratories, and the results were interpreted by IE Consulting

The location of the sampling points is shown in Figure 2 below. Location SW3 not sampled as the settlement ponds are not yet constructed.

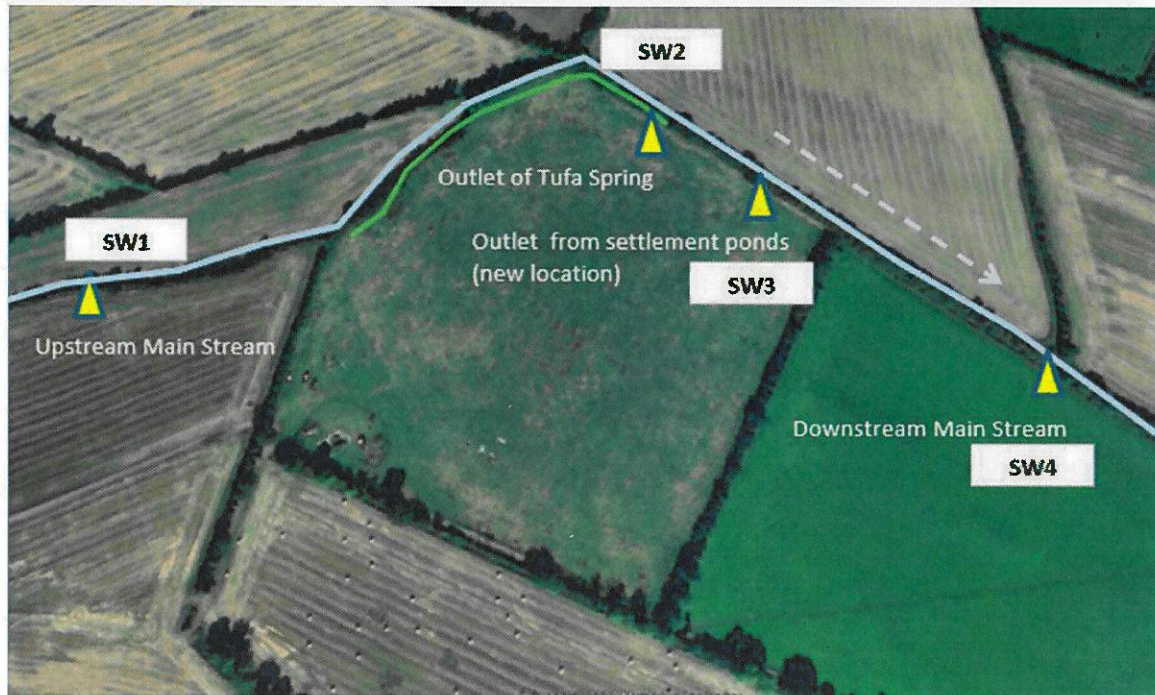


Figure 2 – Surface Water Sampling Locations

Sampling Data shown in Table 2 below.

Sample & Analysis

- pH, Conductivity, Chloride, Sodium, Sulphate, Calcium, Magnesium, Potassium, Ammoniacal N-NH₄, Alkalinity, Nitrate and Phosphorous, total TPH
- To standards BS EN ISO 5667 for Surface Water and BS EN iso 19458 for Groundwater
- Analysis will be at an INAB or UKAS accredited laboratory

INTERPRETATION

The results of analysis are provided in the table below and are compared to the relevant EQS standards. The results are all very similar suggesting, that all streams are calcium rich groundwater fed in the area. There is no evidence of any deterioration in water quality as the stream passes the site.

The only negative is the elevated Nitrate concentrations since nutrient enrichment can cause damage to Tufa spring habitats. The results suggest some nutrient loss to groundwater from the agricultural activity in the vicinity of the site.

Parameter Surface Water Monitoring	SI272/2009 as amended by SI372/2012; SI386/2015; SI77/2019; SI659/2021	Units	SW1	SW2	SW4
			Upstream	Tufa Spring Outlet	Downstream
			30/03/2022	30/03/2022	30/03/2022
Calcium	-	mg/l	117.5	118.8	117.3
Magnesium	-	mg/l	5.2	5.3	6.5
Potassium	-	mg/l	3.2	3	3
Sodium	-	mg/l	6.8	7	9.6
Sulphate as SO ₄	-	mg/l	22.8	22.4	22.9
Chloride	-	mg/l	23.8	23.8	32.6
Nitrate as NO ₃	-	mg/l	39.4	37.7	38.2
Molybdate Reactive Phosphorous as P	≤ 0.035 Good Status	mg/l	<0.015	<0.015	<0.015
Ammoniacal Nitrogen as NH ₄	≤ 0.004 High Status	mg/l	<0.03	0.03	0.03
Electrical Conductivity	-	uS/cm	678	677	699
pH	6.0 < pH < 9.0 *	pH units	8.14	8.31	8.19
Total Alkalinity as CaCO ₃	-	mg/l	302	292	290
TPH CWG					
>C5-C6	-	ug/l	<10	<10	<10
>C6-C8	-	ug/l	<10	<10	<10
>C8-C10	-	ug/l	<10	<10	<10
>C10-C12	-	ug/l	<5	<5	<5
>C12-C16	-	ug/l	<10	<10	<10
>C16-C21	-	ug/l	<10	<10	<10
>C21-C35	-	ug/l	<10	<10	<10
>C35-C44	-	ug/l	<10	<10	<10
Total aliphatics C5-44	-	ug/l	<10	<10	<10
>C5-C6	-	ug/l	<10	<10	<10
>C5-EC7	-	ug/l	<10	<10	<10
>EC7-EC8	-	ug/l	<10	<10	<10
>EC8-EC10	-	ug/l	<10	<10	<10
>EC10-EC12	-	ug/l	<5	<5	<5
>EC12-EC16	-	ug/l	<10	<10	<10
>EC16-EC21	-	ug/l	<10	<10	<10
>EC21-EC35	-	ug/l	<10	<10	<10
>EC35-EC44	-	ug/l	<10	<10	<10
Total aromatics C5-44	-	ug/l	<10	<10	<10
Total aliphatics and aromatics (C5-44)	-	ug/l	<10	<10	<10
MTBE	-	ug/l	<5	<5	<5
Benzene	10 #	ug/l	<5	<5	<5
Toluene	10 #	ug/l	<5	<5	<5
Ethylbenzene	-	ug/l	<5	<5	<5
m/p-Xylene	10 #	ug/l	<5	<5	<5
o-Xylene	10 #	ug/l	<5	<5	<5

*Water hardness > 100 mg/l

River Water body

Table 2 – Surface Water Sampling Data