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6.4 Environmental Statement
Appendix 13.12 Water Environment Monitoring Data

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APFP Regulation 5(2)(a)
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Infrastructure Planning

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6.4 Environmental Statement
Appendix 13.12 Water Environment Monitoring Data

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1 Introduction

1.1 Purpose of this document

1.1.1 This document summarises the methodologies and results for the surface and spring water quality, surface and spring water flow and rainfall data collected to inform ES Chapter 13 Road drainage and the water environment (Document Reference 6.2).

1.1.2 A baseline of the characteristics of the existing water environment have been established to inform ES Chapter 13 Road drainage and the water environment (Document Reference 6.2), to ensure a robust and reliable assessment. This comprises of the following monitoring: surface water and spring water quality, surface water and spring water flow and rainfall. The baseline data from the monitoring can also be used to compare data collected in the construction and operational phases of the scheme against. The EA has been consulted on the scope of the monitoring to be undertaken, as well as key effects of the scheme and mitigation.

1.1.3 Locations of monitoring are shown on ES Figure 13.15 Water environment monitoring locations (Document Reference 6.3).

1.1.4 A water features survey was completed between April 2018 and March 2019, which included five rounds of surveys, and is provided in ES Appendix 13.11 Water Features Survey (Document Reference 6.4). The surveys were conducted within the study area and at some locations beyond the study area as it was developed prior to option 30 becoming the preferred alignment. It is anticipated that locations outside the study area were identified due to their potential hydraulic connectivity to features within the study area that may be impacted. Information collected from these surveys and subsequent site visits were used to inform the scopes.

2 Monitoring scopes

2.1 Surface water quality

Locations

2.1.1 Surface water quality monitoring was carried out at the six locations shown in Table 2-1.

Table 2-1 Surface water quality monitoring locations

ID	Northing	Easting	Receptor
SW1	391327	216435	Tributary of Norman's Brook (downstream of existing A417 crossing)
SW2	392303	215719	Tributary of Norman's Brook (upstream of existing A417 crossing)
SW3	394386	213349	Tributary of River Frome (within Bushley Muzzard SSSI)
SW4	394683	212717	Tributary of River Frome (downstream of Bushley Muzzard SSSI)
SW5	395010	216262	Tributary of River Churn 1 (downstream of National Star)
SW6	396171	215337	Tributary of River Churn 2 (at Coldwell Bottom)

Methodology

2.1.2 Each of these locations were made to be clearly identifiable using marker posts, photographs and physical features as a reference to enable locations to be consistently identified for the duration of the programme.

2.1.3 Plan and cross section sketches at each location were compiled to aid the recording of physical features and the precise location of the site. These were updated on a monthly basis.

2.1.4 At each sampling location photographs and notes of possible influencing factors, such as weather conditions, ambient air temperature, the weather, the presence of dead fish floating in the water or of oil slicks, growth of algae, any unusual sights or smells, and recent management of the watercourse, were recorded as these may have a bearing on the water quality results. Where no water is present, this has been recorded.

In-situ monitoring

2.1.5 The following parameters were monitored in-situ, reducing the potential for contamination or degradation of the samples. The appropriate field kit for undertaking in-situ spot sampling was used and the manufacturer's instructions followed carefully. Calibration of the in-situ monitoring equipment was undertaken as per the manufacturer's instructions and a log detailing the type of calibration and results was kept.

2.1.6 The in-situ parameters that were sampled at all 6 locations include:

- Temperature: Water Temperature influences several other water quality parameters metabolic rates and biological activity of aquatic organisms[i];
- pH: If the pH is too high (Alkali) or too low (Acidic) aquatic organisms will die. pH can also affect solubility and toxicity of chemicals and heavy metals in water[ii];

- Conductivity: Is a measure of waters capability to pass electrical flow. Conductivity is the basis of salinity and total dissolved solids calculations. Conductivity is an early indicator of change in a water system[iii];
- Total Suspended Solids (TSS): TSS are the main cause of turbidity. High TSS blocks light from reaching aquatic plants this may in turn cause them to die due to a reduction in photosynthesis. High TSS can often mean higher concentrations of metal in water[iv];
- Dissolved oxygen (DO): DO is needed for aquatic organisms to respire. If the level is too high or low it can harm aquatic life and affect water quality[v];
- Turbidity: Turbidity is caused by particles and coloured material in water. TSS are the main cause of turbidity[vi];
- Alkalinity: In-situ measurements of alkalinity will allow more accurate characterisation of supersaturated waters in areas of identified and potential tufa formations; and
- Redox: Oxidation-reduction potential for ion exchange environment.

Laboratory sampling

2.1.7 Testing of the below parameters followed standard water quality sampling laboratory procedures and were undertaken in a United Kingdom Accreditation Service (UKAS) accredited laboratory facility. Samples were transported to a certified laboratory for testing within 24 hours from sampling, or within the holding times of the certified laboratory for the parameters sampled (if shorter) in a sturdy insulated box to protect samples from sunlight, prevent the breakage of sample bottles, and the use of cool packs should have allowed a temperature of 4°C to be maintained during transport. The samples were delivered to the laboratory.

2.1.8 The laboratory parameters sampled at all 6 locations include:

- General parameters: pH, Electrical Conductivity (EC), alkalinity
- Aluminium (Al): Al can be toxic to fish between pH values 5.0 and 5.5, and Al ions can accumulate on gills and obstruct them, limiting the ability to breathe[vii]
- Arsenic (As) (total and dissolved): Arsenic is toxic to wildlife in the vicinity of its release[viii]
- Calcium (Ca): Ca is a dietary requirement for most organisms, except for some insects and bacteria[ix]
- Copper (Cu) (total and dissolved): Cu can be toxic to fish and aquatic organisms. In fish, the adverse effects include that gills can lose their ability to regulate transport of salts important for the functioning of the cardiovascular and nervous systems[x]
- Cadmium (Cd) (total and dissolved): Cd can impact photosynthesis and transpiration in plants and can affect the growth and reproduction of micro-organisms in soil and water and of fish[xi]
- Dissolved Organic Carbon (DOC): DOC is a primary food sources for aquatic organisms
- Lead (Pb) (total and dissolved): Exposure to high levels of lead is toxic to plants and animals and the solubility of lead increases in acidic waters[xii]
- Zinc (Zn) (total and dissolved): Zn can be toxic even at low concentrations within aquatic organisms, with potential contributions to the water environment coming from car tires (containing Zn), brakes and motor oils[xiii]
- Total Petroleum Hydrocarbons (TPH) (speciated, aliphatic and aromatic split): impact aquatic organisms and ecosystems;

  - Polycyclic Aromatic Hydrocarbons (16 US EPA PAHs)
  - Major ions (anions and cations)
- Nutrients: nitrates and phosphate

2.1.9 *Frequency*

2.1.10 Water quality sampling was undertaken on a monthly basis, with samples taken at a similar time of day throughout the programme and each sample taken approximately 4 weeks apart from the previous round.

2.2 Surface water flow

Locations

2.2.1 Surface water flow monitoring has been undertaken at the six locations shown in Table 2-2.

Table 2-2 Surface water flow monitoring locations

ID	Northing	Easting	Type of measurement	Receptor
SW1	391327	216435	Manual	Tributary of Norman's Brook (downstream of existing A417 crossing)
SW2	392303	215719	Automatic	Tributary of Norman's Brook (upstream of existing A417 crossing)
SW3	394386	213349	Manual	Tributary of River Frome (within Bushley Muzzard SSSI)
SW4	394683	212717	Automatic	Tributary of River Frome (downstream of Bushley Muzzard SSSI)
SW5	395010	216262	Manual	Tributary of River Churn 1 (downstream of National Star)
SW6	396171	215337	Automatic	Tributary of River Churn 2 (at Coldwell Bottom)

Methodology

2.2.2 Each of these locations were made to be clearly identifiable using marker posts, photographs and physical features as a reference to enable locations to be consistently identified for the duration of the programme.

2.2.3 Plan and cross section sketches at each location have been compiled to aid the recording of physical features and the precise location of the site. These have been updated on a monthly basis.

2.2.4 All surface water level monitoring activities and installations were conducted in accordance with relevant British Standards, industry guidance and best practice, including:

- Environment Agency (2011), Hydrometric manual
- British Standard ISO 4373: 2008 Hydrometry – Water level measuring devices

2.2.5 At surface water monitoring locations, the type of flow measurement depends upon the suitability of the location. Each location has been assessed for suitability prior to installation.

2.2.6 Calibration of monitoring equipment was undertaken as per the manufacturer's instructions and a log detailing the type of calibration and results has been kept.

Automatic flow measurement

2.2.7 Acoustic (echo) correlation velocity profilers and ultrasonic doppler systems were bed mounted onto a levelled concreted slab and left in-situ for the duration of the programme.

2.2.8 Should this method be not appropriate due to local conditions or circumstances, plans were made for alternative solutions to be developed and proposed. This was a consideration particularly in locations that were likely to be temporarily dry for extended periods of time.

Manual flow measurement

2.2.9 Manual flow gauging measurements were taken using the most appropriate technique, such as a calibrated rotating element or electromagnetic current meter for wade gauging or where flow monitoring locations were greater than 0.5m at the deepest point of the cross section, flow gauging was undertaken using an Acoustic Doppler Current Profiler (ADCP). The ADCP was deployed and operated by a suitably qualified hydrologist.

2.2.10 Electromagnetic current meters were considered where monitoring locations experience very low velocities (<0.1m/s), shallow depths, high silt loads and/or vegetated conditions.

2.2.11 When using an electromagnetic current meter, care was taken during the site selection process to ensure the monitoring location was remote from overhead or underground power cables, or other structure which may generate an electrical magnetic field which could have interfered with the electromagnetic current meter.

2.2.12 Where no flow was present, this has been recorded.

Frequency

Automatic flow measurement

2.2.13 Automatic flow monitoring was undertaken throughout the baseline phase of the proposed scheme on 15-minute intervals.

Manual flow measurement

2.2.14 Manual flow measurements were undertaken on a monthly basis.

2.3 Spring water quality

Locations

2.3.1 Spring water quality monitoring was undertaken at the eight locations shown in Table 2-3.

Table 2-3 Spring water quality monitoring locations

ID	Northing	Easting	Spring Type	Receptor[1]
GW1	392415	215702	Spring (previously considered to be potential tufa formation)	81 (supplying tributary of Norman's Brook)
GW2	392839	215713	Spring considered to support tufa habitat	G231 (supplying tributary of Norman's Brook)
GW3	393056	215689	Spring	Supplying tributary of Norman's Brook
GW4	393069	215849	Spring	76 (supplying tributary of Norman's Brook)
GW5	394249	213387	Spring	Within Bushley Muzzard SSSI and supplying unnamed tributary of River Frome
GW6	394392	213186	Spring with potential tufa formation	G11 (within Bushley Muzzard SSSI)
GW7	394154	216527	Spring	Spring shown on OS mapping (at National Star)
GW8	394531	214760	Spring with potential tufa formation	G4 (supplying unnamed tributary of River Churn 2)

Methodology

2.3.2 Each of these locations were made clearly identifiable using marker posts, photographs and physical features as a reference to enable locations to be consistently identified for the duration of the programme.

2.3.3 Plan and cross section sketches at each location have been compiled to aid the recording of physical features and the precise location of the site. These were updated on a monthly basis.

2.3.4 At each sampling location photographs and notes of possible influencing factors, such as weather conditions, ambient air temperature, the weather, the presence of dead fish floating in the water or of oil slicks, growth of algae, any unusual sights or smells, and recent management of the watercourse, were recorded as these may have had a bearing on the water quality results. Where no water was present, this has been recorded.

2.3.5 Water sampling at springs with potential tufa formations had to be taken from spring inflows, runnels or outflows in conjunction with in-situ water quality parameters and notes taken on the vegetation. The samples could not be collected from pure stands. Care was taken to avoid disturbing turbidity.

In-situ monitoring

2.3.6 The following parameters were monitored in-situ, reducing the potential for contamination or degradation of the samples. The appropriate field kit for undertaking in-situ spot sampling was acquired, and the manufacturer's instructions followed carefully. Calibration of the in-situ monitoring equipment was

[1] Identification number/reference described ES Appendix 13.11 Water Features Survey (Document Reference 6.4)

undertaken as per the manufacturer's instructions and a log detailing the type of calibration and results was kept.

2.3.7 The in-situ parameters sampled at all 8 locations include:

- Temperature: Water Temperature influences several other water quality parameters metabolic rates and biological activity of aquatic organisms[xiv];
- pH: If the pH is too high (Alkali) or too low (Acidic) aquatic organisms will die. pH can also affect solubility and toxicity of chemicals and heavy metals in water[xv];
- Conductivity: Is a measure of waters capability to pass electrical flow. Conductivity is the basis of salinity and total dissolved solids calculations. Conductivity is an early indicator of change in a water system[xvi];
- Total Suspended Solids (TSS): TSS are the main cause of turbidity. High TSS blocks light from reaching aquatic plants this may in turn cause them to die due to a reduction in photosynthesis. High TSS can often mean higher concentrations of metal in water[xvii];
- Dissolved oxygen (DO): DO is needed for aquatic organisms to respire. If the level is too high or low it can harm aquatic life and affect water quality[xviii];
- Turbidity: Turbidity is caused by particles and coloured material in water. TSS are the main cause of turbidity[xix];
- Alkalinity: In-situ measurements of alkalinity will allow more accurate characterisation of supersaturated waters in areas of identified and potential tufa formations; and
- Redox: Oxidation-reduction potential for ion exchange environment.

Laboratory sampling

2.3.8 Testing of the below parameters followed standard water quality sampling laboratory procedures and were undertaken in a United Kingdom Accreditation Service (UKAS) accredited laboratory facility. Samples were transported to a certified laboratory for testing within 24 hours from sampling, or within the holding times of the certified laboratory for the parameters sampled (if shorter) in a sturdy insulated box to protect samples from sunlight, prevent the breakage of sample bottles, and the use of cool packs allowed a temperature of 4°C to be maintained during transport. The samples were delivered to the laboratory.

2.3.9 To provide additional data on baseline water quality, to allow characterisation of emerging springs water quality in relation to the groundwater and to develop understanding of tufa formation process, the following testing suites will be required at the spring water quality monitoring locations:

- General parameters: pH, Electrical Conductivity (EC), alkalinity;
- Major ions (anions and cations); and
- Nutrients: nitrates and phosphate.

Frequency

2.3.10 Water quality sampling was undertaken on a monthly basis, with samples taken at a similar time of day throughout the programme approximately 4 weeks apart from the previous round.

2.4 Spring water flow

Locations

2.4.1 Spring water flow monitoring will be undertaken at the five locations shown in Table 2-4.

Table 2-4 Spring water flow monitoring locations

ID	Northing	Easting	Receptor[2]
GW2	392839	215713	G231 (supplying tributary of Norman's Brook)
GW4	393069	215849	76 (supplying tributary of Norman's Brook)
GW6	394392	213186	G11 (within Bushley Muzzard SSSI)
GW7	394154	216527	Spring shown on OS mapping (at National Star)
GW8	394531	214760	G4 (supplying unnamed tributary of River Churn 2)

Methodology

2.4.2 Each of these locations were made clearly identifiable using marker posts, photographs and physical features as a reference to enable locations to be consistently identified for the duration of the programme.

2.4.3 Plan and cross section sketches at each location have been compiled to aid the recording of physical features and the precise location of the site. These have been updated on a monthly basis.

2.4.4 All surface water level monitoring activities and installations were conducted in accordance with relevant British Standards, industry guidance and best practice, including:

- Environment Agency (2011), Hydrometric manual
- British Standard ISO 4373: 2008 Hydrometry – Water level measuring devices

2.4.5 For spring flow monitoring locations, only manual flow measurements have been undertaken.

2.4.6 Calibration of monitoring equipment has been undertaken as per the manufacturer's instructions and a log detailing the type of calibration and results kept.

Manual flow measurement

2.4.7 Manual flow gauging measurements were taken using the most appropriate technique, such as a calibrated rotating element (REM) or electromagnetic current meter for wade gauging.

2.4.8 Electromagnetic current meters were used where monitoring locations experience very low velocities (<0.1m/s), shallow depths, high silt loads and/or vegetated conditions.

2.4.9 Where no flow is present, this was recorded.

[2] Identification number/reference described ES Appendix 13.11 Water Features Survey (Document Reference 6.4)

Frequency

Manual flow measurement

2.4.10 Manual flow measurements were undertaken on a monthly basis.

2.5 Rainfall

Locations

2.5.1 Surface water flow monitoring will be undertaken at the two locations shown in Table 2-5.

Table 2-5 Rainfall monitoring locations

ID	Northing	Easting
R1	392468	215428
R2	394733	214567

Methodology

2.5.2 Prior to installation, the height of sheltering objects around the site will be measured, taking into account anticipated growth of surrounding vegetation. If the site is considered to be unsuitable following this, it will be relocated to a more suitable location nearby and the location recorded. In locations that may be over exposed, with no natural shelter, a turf wall may be used or a wind screen.

2.5.3 Where required, protection, such as a fence, may need to be installed should the location be within a field containing livestock. If this is the case, care will be taken to ensure that this does not impact the performance of the rain gauge.

2.5.4 On a monthly basis, data will be downloaded from each of the gauges and calibration and maintenance undertaken where required, as per the manufacturer's instructions. Additionally, photographs will be taken, and notes of possible influencing factors recorded, such as the height of sheltering objects (e.g. vegetation) at each rain gauge location.

Frequency

2.5.5 Data from the rain gauge will be downloaded and the location of the rain gauge will be inspected to note any changes in the exposure of the instrument on a monthly basis.

3 Results

3.1 Surface water quality

In-situ monitoring

3.1.1 Table 3-1 to Table 3-6 display surface water quality results from in-situ monitoring between August 2020 and April 2021. Monitoring for March 2021 was unable to be conducted, and samples were taken in early April 2021

Table 3-1 In-situ surface water quality data August 2020

Location ID	SW1	SW2	SW3	SW4	SW5
Date	24-Aug-20	24-Aug-20	25-Aug-20	25-Aug-20	24-Aug-20
Time (GMT)	11:44	13:19	10:25	13:05	16:04
pH	7.91	7.76	7.94	8.18	7.86
Actual Conductivity (µS/cm)	565.58	458.14	460.3	358.6	479.54
Specific Conductivity (µS/cm)	693.49	575.96	567.98	438.17	596.44
Salinity (PSU)	0.34	0.28	0.28	0.21	0.29
Total Dissolved Solids (ppt)	0.45	0.37	0.37	0.28	0.39
Turbidity (NTU)	11.76	20.98	42.27	20.19	9.06
Total Suspended Solids (mg/L)	0.00	0.00	0.00	0.00	0.00
RDO Concentration (mg/L)	8.39	8.43	8.41	8.49	8.48
RDO Saturation (%)	84.40	82.82	84.14	85.65	84.21
Oxygen Partial Pressure (Torr)	131.40	129.09	131.05	133.33	131.20
Temperature (°C)	15.35	14.28	15.07	15.49	14.73

Table 3-2 In-situ surface water quality data September 2020

Location ID	SW1	SW2	SW3	SW4	SW5
Date	15-Sep-20	15-Sep-20	16-Sep-20	16-Sep-20	15-Sep-20
Time (GMT)	10:48	12:02	12:38	11:05	13:58
pH	8.07	7.94	7.96	7.79	8.09
Actual Conductivity (µS/cm)	504.51	471.62	590.58	490.24	536.04
Specific Conductivity (µS/cm)	634.55	590.23	739.69	621.60	663.90
Salinity (PSU)	0.31	0.29	0.36	0.30	0.33
Total Dissolved Solids (ppt)	0.41	0.38	0.48	0.40	0.43
Turbidity (NTU)	21.15	28.92	12.92	0.01	10.98
Total Suspended Solids (mg/L)	0.00	0.00	0.00	0.00	0.00
RDO Concentration (mg/L)	8.83	8.49	9.31	7.91	8.54
RDO Saturation (%)	86.77	83.73	91.88	77.15	85.00
Oxygen Partial Pressure (Torr)	135.25	130.50	143.26	120.30	132.41
Temperature (°C)	14.27	14.42	14.45	13.95	14.91

Table 3-3 In-situ surface water quality data October 2020

Location ID	SW1	SW2	SW3	SW4	SW5	SW6
Date	20-Oct-20	20-Oct-20	21-Oct-20	21-Oct-20	22-Oct-20	22-Oct-20
Time (GMT)	15:12	12:58	15:50	14:56	12:05	10:40
pH	8.26	8.30	7.79	8.41	8.07	7.87
Actual Conductivity (µS/cm)	478.84	445.06	503.91	418.52	467.38	288.41
Specific Conductivity (µS/cm)	638.16	595.09	671.18	555.30	627.68	395.02
Salinity (PSU)	0.31	0.29	0.33	0.27	0.31	0.19
Total Dissolved Solids (ppt)	0.41	0.39	0.44	0.36	0.41	0.25
Turbidity (NTU)	12.46	13.58	19.35	7.96	3.13	1.07
Total Suspended Solids (mg/L)	0.00	0.00	0.00	0.00	0.00	0.00
RDO Concentration (mg/L)	10.45	10.07	10.18	10.63	10.51	8.99
RDO Saturation (%)	99.84	95.89	97.39	101.97	99.77	83.79
Oxygen Partial Pressure (Torr)	126.59	121.59	123.48	129.27	126.55	106.34
Temperature (°C)	11.92	11.80	11.95	12.09	11.63	10.86

Table 3-4 In-situ surface water quality data November 2020

Location ID	SW1	SW2	SW3	SW4	SW5	SW6
Date	18-Nov-20	18-Nov-20	19-Nov-20	19-Nov-20	18-Nov-20	18-Nov-20
Time (GMT)	15:48	11:40	11:14	13:50	14:21	15:30
pH	8.53	8.48	8.01	8.47	8.02	8.01
Actual Conductivity (µS/cm)	418.32	388.60	512.93	453.51	444.62	351.71
Specific Conductivity (µS/cm)	588.88	532.07	716.17	646.01	606.22	479.42
Salinity (PSU)	0.29	0.26	0.35	0.31	0.29	0.23
Total Dissolved Solids (ppt)	0.38	0.35	0.47	0.42	0.39	0.31
Turbidity (NTU)	18.56	55.34	5.11	2.58	1.75	0.14
RDO Concentration (mg/L)	12.37	11.62	11.52	12.38	10.74	9.80
RDO Saturation (%)	112.58	104.22	105.70	111.53	96.74	91.67
Oxygen Partial Pressure (Torr)	143.02	137.47	134.23	141.65	127.59	116.33
Temperature (°C)	9.83	10.87	10.14	9.39	11.05	11.02

Table 3-5 In-situ surface water quality data December 2020 (round 1)

Location ID	SW1	SW2	SW3	SW4	SW5	SW6
Date	14-Dec-20	14-Dec-20	16-Dec-20	15-Dec-20	16-Dec-20	16-Dec-20
Time (GMT)	10:47	11:59	09:28	12:43	14:05	12:40
pH	8.18	8.25	7.96	8.33	7.65	7.80
Actual Conductivity (µS/cm)	438.05	371.14	530.23	452.05	376.54	330.51
Specific Conductivity (µS/cm)	632.72	534.19	760.79	667.63	546.30	485.10
Salinity (PSU)	0.31	0.26	0.37	0.32	0.26	0.23
Total Dissolved Solids (ppt)	0.41	0.35	0.49	0.43	0.36	0.32
Turbidity (NTU)	36.64	56.24	17.94	2.42	177.95	1.05
RDO Concentration (mg/L)	11.16	11.14	10.58	11.55	10.31	10.11
RDO Saturation (%)	100.10	100.14	95.46	101.62	92.01	89.31
Oxygen Partial Pressure (Torr)	137.72	137.76	131.30	139.88	126.60	122.93
Temperature (°C)	8.89	9.00	9.13	8.09	8.72	8.31

Table 3-6 In-situ surface water quality data December 2020 (round 2)

Location ID	SW1	SW2	SW3	SW4	SW5	SW6
Date	21-Dec-20	21-Dec-20	22-Dec-20	22-Dec-20	21-Dec-20	22-Dec-20
Time (GMT)	09:15	10:16	11:40	10:01	14:38	15:53
pH	8.28	8.32	8.04	8.37	7.63	7.82
Actual Conductivity (µS/cm)	379.83	340.78	439.09	406.40	403.33	316.76
Specific Conductivity (µS/cm)	542.18	483.59	627.14	587.44	573.90	459.61
Salinity (PSU)	0.26	0.23	0.30	0.28	0.28	0.22
Total Dissolved Solids (ppt)	0.35	0.31	0.41	0.38	0.37	0.30
Turbidity (NTU)	110.76	81.73	41.28	8.07	6.68	2.22
RDO Concentration (mg/L)	10.88	10.87	10.58	11.14	9.67	10.70
RDO Saturation (%)	96.51	96.88	94.54	98.48	85.96	94.27
Oxygen Partial Pressure (Torr)	139.69	140.22	135.74	141.44	124.41	135.41
Temperature (°C)	9.32	9.53	9.30	8.86	9.44	8.74

Table 3-7 In-situ surface water quality data January 2021

Location ID	SW1	SW2	SW3	SW4	SW5	SW6
Date	26-Jan-21	26-Jan-21	27-Jan-21	26-Jan-21	27-Jan-21	27-Jan-21
Time (GMT)	11:14	12:11	10:12	16:31	14:11	13:49
pH	8.43	8.44	7.87	8.38	7.76	7.84
Actual Conductivity (µS/cm)	435.70	393.67	603.60	909.32	469.61	317.60
Specific Conductivity (µS/cm)	645.01	580.34	904.53	1402.30	691.26	473.15
Salinity (PSU)	0.31	0.28	0.44	0.69	0.34	0.23
Total Dissolved Solids (ppt)	0.42	0.38	0.59	0.91	0.45	0.31
Turbidity (NTU)	18.37	22.99	34.42	5.68	4.28	1.74
RDO Concentration (mg/L)	12.18	12.10	11.71	12.41	11.33	10.98
RDO Saturation (%)	106.69	106.37	101.61	105.33	99.78	95.59
Oxygen Partial Pressure (Torr)	142.36	141.91	135.62	140.68	133.11	127.57
Temperature (°C)	8.00	8.15	7.57	6.61	8.21	7.77

Table 3-8 In-situ surface water quality data February 2021

Location ID	SW1	SW2	SW3	SW4	SW5	SW6
Date	25-Feb-21	25-Feb-21	24-Feb-21	25-Feb-21	24-Feb-21	24-Feb-21
Time (GMT)	14:15	12:21	11:44	09:19	15:27	14:24
pH	8.42	8.44	7.94	8.34	7.93	8.02
Actual Conductivity (µS/cm)	437.96	397.13	541.55	478.12	454.25	338.37
Specific Conductivity (µS/cm)	624.15	566.50	766.67	701.24	645.89	471.24
Salinity (PSU)	0.30	0.27	0.37	0.34	0.31	0.23
Total Dissolved Solids (ppt)	0.41	0.37	0.50	0.46	0.42	0.31
Turbidity (NTU)	23.53	33.31	8.08	1.22	2.00	1.97
RDO Concentration (mg/L)	11.99	11.97	11.24	12.31	11.25	10.65
RDO Saturation (%)	108.69	108.35	102.50	108.79	102.15	98.37
Oxygen Partial Pressure (Torr)	144.86	144.42	136.58	145.14	136.14	131.02
Temperature (°C)	9.40	9.33	9.63	8.35	9.46	10.22

Table 3-9 In-situ surface water quality data April 2021

Location ID	SW1	SW2	SW3	SW4	SW5	SW6
Date	07-Apr-21	06-Apr-21	06-Apr-21	06-Apr-21	06-Apr-21	06-Apr-21
Time (GMT)	09:44	15:45	12:08	10:55	14:47	14:03
pH	8.37	8.26	7.87	8.24	8.08	7.86
Actual Conductivity (µS/cm)	406.13	369.17	440.59	331.76	408.05	301.64
Specific Conductivity (µS/cm)	649.89	572.78	663.42	557.41	585.63	478.11
Salinity (PSU)	0.31	0.27	0.32	0.26	0.28	0.23
Total Dissolved Solids (ppt)	0.42	0.37	0.43	0.36	0.38	0.31
Turbidity (NTU)	14.08	23.64	7.17	0.00	7.36	9.08
RDO Concentration (mg/L)	12.61	12.05	11.95	13.84	10.93	11.02
RDO Saturation (%)	100.44	98.56	100.25	105.88	95.62	88.51
Oxygen Partial Pressure (Torr)	144.12	141.34	143.69	152.09	136.86	127.01
Temperature (°C)	5.35	6.39	7.40	3.80	9.14	5.68

Laboratory sampling

3.1.2 Table 3-10 to Table 3-18 display surface water quality results from laboratory samples between August 2020 and April 2021. Monitoring for March 2021 was unable to be conducted, and samples were taken in early April 2021.

Table 3-10 Laboratory surface water quality data August 2020

Location ID	SW1	SW2	SW3	SW4	SW5
Date	24-Aug-20	24-Aug-20	25-Aug-20	25-Aug-20	24-Aug-20
Time (GMT)	11:45	13:45	10:00	13:08	16:15
Lab ID	19696091	19696092	19619033	19619034	19696093
Cadmium, Total as Cd, mg/l	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Cadmium, Filtered as Cd, mg/l	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Copper, Filtered as Cu, mg/l	<0.009	<0.009	<0.009	<0.009	<0.009
Copper, Total as Cu, mg/l	<0.009	<0.009	0.011	<0.009	<0.009
Lead , Total as Pb, mg/l	<0.006	<0.006	<0.006	<0.006	<0.006
Lead, Filtered as Pb, mg/l	<0.006	<0.006	<0.006	<0.006	<0.006
pH	8.4	8.3	8.2	8.3	8.1
Conductivity- Electrical 20C, uS/cm	608	579	485	396	636
Alkalinity as CaCO3, mg/l	225	235	168	158	198
Nitrate as N, mg/l	1.2	0.7	0.8	0.9	5.3
Phosphates , Total as P, mg/l	0.12	<0.120	0.13	<0.120	0.28
TOC (Filtered), mg/l	3.3	2.4	6.2	5.9	2.6
Aliphatic EPH >C10 - C12, ug/l	<10	<10	<10	<10	<10
Aliphatic EPH >C12 - C16, ug/l	<10	<10	<10	<10	<10
Aliphatic EPH >C16 - C35, ug/l	<10	<10	<10	<10	<10
Aliphatic EPH >C35 - C44, ug/l	<10	<10	<10	<10	<10
Aliphatic EPH >C10 - C44, ug/l	<10	<10	<10	<10	<10
Aromatic EPH >C10 - C12, ug/l	<10	<10	<10	<10	<10
Aromatic EPH >C12 - C16, ug/l	<10	<10	<10	<10	<10
Aromatic EPH >C16 - C21, ug/l	<10	<10	<10	<10	<10

Location ID	SW1	SW2	SW3	SW4	SW5
Aromatic EPH >C21 - C35, ug/l	<10	<10	<10	<10	<10
Aromatic EPH >C35 - C44, ug/l	<10	<10	<10	<10	<10
Aromatic EPH >C10 - C44, ug/l	<10	<10	<10	<10	<10
EPH >C10 - C44, ug/l	<10	<10	<10	<10	<10
Acenaphthene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01
Aluminium, total as Al (mg/l)	0.11	0.47	0.41	0.2	0.25
Anthracene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic, filter as As (mg/l)	0.0011	0.0006	0.0011	0.0008	0.0011
Arsenic, total as As (mg/l)	0.0014	0.0003	0.0014	0.00097	0.0017
Benzo(a)anthracene, ug/l	<0.01	<0.01	0.025	0.012	<0.01
Benzo(a)pyrene, ug/l	<0.01	<0.01	0.051	0.029	<0.01
Benzo(b)fluoranthene, ug/l	<0.01	<0.01	0.048	0.029	<0.01
Benzo(ghi)perylene, ug/l	<0.01	<0.01	0.049	0.026	<0.01
Benzo(k)fluoranthene, ug/l	<0.01	<0.01	0.024	0.015	<0.01
Calcium, total as Ca (mg/l)	110	17.1	81.6	75.9	120
Chrysene, ug/l	<0.01	<0.01	0.028	0.016	<0.01
Dibenzo(ah)anthracene, ug/l	<0.01	<0.01	0.013	<0.01	<0.01
Fluoranthene, ug/l	<0.01	<0.01	0.05	0.034	<0.01
Fluorene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(123cd)pyrene, ug/l	<0.01	<0.01	0.05	0.029	<0.01
Naphthalene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01
PAH, Total of 16, ug/l	<0.01	<0.01	0.388	0.224	<0.01
Phenanthrene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01
Pyrene, ug/l	<0.01	<0.01	0.051	0.034	<0.01
Zinc, filter as Zn (mg/l)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc, total as Zn (mg/l)	0.009	0.66	0.021	0.012	0.015

Table 3-11 Laboratory surface water quality data September 2020

Location ID	SW1	SW2	SW3	SW4	SW5
Date	15-Sep-20	15-Sep-20	16-Sep-20	16-Sep-20	15-Sep-20
Time (GMT)	10:52	12:02	12:40	11:07	13:58
Lab ID	19690422	19690423	19686157	19686156	19690424
Cadmium, Total as Cd, mg/l	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Cadmium, Filtered as Cd, mg/l	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Copper, Filtered as Cu, mg/l	<0.009	<0.009	<0.009	<0.009	<0.009
Copper, Total as Cu, mg/l	<0.009	<0.009	<0.009	<0.009	<0.009
Lead , Total as Pb, mg/l	<0.006	<0.006	<0.006	<0.006	<0.006
Lead, Filtered as Pb, mg/l	<0.006	<0.006	<0.006	<0.006	<0.006
pH	8.4	8.3	7.8	8.2	8.3
Conductivity- Electrical 20C, uS/cm	582	540	628	563	615
Alkalinity as CaCO3, mg/l	218	221	250	247	189
Nitrate as N, mg/l	0.9	1.1	1.5	1.9	9.5
Phosphates , Total as P, mg/l	<0.120	<0.120	<0.120	<0.120	0.76
TOC (Filtered), mg/l	2.3	2	1.2	1.9	2.4
Aliphatic EPH >C10 - C12, ug/l	<10	<10	<10	<10	<10
Aliphatic EPH >C12 - C16, ug/l	<10	<10	<10	<10	<10
Aliphatic EPH >C16 - C35, ug/l	<10	<10	<10	<10	12
Aliphatic EPH >C35 - C44, ug/l	<10	<10	<10	<10	<10
Aliphatic EPH >C10 - C44, ug/l	<10	<10	<10	<10	12
Aromatic EPH >C10 - C12, ug/l	<10	<10	<10	<10	<10
Aromatic EPH >C12 - C16, ug/l	<10	<10	<10	<10	<10
Aromatic EPH >C16 - C21, ug/l	<10	<10	<10	<10	<10
Aromatic EPH >C21 - C35, ug/l	<10	<10	<10	<10	<10
Aromatic EPH >C35 - C44, ug/l	<10	<10	<10	<10	<10
Aromatic EPH >C10 - C44, ug/l	<10	<10	<10	<10	<10

Location ID	SW1	SW2	SW3	SW4	SW5
EPH >C10 - C44, ug/l	-	-	<10	<10	-
Acenaphthene, ug/l	<0.01	N/S	<0.01	<0.01	N/S
Acenaphthylene, ug/l	<0.01	N/S	<0.01	<0.01	N/S
Aluminium, total as Al (mg/l)	0.15	0.25	0.16	0.032	0.05
Anthracene, ug/l	<0.01	N/S	<0.01	<0.01	N/S
Arsenic, filter as As (mg/l)	0.0008	0.0007	0.0002	0.0005	0.001
Arsenic, total as As (mg/l)	0.0011	0.0013	0.00036	0.0004	0.0011
Benzo(a)anthracene, ug/l	<0.01	N/S	<0.01	<0.01	N/S
Benzo(a)pyrene, ug/l	<0.01	N/S	<0.01	<0.01	N/S
Benzo(b)fluoranthene, ug/l	<0.01	N/S	<0.01	<0.01	N/S
Benzo(ghi)perylene, ug/l	<0.01	N/S	<0.01	<0.01	N/S
Benzo(k)fluoranthene, ug/l	<0.01	N/S	<0.01	<0.01	N/S
Calcium, total as Ca (mg/l)	110	110	150	120	97
Chrysene, ug/l	<0.01	N/S	<0.01	<0.01	N/S
Dibenzo(ah)anthracene, ug/l	<0.01	N/S	<0.01	<0.01	N/S
Fluoranthene, ug/l	<0.01	N/S	<0.01	<0.01	N/S
Fluorene, ug/l	<0.01	N/S	<0.01	<0.01	N/S
Indeno(123cd)pyrene, ug/l	<0.01	N/S	<0.01	<0.01	N/S
Naphthalene, ug/l	<0.01	N/S	0.02	0.01	N/S
PAH, Total of 16, ug/l	<0.01	N/S	0.02	0.01	N/S
Phenanthrene, ug/l	<0.01	N/S	<0.01	<0.01	N/S
Pyrene, ug/l	<0.01	N/S	<0.01	<0.01	N/S
Zinc, filter as Zn (mg/l)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc, total as Zn (mg/l)	0.012	0.03	<0.006	<0.006	0.006

Table 3-12 Laboratory surface water quality data October 2020

Location ID	SW1	SW2	SW3	SW4	SW5	SW6
Date	20-Oct-20	20-Oct-20	21-Oct-20	21-Oct-20	22-Oct-20	22-Oct-20
Time (GMT)	15:00	13:00	15:50	14:50	12:05	10:40
Lab ID	19794641	19794642	19799582	19799581	19803374	19803375
Cadmium, Total as Cd, mg/l	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Cadmium, Filtered as Cd, mg/l	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Copper, Filtered as Cu, mg/l	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Copper, Total as Cu, mg/l	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Lead , Total as Pb, mg/l	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Lead, Filtered as Pb, mg/l	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
pH	8.4	8.3	8.2	7.9	8.1	8.1
Conductivity- Electrical 20C, uS/cm	567	532	489	601	557	457
Alkalinity as CaCO3, mg/l	238	225	232	266	209	257
Nitrate as N, mg/l	1.5	2	1.9	2.2	7.2	0.8
Phosphates , Total as P, mg/l	<0.120	<0.120	<0.120	<0.120	0.24	<0.120
TOC (Filtered), mg/l	2.3	2.3	4.5	2.9	2.4	3.7
Aliphatic EPH >C10 - C12, ug/l	<10	<10	<10	<10	<10	<10
Aliphatic EPH >C12 - C16, ug/l	<10	<10	<10	<10	<10	<10
Aliphatic EPH >C16 - C35, ug/l	<10	<10	<10	12	<10	<10
Aliphatic EPH >C35 - C44, ug/l	<10	<10	<10	<10	<10	<10
Aliphatic EPH >C10 - C44, ug/l	<10	<10	<10	12	<10	<10
Aromatic EPH >C10 - C12, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C12 - C16, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C16 - C21, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C21 - C35, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C35 - C44, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C10 - C44, ug/l	<10	<10	<10	<10	<10	<10

Location ID	SW1	SW2	SW3	SW4	SW5	SW6
EPH >C10 - C44, ug/l	<10	<10	<10	12	<10	<10
Acenaphthene, ug/l	-	-	<0.01	<0.01	<0.10	<0.10
Acenaphthylene, ug/l	-	-	<0.01	<0.01	<0.10	<0.10
Aluminium, total as Al (mg/l)	-	-	0.11	0.12	0.1	0.021
Anthracene, ug/l	-	-	<0.01	<0.01	<0.10	<0.10
Arsenic, filter as As (mg/l)	0.0006	0.001	0.0004	0.0003	0.0007	0.001
Arsenic, total as As (mg/l)	0.0011	0.0041	0.00042	0.00036	0.00099	0.0014
Benzo(a)anthracene, ug/l	-	-	<0.01	0.01	<0.10	<0.10
Benzo(a)pyrene, ug/l	-	-	<0.01	0.01	<0.10	<0.10
Benzo(b)fluoranthene, ug/l	-	-	0.01	0.02	<0.10	<0.10
Benzo(ghi)perylene, ug/l	-	-	<0.01	0.02	<0.10	<0.10
Benzo(k)fluoranthene, ug/l	-	-	<0.01	<0.01	<0.10	<0.10
Calcium, total as Ca (mg/l)	100	100	96.8	120	110	110
Chrysene, ug/l	-	-	<0.01	0.01	<0.10	<0.10
Dibenzo(ah)anthracene, ug/l	-	-	<0.01	<0.01	<0.10	<0.10
Fluoranthene, ug/l	-	-	0.02	0.02	<0.10	<0.10
Fluorene, ug/l	-	-	<0.01	<0.01	<0.10	<0.10
Indeno(123cd)pyrene, ug/l	-	-	<0.01	0.02	<0.10	<0.10
Naphthalene, ug/l	-	-	<0.01	<0.01	<0.10	<0.10
PAH, Total of 16, ug/l	-	-	0.04	0.13	<0.10	<0.10
Phenanthrene, ug/l	-	-	<0.01	<0.01	<0.10	<0.10
Pyrene, ug/l	-	-	0.02	0.02	<0.10	<0.10
Zinc, filter as Zn (mg/l)	<0.0050	<0.0050	<0.0050	0.0052	<0.0050	<0.0050
Zinc, total as Zn (mg/l)	0.008	0.014	0.008	0.01	0.007	<0.006

Table 3-13 Laboratory surface water quality data November 2020

Location ID	SW1	SW2	SW3	SW4	SW5	SW6
Date	19-Nov-20	18-Nov-20	19-Nov-20	19-Nov-20	18-Nov-20	18-Nov-20
Time (GMT)	15:40	11:40	11:11	13:55	14:21	15:30
Lab ID	19890569	19886167	19890570	19890571	19886168	19886169
Cadmium, Total as Cd, mg/l	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Cadmium, Filtered as Cd, mg/l	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Copper, Filtered as Cu, mg/l	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Copper, Total as Cu, mg/l	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Lead , Total as Pb, mg/l	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Lead, Filtered as Pb, mg/l	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
pH	8.4	8.3	8	8	8.1	8.1
Conductivity- Electrical 20C, uS/cm	532	488	651	547	553	439
Alkalinity as CaCO3, mg/l	226	215	290	232	222	247
Nitrate as N, mg/l	2.1	2.2	3.2	3.6	8.4	1.4
Phosphates , Total as P, mg/l	<0.120	<0.120	<0.120	<0.120	0.21	<0.120
TOC (Filtered), mg/l	2.2	2.2	2.5	2.5	1.7	2
Aliphatic EPH >C10 - C12, ug/l	<10	<10	<10	<10	<10	<10
Aliphatic EPH >C12 - C16, ug/l	<10	<10	<10	<10	<10	<10
Aliphatic EPH >C16 - C35, ug/l	20	<10	<10	<10	<10	<10
Aliphatic EPH >C35 - C44, ug/l	<10	<10	<10	<10	<10	<10
Aliphatic EPH >C10 - C44, ug/l	20	<10	<10	<10	<10	<10
Aromatic EPH >C10 - C12, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C12 - C16, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C16 - C21, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C21 - C35, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C35 - C44, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C10 - C44, ug/l	<10	<10	<10	<10	<10	<10

Location ID	SW1	SW2	SW3	SW4	SW5	SW6
EPH >C10 - C44, ug/l	20	<10	<10	<10	<10	<10
Acenaphthene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aluminium, total as Al (mg/l)	0.18	0.45	0.078	0.11	0.069	0.015
Anthracene, ug/l	<0.01	0.01	<0.01	<0.01	<0.01	<0.01
Arsenic, filter as As (mg/l)	0.0005	0.0007	<0.0002	0.0002	0.0007	0.0008
Arsenic, total as As (mg/l)	0.00081	0.0024	0.00026	0.00029	0.00082	0.00097
Benzo(a)anthracene, ug/l	0.01	0.06	<0.01	0.03	<0.01	<0.01
Benzo(a)pyrene, ug/l	0.02	0.09	<0.01	0.05	<0.01	<0.01
Benzo(b)fluoranthene, ug/l	0.02	0.09	<0.01	0.05	<0.01	<0.01
Benzo(ghi)perylene, ug/l	0.02	0.1	0.01	0.05	<0.01	<0.01
Benzo(k)fluoranthene, ug/l	0.01	0.06	<0.01	0.03	<0.01	<0.01
Calcium, total as Ca (mg/l)	100	100	140	130	120	100
Chrysene, ug/l	0.02	0.07	<0.01	0.03	<0.01	<0.01
Dibenzo(ah)anthracene, ug/l	<0.01	0.02	<0.01	0.01	<0.01	<0.01
Fluoranthene, ug/l	0.02	0.1	<0.01	0.04	<0.01	<0.01
Fluorene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(123cd)pyrene, ug/l	0.02	0.09	<0.01	0.05	<0.01	<0.01
Naphthalene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PAH, Total of 16, ug/l	0.15	0.82	0.01	0.37	<0.01	<0.01
Phenanthrene, ug/l	<0.01	0.04	<0.01	<0.01	<0.01	<0.01
Pyrene, ug/l	0.02	0.1	<0.01	0.04	<0.01	<0.01
Zinc, filter as Zn (mg/l)	0.013	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc, total as Zn (mg/l)	0.024	0.026	<0.006	0.008	0.01	<0.006

Table 3-14 Laboratory surface water quality data December 2020 (round 1)

Location ID	SW1	SW2	SW3	SW4	SW5	SW6
Date	14-Dec-20	14-Dec-20	16-Dec-20	15-Dec-20	16-Dec-20	16-Dec-20
Time (GMT)	10:45	11:55	09:25	11:48	14:00	12:38
Lab ID	19971908	19971909	19981986	19981985	19981988	19981987
Cadmium, Total as Cd, mg/l	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	0.0007
Cadmium, Filtered as Cd, mg/l	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Copper, Filtered as Cu, mg/l	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Copper, Total as Cu, mg/l	<0.009	<0.009	<0.009	<0.009	0.012	<0.009
Lead , Total as Pb, mg/l	<0.006	<0.006	<0.006	<0.006	0.009	<0.006
Lead, Filtered as Pb, mg/l	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
pH	8.1	8.2	7.8	8	7.6	7.8
Conductivity- Electrical 20C, uS/cm	578	489	688	529	489	451
Alkalinity as CaCO3, mg/l	221	200	279	240	212	232
Nitrate as N, mg/l	2.1	2.4	2.8	3.2	6.1	1.7
Phosphates , Total as P, mg/l	<0.120	<0.120	<0.120	<0.120	0.26	<0.120
TOC (Filtered), mg/l	3.9	3	2	1.9	4.2	1.8
Aliphatic EPH >C10 - C12, ug/l	<10	<10	<10	<10	<20	<10
Aliphatic EPH >C12 - C16, ug/l	<10	<10	<10	<10	<20	<10
Aliphatic EPH >C16 - C35, ug/l	<10	<10	<10	<10	31	<10
Aliphatic EPH >C35 - C44, ug/l	<10	<10	<10	<10	<20	<10
Aliphatic EPH >C10 - C44, ug/l	<10	<10	<10	<10	31	<10
Aromatic EPH >C10 - C12, ug/l	<10	<10	<10	<10	<20	<10
Aromatic EPH >C12 - C16, ug/l	<10	<10	<10	<10	<20	<10
Aromatic EPH >C16 - C21, ug/l	<10	<10	<10	<10	<20	<10
Aromatic EPH >C21 - C35, ug/l	<10	<10	<10	<10	<20	<10
Aromatic EPH >C35 - C44, ug/l	<10	<10	<10	<10	<20	<10
Aromatic EPH >C10 - C44, ug/l	<10	<10	<10	<10	<20	<10

Location ID	SW1	SW2	SW3	SW4	SW5	SW6
EPH >C10 - C44, ug/l	<10	<10	<10	<10	31	<10
Acenaphthene, ug/l	<0.01	<0.01	<0.01	<0.01	0.12	<0.01
Acenaphthylene, ug/l	<0.01	<0.01	<0.01	<0.01	0.03	<0.01
Aluminium, total as Al (mg/l)	0.26	0.48	0.14	0.11	1	0.044
Anthracene, ug/l	<0.01	<0.01	0.01	<0.01	0.09	<0.01
Arsenic, filter as As (mg/l)	0.0005	0.0004	0.0004	0.0004	0.0008	0.0006
Arsenic, total as As (mg/l)	0.001	0.0009	0.00067	0.00039	0.0027	0.0011
Benzo(a)anthracene, ug/l	0.02	0.01	0.05	<0.01	0.68	<0.01
Benzo(a)pyrene, ug/l	0.03	0.02	0.06	0.01	1.01	<0.01
Benzo(b)fluoranthene, ug/l	0.03	0.03	0.06	0.01	1.01	<0.01
Benzo(ghi)perylene, ug/l	0.03	0.03	0.06	<0.01	0.99	<0.01
Benzo(k)fluoranthene, ug/l	0.02	0.01	0.05	<0.01	0.76	<0.01
Calcium, total as Ca (mg/l)	110	97.8	120	110	94.3	87.7
Chrysene, ug/l	0.02	0.02	0.06	<0.01	0.68	<0.01
Dibenzo(ah)anthracene, ug/l	<0.01	<0.01	0.01	<0.01	0.2	<0.01
Fluoranthene, ug/l	0.03	0.03	0.09	0.02	1.14	<0.01
Fluorene, ug/l	<0.01	<0.01	<0.01	<0.01	0.12	<0.01
Indeno(123cd)pyrene, ug/l	0.03	0.02	0.06	<0.01	1.08	<0.01
Naphthalene, ug/l	<0.01	<0.01	<0.01	<0.01	0.05	<0.01
PAH, Total of 16, ug/l	0.25	0.23	0.63	0.06	9.44	<0.01
Phenanthrene, ug/l	<0.01	0.01	0.04	<0.01	0.44	<0.01
Pyrene, ug/l	0.04	0.04	0.09	0.02	1.05	<0.01
Zinc, filter as Zn (mg/l)	<0.0050	<0.0050	<0.0050	<0.0050	0.0092	<0.0050
Zinc, total as Zn (mg/l)	0.015	0.015	0.016	<0.006	0.064	<0.006

Table 3-15 Laboratory surface water quality data December 2020 (round 2)

Location ID	SW1	SW2	SW3	SW4	SW5	SW6
Date	21-Dec-20	21-Dec-20	22-Dec-20	22-Dec-20	21-Dec-20	22-Dec-20
Time (GMT)	09:12	10:17	11:42	09:40	14:35	15:55
Lab ID	19995616	19995617	19999304	19999303	19995618	19999305
Cadmium, Total as Cd, mg/l	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Cadmium, Filtered as Cd, mg/l	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Copper, Filtered as Cu, mg/l	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Copper, Total as Cu, mg/l	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Lead , Total as Pb, mg/l	0.007	<0.006	<0.006	0.007	<0.006	<0.006
Lead, Filtered as Pb, mg/l	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
pH	8.3	8.3	8.2	8.4	8	8.1
Conductivity- Electrical 20C, uS/cm	511	454	588	548	532	425
Alkalinity as CaCO3, mg/l	200	187	264	263	211	231
Nitrate as N, mg/l	2.1	2.3	3	3	7.7	2.3
Phosphates , Total as P, mg/l	<0.120	<0.120	<0.120	<0.120	<0.120	<0.120
TOC (Filtered), mg/l	3.5	3.4	2.8	2.8	6.3	2.1
Aliphatic EPH >C10 - C12, ug/l	<10	<10	<10	<10	<10	<10
Aliphatic EPH >C12 - C16, ug/l	<10	<10	<10	<10	<10	<10
Aliphatic EPH >C16 - C35, ug/l	<10	<10	<10	<10	<10	<10
Aliphatic EPH >C35 - C44, ug/l	<10	<10	<10	<10	<10	<10
Aliphatic EPH >C10 - C44, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C10 - C12, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C12 - C16, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C16 - C21, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C21 - C35, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C35 - C44, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C10 - C44, ug/l	<10	<10	<10	<10	<10	<10

Location ID	SW1	SW2	SW3	SW4	SW5	SW6
EPH >C10 - C44, ug/l	<10	<10	<10	<10	<10	<10
Acenaphthene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aluminium, total as Al (mg/l)	0.87	0.66	0.3	0.34	0.095	0.16
Anthracene, ug/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic, filter as As (mg/l)	0.0005	0.0004	0.0007	0.0004	0.0005	0.0005
Arsenic, total as As (mg/l)	0.0014	0.001	0.00089	0.00066	0.00063	0.0014
Benzo(a)anthracene, ug/l	0.07	0.02	<0.01	0.01	<0.01	<0.01
Benzo(a)pyrene, ug/l	0.09	0.03	<0.01	0.02	0.01	<0.01
Benzo(b)fluoranthene, ug/l	0.09	0.03	<0.01	0.02	0.01	<0.01
Benzo(ghi)perylene, ug/l	0.09	0.03	<0.01	0.01	0.01	<0.01
Benzo(k)fluoranthene, ug/l	0.07	0.03	<0.01	0.01	<0.01	<0.01
Calcium, total as Ca (mg/l)	100	86.4	120	130	110	96.1
Chrysene, ug/l	0.08	0.03	<0.01	0.02	<0.01	<0.01
Dibenzo(ah)anthracene, ug/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene, ug/l	0.11	0.04	<0.01	0.02	0.02	<0.01
Fluorene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(123cd)pyrene, ug/l	0.08	0.03	<0.01	0.01	<0.01	<0.01
Naphthalene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PAH, Total of 16, ug/l	0.86	0.3	0.01	0.14	0.07	<0.01
Phenanthrene, ug/l	0.04	0.01	<0.01	<0.01	<0.01	<0.01
Pyrene, ug/l	0.12	0.04	0.01	0.02	0.01	<0.01
Zinc, filter as Zn (mg/l)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc, total as Zn (mg/l)	0.031	0.021	0.023	0.022	0.008	0.013

Table 3-16 Laboratory surface water quality data January 2021

Location ID	SW1	SW2	SW3	SW4	SW5	SW6
Date	26-Jan-21	26-Jan-21	27-Jan-21	26-Jan-21	27-Jan-21	27-Jan-21
Time (GMT)	11:11	12:10	10:13	16:17	14:10	13:45
Lab ID	20082976	20082977	20088124	20082978	20087903	20088125
Cadmium, Total as Cd, mg/l	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Cadmium, Filtered as Cd, mg/l	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Copper, Filtered as Cu, mg/l	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Copper, Total as Cu, mg/l	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Lead , Total as Pb, mg/l	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Lead, Filtered as Pb, mg/l	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
pH	8.3	8.4	8	8.1	8	8
Conductivity- Electrical 20C, uS/cm	552	493	852	1030	594	406
Alkalinity as CaCO3, mg/l	198	186	254	239	202	216
Nitrate as N, mg/l	3.3	3.4	2.7	4	7.4	2
Phosphates , Total as P, mg/l	<0.120	<0.120	<0.120	<0.120	<0.120	<0.120
TOC (Filtered), mg/l	1.4	1	1.7	1.5	1.8	1.3
Aliphatic EPH >C10 - C12, ug/l	<10	<10	<10	<10	<10	<10
Aliphatic EPH >C12 - C16, ug/l	<10	<10	<10	<10	<10	<10
Aliphatic EPH >C16 - C35, ug/l	<10	<10	<10	<10	<10	<10
Aliphatic EPH >C35 - C44, ug/l	<10	<10	<10	<10	<10	<10
Aliphatic EPH >C10 - C44, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C10 - C12, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C12 - C16, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C16 - C21, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C21 - C35, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C35 - C44, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C10 - C44, ug/l	<10	<10	<10	<10	<10	<10

Location ID	SW1	SW2	SW3	SW4	SW5	SW6
EPH >C10 - C44, ug/l	<10	<10	<10	<10	<10	<10
Acenaphthene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aluminium, total as Al (mg/l)	0.2	0.29	0.4	0.097	0.057	0.083
Anthracene, ug/l	<0.01	<0.01	0.01	<0.01	<0.01	<0.01
Arsenic, filter as As (mg/l)	0.0004	0.0008	0.0003	0.0002	0.0005	0.0004
Arsenic, total as As (mg/l)	0.00062	0.00064	0.00067	0.00028	0.00062	0.00083
Benzo(a)anthracene, ug/l	<0.01	<0.01	0.1	<0.01	<0.01	<0.01
Benzo(a)pyrene, ug/l	<0.01	<0.01	0.16	<0.01	0.01	<0.01
Benzo(b)fluoranthene, ug/l	<0.01	<0.01	0.13	<0.01	0.01	<0.01
Benzo(ghi)perylene, ug/l	<0.01	<0.01	0.14	<0.01	0.01	<0.01
Benzo(k)fluoranthene, ug/l	<0.01	<0.01	0.1	<0.01	<0.01	<0.01
Calcium, total as Ca (mg/l)	100	91.8	120	130	100	90
Chrysene, ug/l	<0.01	<0.01	0.12	<0.01	0.01	<0.01
Dibenzo(ah)anthracene, ug/l	<0.01	<0.01	0.02	<0.01	<0.01	<0.01
Fluoranthene, ug/l	<0.01	<0.01	0.17	0.01	0.02	<0.01
Fluorene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(123cd)pyrene, ug/l	<0.01	<0.01	0.12	0.01	0.01	<0.01
Naphthalene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PAH, Total of 16, ug/l	<0.01	<0.01	1.29	0.02	0.09	<0.01
Phenanthrene, ug/l	<0.01	<0.01	0.06	<0.01	<0.01	<0.01
Pyrene, ug/l	<0.01	<0.01	0.17	<0.01	0.02	<0.01
Zinc, filter as Zn (mg/l)	<0.0050	<0.0050	0.011	0.006	<0.0050	<0.0050
Zinc, total as Zn (mg/l)	0.009	0.01	0.041	0.008	<0.006	<0.006

Table 3-17 Laboratory surface water quality data February 2021

Location ID	SW1	SW2	SW3	SW4	SW5	SW6
Date	25-Feb-21	25-Feb-21	24-Feb-21	25-Feb-21	24-Feb-21	24-Feb-21
Time (GMT)	14:14	12:17	11:44	09:16	15:31	14:23
Lab ID	20184682	20184683	20178334	20184684	20178336	20178335
Cadmium, Total as Cd, mg/l	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Cadmium, Filtered as Cd, mg/l	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Copper, Filtered as Cu, mg/l	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Copper, Total as Cu, mg/l	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Lead , Total as Pb, mg/l	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Lead, Filtered as Pb, mg/l	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
pH	8.3	8.4	8	8.1	8	8.1
Conductivity- Electrical 20C, uS/cm	529	481	646	574	543	398
Alkalinity as CaCO3, mg/l	203	187	268	246	201	213
Nitrate as N, mg/l	2.9	2.9	3.2	3.6	7.6	2.4
Phosphates , Total as P, mg/l	<0.120	<0.120	<0.120	<0.120	<0.120	<0.120
TOC (Filtered), mg/l	2	2	1.4	1.8	2.7	3
Aliphatic EPH >C10 - C12, ug/l	<10	<10	<10	<10	<10	<10
Aliphatic EPH >C12 - C16, ug/l	<10	<10	<10	<10	<10	<10
Aliphatic EPH >C16 - C35, ug/l	<10	<10	<10	<10	<10	<10
Aliphatic EPH >C35 - C44, ug/l	<10	<10	<10	<10	<10	<10
Aliphatic EPH >C10 - C44, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C10 - C12, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C12 - C16, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C16 - C21, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C21 - C35, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C35 - C44, ug/l	<10	<10	<10	<10	<10	<10
Aromatic EPH >C10 - C44, ug/l	<10	<10	<10	<10	<10	<10

Location ID	SW1	SW2	SW3	SW4	SW5	SW6
EPH >C10 - C44, ug/l	<10	<10	<10	<10	<10	<10
Acenaphthene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aluminium, total as Al (mg/l)	0.24	0.26	0.17	0.026	0.057	0.095
Anthracene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic, filter as As (mg/l)	0.0004	0.0004	0.0002	0.0002	0.0006	0.0005
Arsenic, total as As (mg/l)	0.00065	0.00064	0.00037	<0.00024	0.00061	0.001
Benzo(a)anthracene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(ghi)perylene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(k)fluoranthene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium, total as Ca (mg/l)	100	91.1	140	130	110	96.4
Chrysene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenzo(ah)anthracene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(123cd)pyrene, ug/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Naphthalene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PAH, Total of 16, ug/l	0.02	<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pyrene, ug/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc, filter as Zn (mg/l)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc, total as Zn (mg/l)	0.009	0.006	0.006	<0.006	0.006	0.007

Table 3-18 Laboratory surface water quality data April 2021

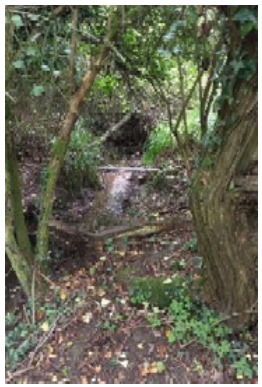
Location ID	SW1	SW2	SW3	SW4	SW5	SW6
Date	07-Apr-21	06-Apr-21	06-Apr-21	06-Apr-21	06-Apr-21	06-Apr-21
Time (GMT)	09:42	15:43	12:08	11:00	14:45	14:02
Lab ID	20311120	20305977	20305974	20305973	20305976	20305975
Cadmium, Total as Cd, mg/l	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Cadmium, Filtered as Cd, mg/l	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Copper, Filtered as Cu, mg/l	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Copper, Total as Cu, mg/l	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Lead , Total as Pb, mg/l	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Lead, Filtered as Pb, mg/l	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
pH	8.1	8	7.8	7.9	8.3	8.2
Conductivity- Electrical 20C, uS/cm	592	538	620	568	542	427
Alkalinity as CaCO3, mg/l	213	208	272	231	198	238
Nitrate as N, mg/l	1.9	2.3	2.6	3.3	7.7	1.9
Phosphates , Total as P, mg/l	<0.120	<0.120	<0.120	<0.120	0.17	<0.120
TOC (Filtered), mg/l	2.2	1.9	1.7	2.4	3.4	2.6
Aliphatic EPH >C10 - C12, ug/l	<100	<100	<10	<100	<100	<100
Aliphatic EPH >C12 - C16, ug/l	<100	<100	<10	<100	<100	<100
Aliphatic EPH >C16 - C35, ug/l	<100	<100	<10	<100	<100	<100
Aliphatic EPH >C35 - C44, ug/l	<100	<100	<10	<100	<100	<100
Aliphatic EPH >C10 - C44, ug/l	<100	<100	<10	<100	<100	<100
Aromatic EPH >C10 - C12, ug/l	<100	<100	<10	<100	<100	<100
Aromatic EPH >C12 - C16, ug/l	<100	<100	<10	<100	<100	<100
Aromatic EPH >C16 - C21, ug/l	<100	<100	<10	<100	<100	<100
Aromatic EPH >C21 - C35, ug/l	<100	<100	<10	<100	<100	<100
Aromatic EPH >C35 - C44, ug/l	<100	<100	<10	<100	<100	<100
Aromatic EPH >C10 - C44, ug/l	<100	<100	<10	<100	<100	<100

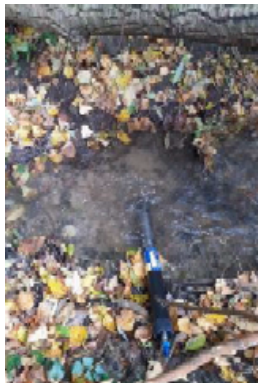
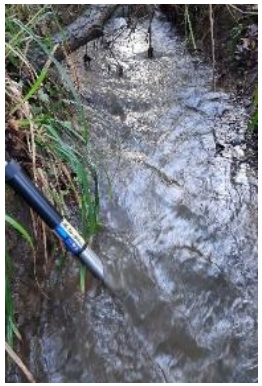
Location ID	SW1	SW2	SW3	SW4	SW5	SW6
EPH >C10 - C44, ug/l	<100	<100	<10	<100	<100	<100
Acenaphthene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aluminium, total as Al (mg/l)	0.35	0.67	0.053	0.027	0.079	0.36
Anthracene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic, filter as As (mg/l)	0.0005	0.0004	<0.0002	0.0002	0.0006	0.0005
Arsenic, total as As (mg/l)	0.001	0.0012	<0.00024	0.00025	0.00077	0.0022
Benzo(a)anthracene, ug/l	<0.01	<0.01	0.01	0.01	<0.01	<0.01
Benzo(a)pyrene, ug/l	<0.01	<0.01	0.04	<0.01	<0.01	<0.01
Benzo(b)fluoranthene, ug/l	<0.01	<0.01	0.03	0.01	<0.01	<0.01
Benzo(ghi)perylene, ug/l	<0.01	0.01	0.04	0.01	<0.01	<0.01
Benzo(k)fluoranthene, ug/l	<0.01	<0.01	0.03	<0.01	<0.01	<0.01
Calcium, total as Ca (mg/l)	110	94.7	120	110	100	94.7
Chrysene, ug/l	<0.01	<0.01	0.02	0.01	<0.01	<0.01
Dibenzo(ah)anthracene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene, ug/l	0.01	<0.01	0.02	0.02	<0.01	<0.01
Fluorene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(123cd)pyrene, ug/l	<0.01	<0.01	0.04	0.01	<0.01	<0.01
Naphthalene, ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PAH, Total of 16, ug/l	0.03	0.02	0.25	0.12	<0.01	<0.01
Phenanthrene, ug/l	<0.01	<0.01	<0.01	0.01	<0.01	<0.01
Pyrene, ug/l	0.01	0.01	0.02	0.02	<0.01	<0.01
Zinc, filter as Zn (mg/l)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc, total as Zn (mg/l)	0.012	0.016	<0.006	0.01	0.007	0.01

Visual observations

3.1.3 Table 3-19 to Table 3-24 show visual data collected between July 2020 and April 2021. Monitoring for March 2021 was unable to be conducted, and samples were taken in early April 2021.

Table 3-19 Visual observations for SW1 between July 2020 and April 2021

Month	Observations	Images
July 2020	None taken	None taken
August 2020	The channel upstream was very overgrown with vegetation. Further downstream, the channel was clear of vegetation with very limited flow moving downstream.	  
September 2020	The channel downstream was clear of vegetation. Some leaves/debris present in the channel.	 

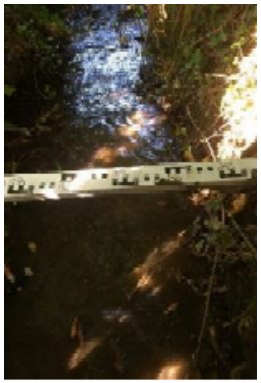
Month	Observations	Images
October 2020	The channel was clear of vegetation downstream. More leaves/debris accumulating on the edges of the channel and on the banks.	
November 2020	The channel had increased in depth and was flowing quicker than previous visit. The leaves/debris appear to have been washed downstream. There is no vegetation build up in the channel.	
December 2020 (Round 1)	Weather: Cloudy Air temperature: 11°C Water colour: Light brown Algae growth: No Smell: No Dead fish: No	 

Month	Observations	Images
December 2020 (Round 2)	Weather: Cloudy Air temperature: 10°C Water colour: Light brown Algae growth: No Smell: No Dead fish: No	 
January 2021	Weather: Overcast Air temperature: 6°C Water colour: Light brown Algae growth: No Smell: No Dead fish: No	
February 2021	Weather: Overcast Air temperature: 11°C Water colour: Light brown Algae growth: No Smell: No Dead fish: No	

Month	Observations	Images
April 2021	Weather: Overcast Air temperature: 6°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	

Table 3-20 Visual observations for SW2 between July 2020 and April 2021

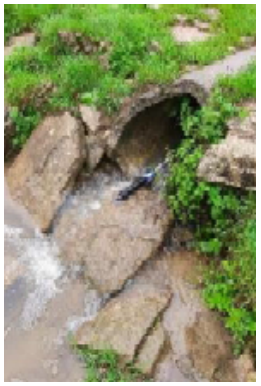
Month	Observations	Images
July 2020	There was very little flow in the channel. There was a lot of vegetation on the banks, but the channel was clear.	
August 2020	There was very little flow in the channel. There was a lot of vegetation on the banks, but channel was clear.	
September 2020	As observed in prior visits, channel flow has been very limited. There was vegetation on the banks, but the channel was clear.	

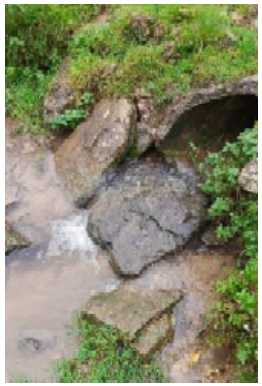
Month	Observations	Images
October 2020	There was more leaf and twig debris in the channel than previous months. The water level was deeper and flowing more quickly.	 
November 2020	The water level was deeper than the previous visit with a lot more debris in the channel. The colour of the water was less clear than previous visits.	 
December 2020 (Round 1)	Weather: Cloudy Air temperature: 11°C Water colour: Light brown Algae growth: No Smell: No Dead fish: No	 

Month	Observations	Images
December 2020 (Round 2)	Weather: Cloudy Air temperature: 13°C Water colour: Light brown Algae growth: No Smell: No Dead fish: No	
January 2021	Weather: Overcast Air temperature: 6°C Water colour: Clear Noticeable orange sediment and oil on bank (possibly natural) Algae growth: No Smell: No Dead fish: No	
February 2021	Weather: Overcast Air temperature: 11°C Water colour: Clear. Noticeable orange sediment and oil on bank (possibly natural) Algae growth: No Smell: Yes Dead fish: No	

Month	Observations	Images
April 2021	Weather: Overcast Air temperature: 7°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	

Table 3-21 Visual observations for SW3 between July 2020 and April 2021

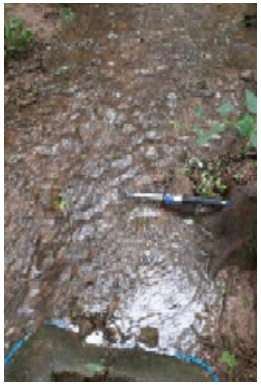
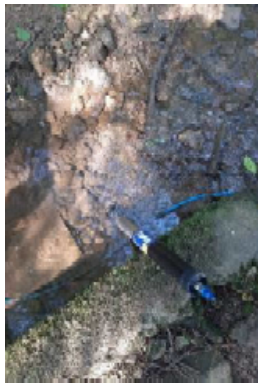
Month	Observations	Images
July 2020	None taken	None taken
August 2020	No vegetation build-up in the channel. The water was fast flowing, and the water depth was shallow. The water was clear.	 
September 2020	No vegetation build up in the channel. The water wasn't flowing as fast as it was during the previous visit. The water was clear.	 

Month	Observations	Images
October 2020	The channel as per previous months had no vegetation in the channel. The water was deeper and flowing faster than the previous visit. The colour of the water was less clear too.	
November 2020	The water was flowing quicker out of the pipe than last month. The water colour was clearer than the last visit.	 
December 2020 (Round 1)	Weather: Heavy rain Air temperature: 10°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	

Month	Observations	Images
December 2020 (Round 2)	Weather: Cloudy Air temperature: 8°C Water colour: Cloudy Algae growth: No Smell: No Dead fish: No	
January 2021	Weather: Overcast Air temperature: 10°C Water colour: Cloudy Algae growth: No Smell: No Dead fish: No	
February 2021	Weather: Overcast Air temperature: 15°C Water colour: Clear Algae growth: No Smell: Yes Dead fish: No	

Month	Observations	Images
April 2021	Weather: Overcast Air temperature: 7°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	

Table 3-22 Visual observations for SW4 between July 2020 and April 2021

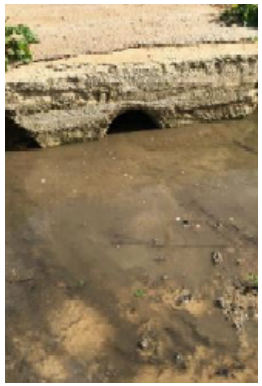
Month	Observations	Images
July 2020	There was very little water in the channel, there was no vegetation, and the water was clear.	 
August 2020	There was very little water in the channel, there was no vegetation, and the water was clear.	  
September 2020	There was very little water in the channel, there was no vegetation, and the water was clear.	 

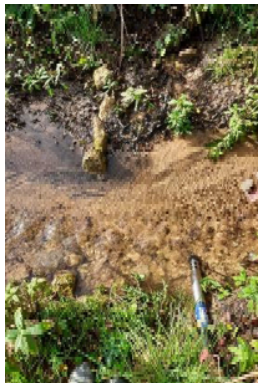
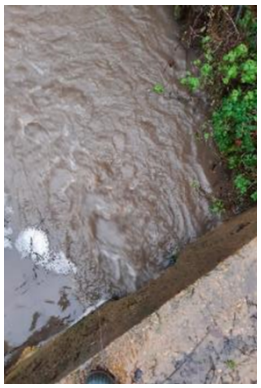
Month	Observations	Images
October 2020	There was very little water and no vegetation in the channel, and the water was clear.	 
November 2020	There was a higher volume of water in the channel than previous visit. The water was clear and the was no vegetation in the channel.	
December 2020 (Round 1)	Weather: Cloudy Air temperature: 11°C Water colour: Light brown Algae growth: No Smell: No Dead fish: No	 

Month	Observations	Images
December 2020 (Round 2)	Weather: Cloudy Air temperature: 8°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	
January 2021	Weather: Overcast Air temperature: 6°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	
February 2021	Weather: Overcast Air temperature: 11°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	

Month	Observations	Images
April 2021	Weather: Overcast Air temperature: 7°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	

Table 3-23 Visual observations for SW5 between July 2020 and April 2021

Month	Observations	Images
July 2020	None taken	None taken
August 2020	The water was clear. The bed was free of vegetation but very silty.	  
September 2020	The water was clear. The bed was free of vegetation but very silty.	 

Month	Observations	Images
October 2020	The water was clear. The bed was free of vegetation but very silty.	
November 2020	The water was clear. The bed was free of vegetation but very silty.	 
December 2020 (Round 1)	Weather: Heavy rain Air temperature: 8°C Water colour: Dark brown/silty Algae growth: No Smell: No Dead fish: No	 

Month	Observations	Images
December 2020 (Round 2)	Weather: Cloudy Air temperature: 13°C Water colour: Clear/Silty on the bed Algae growth: No Smell: No Dead fish: No	
January 2021	Weather: Overcast Air temperature: 10°C Water colour: Clear but cloudy outside of main flow Algae growth: No Smell: No Dead fish: No	
February 2021	Weather: Overcast Air temperature: 11°C Water colour: Clear, but *cloudy outside of main flow. Small quantity of oil/iron oxide near bank.* Algae growth: No Smell: No Dead fish: No	

Month	Observations	Images
April 2021	Weather: Overcast Air temperature: 7°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	

Table 3-24 Visual observations for SW6 between July 2020 and April 2021

Month	Observations	Images
July 2020	Unable to access location	Unable to access location
August 2020	Unable to access location	Unable to access location
September 2020	Unable to access location	Unable to access location
October 2020	The water was clear. small twigs and debris sitting on the bed of the channel. The channel was free of vegetation and the water was freely moving.	
November 2020	The water was moving freely in the channel. No vegetation present. Water is a slightly brown/orange/red. Some deposits visible on the gauge board and on top of the Nivus PCM4 meter.	

Month	Observations	Images
December 2020 (Round 1)	Weather: Heavy rain Air temperature: 9°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	 
December 2020 (Round 2)	Weather: Cloudy Air temperature: 8°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	 
January 2021	Weather: Overcast Air temperature: 10°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	 

Month	Observations	Images
February 2021	Weather: Overcast Air temperature: 15°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	
April 2021	Weather: Overcast Air temperature: 7°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	

3.2 Surface water flow

Automatic flow measurements

3.2.1 The raw data from automatic flow measurements taken between July 2020 and April 2021 for SW2, SW4 and SW6 are shown on Figure 3-1, Figure 3-2 and Figure 3-3, respectively.

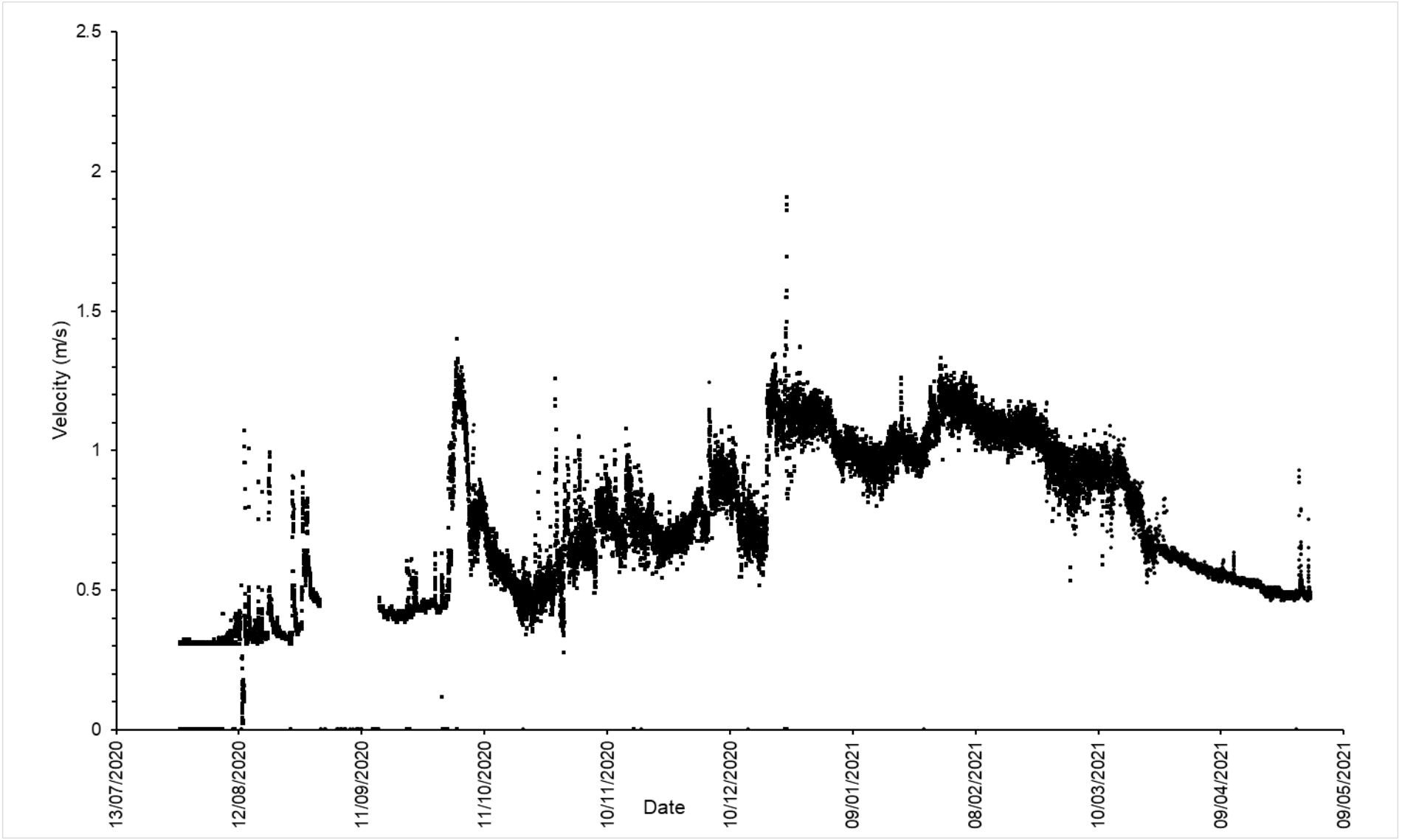


Figure 3-1 SW2 automatic velocity measurements

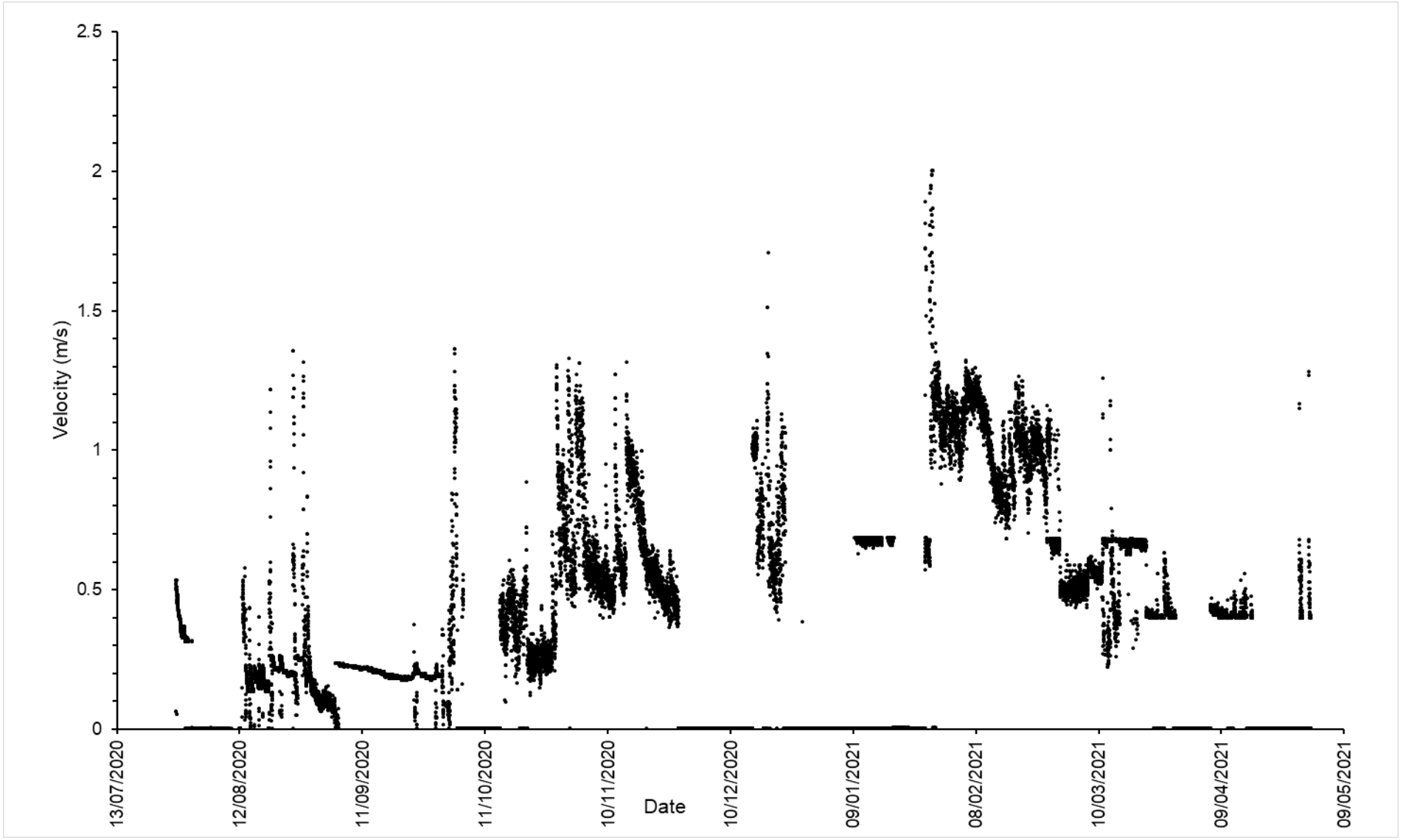


Figure 3-2 SW4 automatic velocity measurements

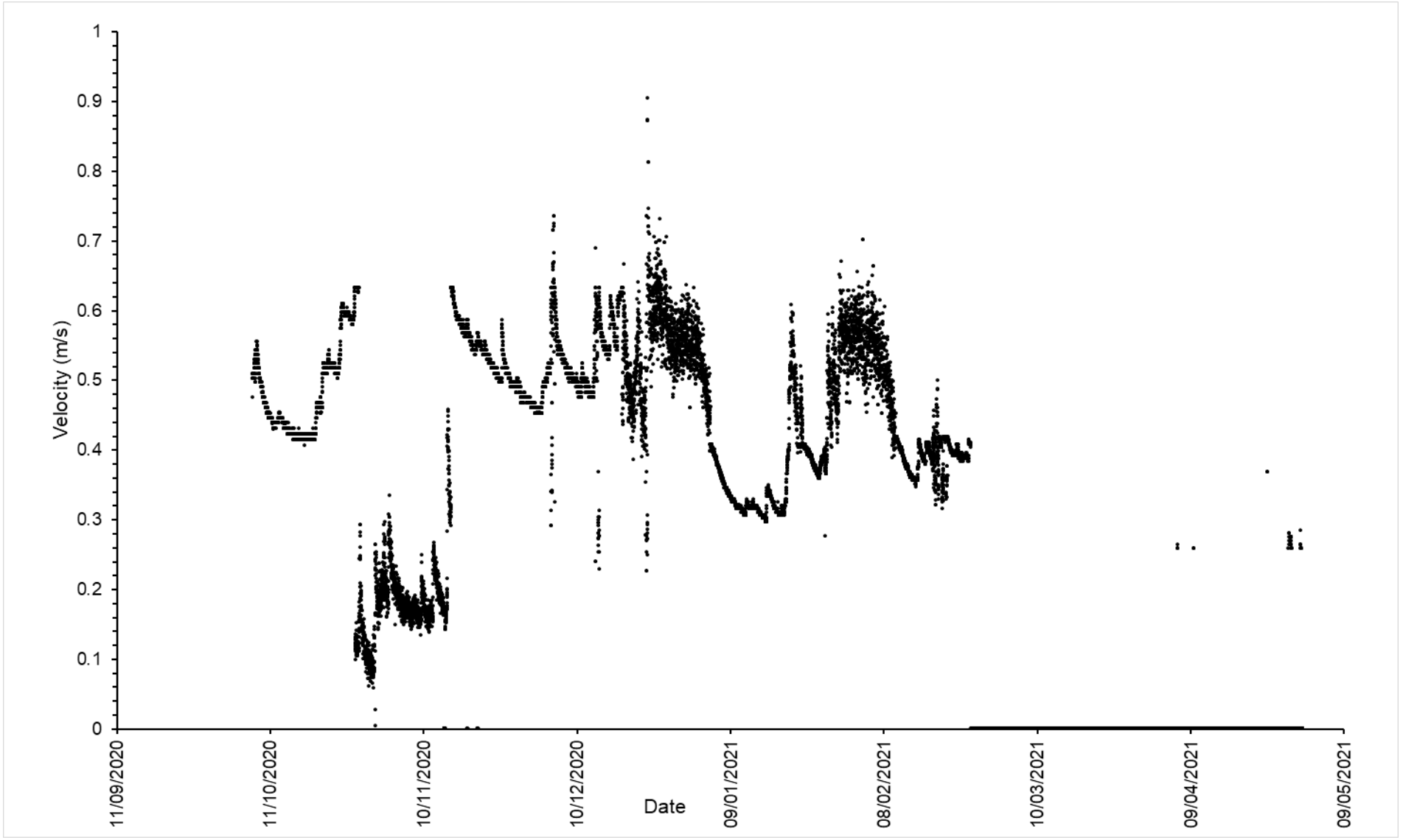


Figure 3-3 SW6 automatic velocity measurements

Manual flow measurements

3.2.2 The raw data from the surface water flow monitoring at SW1 to SW6 monitoring stations between July 2020 and April 2021 is shown in Table 3-25. Monitoring for March 2021 was unable to be conducted and was undertaken in early April 2021.

Table 3-25 Surface water flows between July 2020 and April 2021

Date	SW1		SW2		SW3		SW4		SW5		SW6	
	Stage	Flow	Stage	Flow	Stage	Flow	Stage	Flow	Stage	Flow	Stage	Flow
27/07/2020	-	-	-	-	-	-	0.080	0.0013	-	-	No access	
28/07/2020	-	-	0.070	0.001	-	-	-	-	-	-	No access	
24/08/2020	9.202	0.004	0.057	0.003	-	-	-	-	9.036	0.005	No access	
25/08/2020	-	-	-	-	9.608	0.011	0.135	0.022	-	-	No access	
15/09/2020	9.209	0.003	0.078	0.003	-	-	-	-	9.045	0.005	No access	
16/09/2020	-	-	-	-	9.565	0.001	0.083	0.0011	-	-	No access	
07/10/2020	-	-	-	-	-	-	-	-	-	-	0.151	0.004
20/10/2020	9.254	0.010	0.135	0.007	-	-	-	-	-	-	-	-
21/10/2020	-	-	-	-	9.550	0.005	0.130	0.018	-	-	-	-
22/10/2020	-	-	-	-	-	-	-	-	9.105	0.015	0.160	0.002
18/11/2020	-	-	0.188	0.027	-	-	-	-	-	-	0.165	0.004
19/11/2020	9.316	0.021			9.705	0.013	0.153	0.029	9.120	0.015	-	-
14/12/2020	9.350	0.052	0.230	0.032	-	-	-	-	-	-	-	-
15/12/2020	-	-	-	-	-	-	0.160	0.058	-	-	-	-
16/12/2020	-	-	-	-	9.723	0.021	-	-	9.158	0.039	0.169	0.006
21/12/2020	9.390	0.097	0.288	0.062	-	-	-	-	9.210	0.054	-	-
22/12/2020	-	-	-	-	9.790	0.054	0.248	0.166	-	-	0.200	0.018
24/02/2021	-	-	-	-	9.910	0.011	-	-	9.050	0.039	0.170	0.004
25/02/2021	9.390	0.067	0.240	0.043	-	-	0.090	0.027	-	-	-	-
06/04/2021	-	-	0.115	0.005	0.035	0.002	0.037	0.006	9.518	0.014	0.142	0.001
07/04/2021	9.226	0.010	-	-	-	-	-	-	-	-	-	-

3.2.3 Figure 3-4 displays the velocity data from Table 3-25 over the period between July 2020 and April 2021.

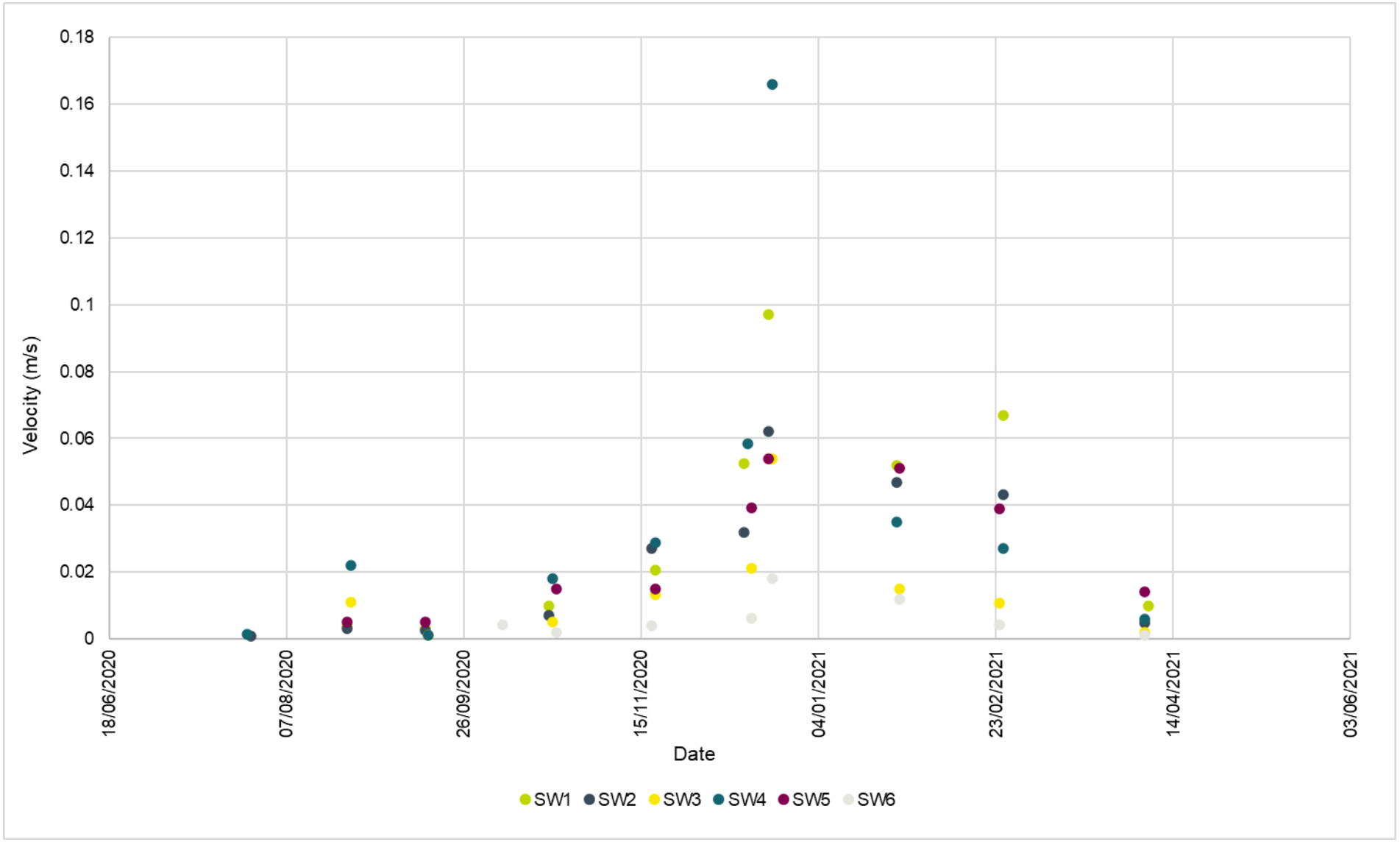


Figure 3-4 Surface water manual velocity data between July 2020 and April 2021

3.3 Spring water quality

In-situ monitoring

3.3.1 Table 3-26 to Table 3-34 display spring water quality results from in-situ monitoring between August 2020 and April 2021. Monitoring for March 2021 was unable to be conducted, and samples were taken in early April 2021.

Table 3-26 In-situ spring water quality data August 2020

Location ID	GW1	GW5	GW6
Date	24-Aug-20	25-Aug-20	25-Aug-20
Time (GMT)	Sample unable to be obtained due to low water levels at and around the monitoring location.	11:01	11:38
PH		8.01	7.78
Actual Conductivity (µS/cm)		460.1	407.33
Specific Conductivity (µS/cm)		550.21	494.46
Salinity (PSU)		0.27	0.24
Total Dissolved Solids (ppt)		0.36	0.32
Turbidity (NTU)		136.66	48.61
Total Suspended Solids (mg/L)		0.00	0.00
RDO Concentration (mg/L)		8.09	7.40
RDO Saturation (%)		83.22	75.11
Oxygen Partial Pressure (Torr)		129.40	116.88
Temperature (°C)		16.43	15.77

Table 3-27 In-situ spring water quality data September 2020

Location ID	GW1	GW5	GW6
Date	15-Sep-20	16-Sep-20	16-Sep-20
Time (GMT)	13:05	Sample unable to be obtained due to low water levels at and around the monitoring location.	13:05
PH	8.31		8.12
Actual Conductivity (µS/cm)	418.70		578.62
Specific Conductivity (µS/cm)	522.58		703.45
Salinity (PSU)	0.25		0.35
Total Dissolved Solids (ppt)	0.34		0.46
Turbidity (NTU)	35.21		23.01
Total Suspended Solids (mg/L)	0.00		0.00
RDO Concentration (mg/L)	8.97		8.70
RDO Saturation (%)	88.75		88.11
Oxygen Partial Pressure (Torr)	138.22		137.12
Temperature (°C)	14.58		15.68

Table 3-28 In-situ spring water quality data October 2020

Location ID	GW1	GW2	GW3	GW4	GW5	GW6	GW8
Date	20-Oct-20	20-Oct-20	20-Oct-20	20-Oct-20	21-Oct-20	21-Oct-20	22-Oct-20
Time (GMT)	13:16	13:25	14:15	14:30	15:57	16:05	10:10
PH	8.49	8.41	7.61	7.79	7.39	8.06	7.90
Actual Conductivity (µS/cm)	421.23	429.62	313.97	436.15	515.47	499.18	444.82
Specific Conductivity (µS/cm)	562.06	576.04	432.88	608.30	688.06	657.13	601.05
Salinity (PSU)	0.27	0.28	0.21	0.29	0.34	0.32	0.29
Total Dissolved Solids (ppt)	0.37	0.37	0.28	0.40	0.45	0.43	0.39
Turbidity (NTU)	12.84	13.65	0.33	0.00	55.15	51.10	25.63
Total Suspended Solids (mg/L)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RDO Concentration (mg/L)	10.37	10.22	10.86	10.50	10.30	9.90	4.05
RDO Saturation (%)	98.98	97.08	100.61	96.33	98.28	95.61	38.20
Oxygen Partial Pressure (Torr)	125.51	123.12	127.76	122.34	124.63	121.18	48.46
Temperature (°C)	11.88	11.69	10.62	10.19	11.87	12.42	11.39

Table 3-29 In-situ spring water quality data November 2020

Location ID	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
Date	18-Nov-20	18-Nov-20	18-Nov-20	18-Nov-20	19-Nov-20	19-Nov-20	19-Nov-20	19-Nov-20
Time (GMT)	12:12	12:20	13:51	13:27	11:28	11:41	14:56	09:16
PH	8.55	8.42	7.78	8.01	8.05	8.23	8.31	7.7
Actual Conductivity (µS/cm)	378.34	388.83	179.68	397.89	463.41	492.89	356.68	372.15
Specific Conductivity (µS/cm)	518.91	535.73	248.79	559.15	639.2	694.94	501.81	563.19
Salinity (PSU)	0.25	0.26	0.12	0.27	0.31	0.34	0.24	0.27
Total Dissolved Solids (ppt)	0.34	0.35	0.16	0.36	0.42	0.45	0.33	0.37
Turbidity (NTU)	89.01	52.64	0	0	1.81	8.89	10.08	5.04
RDO Concentration (mg/L)	11.72	11.64	11.66	11.79	11.33	11.91	12.28	4.24
RDO Saturation (%)	105.01	103.88	103.5	103.41	105	108.26	111.77	36.2
Oxygen Partial Pressure (Torr)	138.51	137.04	136.56	136.5	133.3	137.53	141.89	46.08
Temperature (°C)	10.83	10.64	10.46	9.91	10.6	9.77	9.85	7.23

Table 3-30 In-situ spring water quality data December 2020 (round 1)

Location ID	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
Date	14-Dec-20	14-Dec-20	14-Dec-20	14-Dec-20	16-Dec-20	16-Dec-20	16-Dec-20	16-Dec-20
Time (GMT)	12:42	14:48	14:36	13:59	09:33	09:43	14:41	11:04
PH	8.35	8.25	7.59	7.88	8.11	8.03	7.92	7.36
Actual Conductivity (µS/cm)	388.88	412.05	276.81	432.75	446.57	496.89	358.70	333.12
Specific Conductivity (µS/cm)	555.11	583.57	385.54	610.70	641.37	719.82	507.73	503.74
Salinity (PSU)	0.27	0.28	0.18	0.30	0.31	0.35	0.24	0.24
Total Dissolved Solids (ppt)	0.36	0.38	0.25	0.40	0.42	0.47	0.33	0.33
Turbidity (NTU)	26.45	13.13	0.00	0.00	7.33	12.07	8.41	3.71
RDO Concentration (mg/L)	11.20	10.98	10.78	10.88	10.88	10.98	10.89	4.91
RDO Saturation (%)	101.46	100.17	99.72	99.58	98.05	98.20	99.03	42.26
Oxygen Partial Pressure (Torr)	139.53	137.73	137.03	136.90	134.87	135.11	136.18	58.21
Temperature (°C)	9.32	9.61	10.25	9.74	9.09	8.79	9.50	7.26

Table 3-31 In-situ spring water quality data December 2020 (round 2)

Location ID	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
Date	21-Dec-20	21-Dec-20	21-Dec-20	21-Dec-20	22-Dec-20	22-Dec-20	21-Dec-20	21-Dec-20
Time (GMT)	11:21	12:43	12:54	13:09	11:52	12:08	13:59	15:16
PH	8.37	8.29	7.60	7.88	7.58	8.03	7.96	8.13
Actual Conductivity (µS/cm)	358.38	369.09	254.77	380.97	443.48	429.51	359.70	318.59
Specific Conductivity (µS/cm)	503.88	516.74	355.87	536.66	633.90	615.88	494.83	467.34
Salinity (PSU)	0.24	0.25	0.17	0.26	0.31	0.30	0.24	0.22
Total Dissolved Solids (ppt)	0.33	0.34	0.23	0.35	0.41	0.40	0.32	0.30
Turbidity (NTU)	47.80	28.00	10.10	0.10	1.96	11.06	5.62	30.64
RDO Concentration (mg/L)	10.82	10.70	10.52	10.70	10.14	10.76	10.61	10.85
RDO Saturation (%)	97.23	96.50	95.04	96.02	90.53	95.79	97.16	93.91
Oxygen Partial Pressure (Torr)	140.68	139.60	137.47	138.91	129.99	137.54	140.48	136.04
Temperature (°C)	9.87	10.02	10.14	9.82	9.27	9.15	10.70	8.34

Table 3-32 In-situ spring water quality data January 2021

Location ID	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
Date	26-Jan-21	26-Jan-21	27-Jan-21	27-Jan-21	27-Jan-21	27-Jan-21	27-Jan-21	27-Jan-21
Time (GMT)	13:45	14:09	15:43	15:30	10:25	10:33	14:55	12:26
PH	8.46	8.38	7.72	7.99	7.99	7.99	8.14	7.89
Actual Conductivity (µS/cm)	482.51	457.00	278.77	406.46	464.91	591.57	441.42	309.43
Specific Conductivity (µS/cm)	703.33	656.88	392.26	572.67	674.67	889.46	617.54	485.27
Salinity (PSU)	0.34	0.32	0.19	0.28	0.33	0.43	0.30	0.23
Total Dissolved Solids (ppt)	0.46	0.43	0.25	0.37	0.44	0.58	0.40	0.32
Turbidity (NTU)	19.25	8.79	0.00	2.28	2.74	22.44	0.27	29.72
RDO Concentration (mg/L)	12.00	11.75	11.37	11.57	11.41	11.98	12.31	12.52
RDO Saturation (%)	106.64	105.62	104.08	105.86	101.75	103.67	113.31	104.37
Oxygen Partial Pressure (Torr)	142.23	140.81	138.67	141.05	135.68	138.38	150.93	139.46
Temperature (°C)	8.56	9.07	9.86	9.80	8.72	7.47	10.06	6.02
CaCO3 Mg/l (PPM)	204	180	165	189	288	285	198	-

Table 3-33 In-situ spring water quality data February 2021

Location ID	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
Date	25-Feb-21	25-Feb-21	25-Feb-21	25-Feb-21	24-Feb-21	24-Feb-21	25-Feb-21	24-Feb-21
Time (GMT)	13:29	13:39	11:40	11:30	11:35	11:25	11:06	14:04
PH	8.45	8.42	7.73	8.04	7.87	8.07	8.28	7.60
Actual Conductivity (µS/cm)	393.54	391.97	273.68	398.55	474.34	520.56	418.84	430.45
Specific Conductivity (µS/cm)	559.45	555.70	386.70	563.22	665.84	728.14	584.82	597.29
Salinity (PSU)	0.27	0.27	0.18	0.27	0.32	0.36	0.28	0.29
Total Dissolved Solids (ppt)	0.36	0.36	0.25	0.37	0.43	0.47	0.38	0.39
Turbidity (NTU)	15.10	5.40	250.81	0.00	34.93	3.09	4.01	2.59
RDO Concentration (mg/L)	12.00	11.92	11.54	11.85	11.18	11.75	13.41	5.43
RDO Saturation (%)	109.00	108.49	105.19	108.14	102.64	108.22	123.61	50.39
Oxygen Partial Pressure (Torr)	145.27	144.58	140.17	144.09	136.73	144.16	164.64	67.10
Temperature (°C)	9.48	9.59	9.69	9.68	9.94	10.07	10.13	10.37
CaCO3 Mg/l (PPM)	195.00	174.00	159.00	180.00	369.00	279.00	204.00	276.00

Table 3-34 In-situ spring water quality data April 2021

Location ID	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
Date	07-Apr-21	07-Apr-21	07-Apr-21	-[3]	06-Apr-21	06-Apr-21	06-Apr-21	06-Apr-21
Time (GMT)	10:24	10:56	11:50		12:16	12:29	15:10	13:33
PH	8.40	8.32	7.80	-	7.76	8.15	8.15	7.66
Actual Conductivity (µS/cm)	322.95	337.07	260.61	-	452.76	426.00	380.87	405.28
Specific Conductivity (µS/cm)	518.00	520.84	370.35	-	639.48	641.60	540.74	591.16
Salinity (PSU)	0.25	0.25	0.18	-	0.31	0.31	0.26	0.29
Total Dissolved Solids (ppt)	0.34	0.34	0.24	-	0.42	0.42	0.35	0.38
Turbidity (NTU)	19.00	18.58	0.00	-	16.14	69.57	1.26	3.78
RDO Concentration (mg/L)	12.67	11.94	11.25	-	10.96	12.04	12.07	8.78
RDO Saturation (%)	100.74	97.88	99.21	-	97.15	101.01	106.56	75.70
Oxygen Partial Pressure (Torr)	144.59	140.51	141.98	-	139.00	144.77	152.48	108.41
Temperature (°C)	5.28	6.54	9.48	-	9.67	7.40	9.52	8.53
CaCO3 Mg/l (PPM)	213.00	195.00	204.00	-	285.00	273.00	186.00	300.00

[3] Sample unable to be obtained due to low water levels at and around the monitoring location.

Laboratory sampling

3.3.2 Table 3-35 to Table 3-43 display spring water quality results from laboratory samples between August 2020 and April 2021. Monitoring for March 2021 was unable to be conducted, and samples were taken in early April 2021.

Table 3-35 Laboratory spring water quality data August 2020

Location ID	GW1	GW5	GW6
Date	24-Aug-20	25-Aug-20	25-Aug-20
Time (GMT)	14:45	10:55	11:30
Lab ID	19696094	19619020	19619021
pH	8.3	8	8.1
Conductivity- Electrical 20C, uS/cm	492	622	481
Alkalinity as CaCO3, mg/l	253	310	174
Nitrate as N, mg/l	<0.7	1.9	0.7
Phosphates , Total as P, mg/l	0.12	<0.120	0.13
Anions	-	-	-
Cations	-	-	-

Table 3-36 Laboratory spring water quality data September 2020

Location ID	GW1	GW5	GW6
Date	15-Sep-20	16-Sep-20	16-Sep-20
Time (GMT)	13:05	12:55	13:05
Lab ID	19690494	19686100	19686101
pH	8.1	8	7.9
Conductivity- Electrical 20C, uS/cm	11300	577	600
Alkalinity as CaCO3, mg/l	207	248	244
Nitrate as N, mg/l	0.8	3.1	1.1
Phosphates , Total as P, mg/l	<0.120	<0.120	<0.120
Anions	-	-	-
Cations	-	-	-

Table 3-37 Laboratory spring water quality data October 2020

Location ID	GW1	GW2	GW3	GW4	GW5	GW6	GW8
Date	20-Oct-20	20-Oct-20	20-Oct-20	20-Oct-20	21-Oct-20	21-Oct-20	22-Oct-20
Time (GMT)	13:16	13:24	14:15	14:30	15:55	16:05	10:10
Lab ID	19794635	19794636	19794637	19794638	19799706	19799707	19803377
pH	8.2	8.4	8.1	8.2	7.6	8.1	7.9
Conductivity- Electrical 20C, uS/cm	488	518	336	548	635	582	532
Alkalinity as CaCO3, mg/l	204	211	161	177	306	270	296
Nitrate as N, mg/l	2.2	2.7	3.3	4.2	5.1	2.1	<0.7
Phosphates , Total as P, mg/l	<0.120	<0.120	<0.120	<0.120	<0.120	<0.120	0.62
Anions	-	-	-	-	-	-	-
Cations	-	-	-	-	-	-	-

Table 3-38 Laboratory spring water quality data November 2020

Location ID	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
Date	18-Nov-20	18-Nov-20	18-Nov-20	18-Nov-20	19-Nov-20	19-Nov-20	19-Nov-20	19-Nov-20
Time (GMT)	12:12	12:20	13:51	13:27	11:27	11:42	14:52	09:17
Lab ID	19885907	19885908	19885909	19885910	19890548	19890547	19890546	19890545
pH	8.4	8.3	8	8.1	7.9	8.2	8	7.8
Conductivity- Electrical 20C, uS/cm	473	486	332	512	594	619	490	509
Alkalinity as CaCO3, mg/l	208	197	161	175	294	268	169	284
Nitrate as N, mg/l	2.1	3.1	3.2	3.6	5.4	3.4	15.8	<0.7
Phosphates , Total as P, mg/l	<0.120	<0.120	<0.120	<0.120	<0.120	<0.120	<0.120	0.2
Anions	-	-	-	-	-	-	-	-
Cations	-	-	-	-	-	-	-	-

Table 3-39 Laboratory spring water quality data December 2020 (round 1)

Location ID	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
Date	14-Dec-20	14-Dec-20	14-Dec-20	14-Dec-20	16-Dec-20	16-Dec-20	16-Dec-20	16-Dec-20
Time (GMT)	12:40	14:46	14:35	13:58	09:32	09:45	14:38	11:03
Lab ID	19971958	19971959	19971960	19971961	19982072	19982073	19982075	19982074
pH	8.2	8.2	7.9	8	8.1	8	7.9	7.7
Conductivity- Electrical 20C, uS/cm	502	534	357	559	595	652	469	439
Alkalinity as CaCO3, mg/l	205	192	166	174	293	254	176	224
Nitrate as N, mg/l	2.5	3.2	3.5	4.4	5.7	3.3	12	<0.7
Phosphates , Total as P, mg/l	<0.120	<0.120	<0.120	<0.120	<0.120	<0.120	<0.120	<0.120
Anions	-	-	-	-	-	-	-	-
Cations	-	-	-	-	-	-	-	-

Table 3-40 Laboratory spring water quality data December 2020 (round 2)

Location ID	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
Date	21-Dec-20	21-Dec-20	21-Dec-20	21-Dec-20	22-Dec-20	22-Dec-20	21-Dec-20	21-Dec-20
Time (GMT)	11:20	11:30	12:52	13:07	11:54	12:10	13:55	15:15
Lab ID	19995632	19995633	19995634	19995635	19999306	19999307	19995636	19995637
pH	8.3	8.3	7.9	8.1	7.8	8.3	8.2	8.3
Conductivity- Electrical 20C, uS/cm	472	484	336	506	601	584	513	428
Alkalinity as CaCO3, mg/l	190	190	158	172	293	266	195	219
Nitrate as N, mg/l	2.6	3.4	3.4	4.1	5.4	2.9	13.4	2.1
Phosphates , Total as P, mg/l	<0.120	<0.120	<0.120	<0.120	<0.120	<0.120	<0.120	<0.120
Anions	-	-	-	-	-	-	-	-
Cations	-	-	-	-	-	-	-	-

Table 3-41 Laboratory spring water quality data January 2021

Location ID	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
Date	26-Jan-21	26-Jan-21	27-Jan-21	27-Jan-21	27-Jan-21	27-Jan-21	27-Jan-21	27-Jan-21
Time (GMT)	13:42	14:02	15:42	15:30	10:24	10:34	14:55	12:28
Lab ID	20082970	20082971	20087918	20087917	20087915	20088275	20087916	20088276
pH	8.4	8.4	8	8.1	7.7	8.2	8	8.1
Conductivity- Electrical 20C, uS/cm	608	575	341	492	611	761	524	416
Alkalinity as CaCO3, mg/l	185	181	155	168	286	250	175	210
Nitrate as N, mg/l	3.6	3.9	3.6	4.4	5.3	3	15	2.1
Phosphates , Total as P, mg/l	<0.120	<0.120	<0.120	<0.120	<0.120	<0.120	<0.120	<0.120
Anions								
Cations								

Table 3-42 Laboratory spring water quality data February 2021

Location ID	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
Date	25-Feb-21	25-Feb-21	25-Feb-21	25-Feb-21	24-Feb-21	24-Feb-21	25-Feb-21	24-Feb-21
Time (GMT)	13:27	13:40	11:40	11:30	11:33	11:22	11:04	14:01
Lab ID	20184691	20184692	20184693	20184694	20178326	20178325	20184695	20178327
pH	8.4	8.3	8	8.1	7.8	8.1	8.1	7.7
Conductivity- Electrical 20C, uS/cm	478	476	325	476	585	609	479	488
Alkalinity as CaCO3, mg/l	183	181	158	171	280	258	174	252
Nitrate as N, mg/l	3.1	3.5	3.1	4.3	5.6	3.3	14.6	<0.7
Phosphates , Total as P, mg/l	<0.120	<0.120	<0.120	<0.120	<0.120	<0.120	<0.120	<0.120
Anions	-	-	-	-	-	-	-	-
Cations	-	-	-	-	-	-	-	-

Table 3-43 Laboratory spring water quality data April 2021

Location ID	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
Date	07-Apr-21	07-Apr-21	07-Apr-21	-[4]	06-Apr-21	06-Apr-21	06-Apr-21	06-Apr-21
Time (GMT)	10:23	10:55	11:50	-	12:15	12:28	15:10	13:32
Lab ID	**20311134**	**20311135**	**20311136**	-	**20305954**	**20305955**	**20305957**	**20305956**
pH	8.2	8.4	8.1	-	8.1	8	8	8.3
Conductivity- Electrical 20C, uS/cm	469	483	344	-	608	565	484	539
Alkalinity as CaCO3, mg/l	194	193	160	-	286	258	177	302
Nitrate as N, mg/l	2.2	2.6	4.1	-	5.4	2.6	14	<0.7
Phosphates , Total as P, mg/l	<0.120	<0.120	<0.120	-	<0.120	<0.120	<0.120	0.14
Anions	-	-	-	-	-	-	-	-
Cations	-	-	-	-	-	-	-	-

[4] Location was dry, so unable to sample

Visual observations

3.3.3 Table 3-44 to Table 3-51 show visual data collected between July 2020 and April 2021. Monitoring for March 2021 was unable to be conducted, and samples were taken in early April 2021.

Table 3-44 Visual observations for GW1 between July 2020 and April 2021

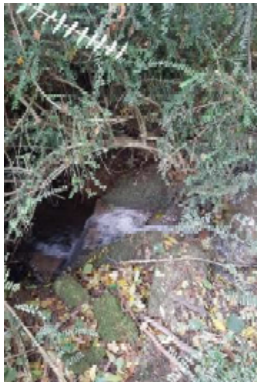
Month	Observations	Images
July 2020	None taken	None taken
August 2020	Photo taken looking down at the site with the flow directed towards observer. Very low flow with slow velocity. There is no vegetation in the channel.	 
September 2020	Depth of the water increased since previous visit, with the flow directed towards observer. There was no vegetation in the channel.	

Month	Observations	Images
October 2020	Evidence of high flows between visits due to amount of debris in the channel. The water level was low during the visit.	
November 2020	More water in the channel during the November visit compared to previous visit. Increased turbidity with leaves and debris present in the channel.	 
December 2020 (Round 1)	Weather: Cloudy Air temperature: 11°C Water colour: Light brown Algae growth: No Smell: No Dead fish: No	 

Month	Observations	Images
December 2020 (Round 2)	Weather: Cloudy Air temperature: 13°C Water colour: Light brown Algae growth: No Smell: No Dead fish: No	 
January 2021	Weather: Overcast Air temperature: 6°C Water colour: Light brown Algae growth: No Smell: No Dead fish: No	 
February 2021	Weather: Overcast Air temperature: 11°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	

Month	Observations	Images
April 2021	Weather: Overcast Air temperature: 6°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	

Table 3-45 Visual observations for GW2 between July 2020 and April 2021

Month	Observations	Images
July 2020	Unable to access location	Unable to access location
August 2020	Unable to access location	Unable to access location
September 2020	Unable to access location	Unable to access location
October 2020	Very low flow velocity in the channel and the water level was very shallow. The channel bed was free of vegetation, but there was a small amount of leaves in the channel.	 
November 2020	Increased channel flow compared to last visit. The water was turbid. The channel bed was free of vegetation, but there was a small amount of leaves in the channel.	

Month	Observations	Images
December 2020 (Round 1)	Weather: Cloudy Air temperature: 11°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	
December 2020 (Round 2)	Weather: Cloudy Air temperature: 13°C Water colour: Light brown Algae growth: No Smell: No Dead fish: No	
January 2021	Weather: Overcast Air temperature: 6°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	

Month	Observations	Images
February 2021	Weather: Overcast Air temperature: 11°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	 
April 2021	Weather: Overcast Air temperature: 6°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	

Table 3-46 Visual observations for GW3 between July 2020 and April 2021

Month	Observations	Images
July 2020	Unable to access location	Unable to access location
August 2020	Unable to access location	Unable to access location
September 2020	Unable to access location	Unable to access location
October 2020	There was a small amount of water flowing out of the pipe and into the channel bed. No debris or vegetation in the chamber.	
November 2020	There was a small amount of water flowing out of the pipe an onto the channel bed. No debris or vegetation was in the chamber. Water was clear.	 

Month	Observations	Images
December 2020 (Round 1)	Weather: Cloudy Air temperature: 11°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	
December 2020 (Round 2)	Weather: Cloudy Air temperature: 13°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	
January 2021	Weather: Overcast Air temperature: 10°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	

Month	Observations	Images
February 2021	Weather: Overcast Air temperature: 11°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	
April 2021	Weather: Overcast Air temperature: 6°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	

Table 3-47 Visual observations for GW4 between July 2020 and April 2021

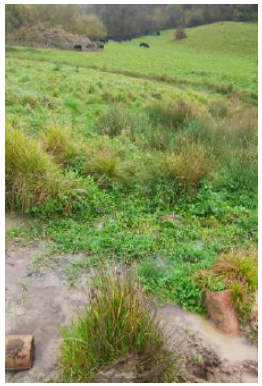
Month	Observations	Images
July 2020	Unable to access location	Unable to access location
August 2020	Unable to access location	Unable to access location
September 2020	Unable to access location	Unable to access location
October 2020	Limited volume of water flowing from the pipe. Bed contained lots of leaves and debris. The water was clear.	
November 2020	There was a more water flowing in the channel that last month. The water was clear and there was no vegetation present in the channel.	 

Month	Observations	Images
December 2020 (Round 1)	Weather: Cloudy Air temperature: 11°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	
December 2020 (Round 2)	Weather: Cloudy Air temperature: 13°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	
January 2021	Weather: Overcast Air temperature: 10°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	

Month	Observations	Images
February 2021	Weather: Overcast Air temperature: 11°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	
April 2021	Weather: Overcast Air temperature: 6°C Water colour: Channel dry Algae growth: No Smell: No Dead fish: No	

Table 3-48 Visual observations for GW5 between July 2020 and April 2021

Month	Observations	Images
July 2020	N/A	N/A
August 2020	The site was very muddy with pools of standing water. There was no vegetation in the channel.	
September 2020	The site was completely dry on this visit.	

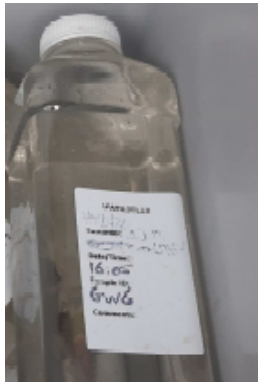
Month	Observations	Images
October 2020	The site was very muddy with pools of standing water. There was very little vegetation present in the channel and pools.	
November 2020	The site was very muddy with pools of standing water. There was some vegetation towards the edge of the channel and pools.	
December 2020 (Round 1)	Weather: Heavy rain Air temperature: 10°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	 

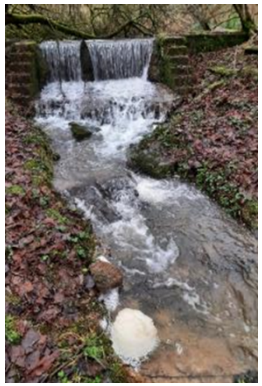
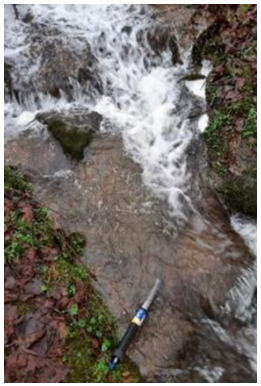
Month	Observations	Images
December 2020 (Round 2)	Weather: Cloudy Air temperature: 8°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	 
January 2021	Weather: Overcast Air temperature: 10°C Water colour: Cloudy Algae growth: No Smell: No Dead fish: No	
February 2021	Weather: Overcast Air temperature: 15°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	

Month	Observations	Images
April 2021	Weather: Overcast Air temperature: 7°C Water colour: Cloudy Algae growth: No Smell: No Dead fish: No	

Table 3-49 Visual observations for GW6 between July 2020 and April 2021

Month	Observations	Images
July 2020	None taken	None taken
August 2020	Very low flow at the site, no water was flowing over the brick dam. Water downstream was pooling.	
September 2020	As observed in the August 2020 visit, no water was flowing over the brick dam and water was pooling downstream. There was some debris in the channel.	

Month	Observations	Images
October 2020	No water flowing over the brick dam and there was pooling downstream. The water was clear.	
November 2020	A small volume of water was observed to be flowing over the brick dam during this visit and water was flowing downstream, whereas in previous visits it has been observed pooling in the channel.	N/A
December 2020 (Round 1)	Weather: Heavy rain Air temperature: 10°C Water colour: Light brown/clear Algae growth: No Smell: No Dead fish: No	 

Month	Observations	Images
December 2020 (Round 2)	Weather: Cloudy Air temperature: 8°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	 
January 2021	Weather: Overcast Air temperature: 10°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	
February 2021	Weather: Overcast Air temperature: 15°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	

Month	Observations	Images
April 2021	Weather: Overcast Air temperature: 7°C Water colour: Cloudy Algae growth: No Smell: No Dead fish: No	

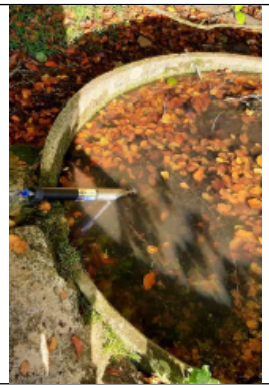
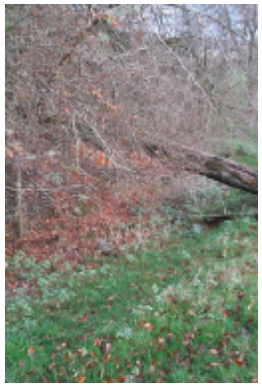
Table 3-50 Visual observations for GW7 between July 2020 and April 2021

Month	Observations	Images
July 2020	Unable to access location	Unable to access location
August 2020	Unable to access location	Unable to access location
September 2020	Unable to access location	Unable to access location
October 2020	Unable to access location	Unable to access location
November 2020	The channel was mostly clear of vegetation and was flowing very slowly. The water was a slightly turbid.	 
December 2020 (Round 1)	Weather: Heavy rain Air temperature: 8°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	 

Month	Observations	Images
December 2020 (Round 2)	Weather: Cloudy Air temperature: 13°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	 
January 2021	Weather: Overcast Air temperature: 10°C Water colour: Cloudy Algae growth: No Smell: No Dead fish: No	 
February 2021	Weather: Overcast Air temperature: 11°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	

Month	Observations	Images
April 2021	Weather: Overcast Air temperature: 7°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	

Table 3-51 Visual observations for GW8 between July 2020 and April 2021

Month	Observations	Images
July 2020	Unable to access location	Unable to access location
August 2020	Unable to access location	Unable to access location
September 2020	Unable to access location	Unable to access location
October 2020	The channel was completely dry and full of debris. It appeared that the channel had been free of water in for quite some time. Just upstream of the channel there is a circular well with a concrete channel that feeds it. This was full of stagnant water, which was filled with debris.	 
November 2020	As observed in the October 2020 visit, the channel was completed dry and full of debris. Appears to have had no flow for a long time. The well was filled of stagnant water.	 

Month	Observations	Images
December 2020 (Round 1)	Weather: Heavy rain Air temperature: 10°C Water colour: Clear Algae growth: No Smell: No Dead fish: No	
December 2020 (Round 2)	Weather: Cloudy Air temperature: 13°C Water colour: Cloudy Algae growth: No Smell: No Dead fish: No	 
January 2021	Weather: Overcast Air temperature: 10°C Water colour: Cloudy Algae growth: No Smell: No Dead fish: No	

Month	Observations	Images
February 2021	Weather: Overcast Air temperature: 15°C Water colour: Clear. Stagnant water. No apparent algal growth Algae growth: No Smell: No Dead fish: No	
April 2021	Weather: Overcast Air temperature: 7°C Water colour: Clear. Stagnant water. No apparent algal growth Algae growth: No Smell: No Dead fish: No	

3.4 Spring water flow

Manual flow measurements

3.4.1 The raw data from spring water flow monitoring from stations GW2, GW4, GW6, GW7 and GW8 are displayed in Table 3-52. Data noted that there were times when access to the site was not possible, and GW8 was completely dry on all sampling occasions. Monitoring for March 2021 was unable to be conducted, and samples were taken in early April 2021.

Table 3-52 Spring water flows between July 2020 and April 2021

Date	GW2		GW4		GW6		GW7		GW8	
	Stage	Flow	Stage	Flow	Stage	Flow	Stage	Flow	Stage	Flow
27/07/2020	No access		No access		-	-	No access		No access	
28/07/2020	No access		No access		-	-	No access		No access	
24/08/2020	No access		No access		-	-	No access		No access	
25/08/2020	No access		No access		Very low flow, unable to gauge		No access		No access	
15/09/2020	No access		No access		-	-	No access		No access	
16/09/2020	No access		No access		Very low flow, unable to gauge		No access		No access	
07/10/2020	No access		No access		-	-	No access		No access	
20/10/2020	No access		No access		-	-	No access		No access	
21/10/2020	No access		No access		-	-	No access		No access	
22/10/2020	Very low flow, unable to gauge		Very low flow, unable to gauge		Very low flow, unable to gauge		No access		Dry	Dry
18/11/2020	-	-	-	-	-	-	-	-	-	-
19/11/2020	N/A	0.017	N/A	0.004	9.245	0.008	9.295	0.001	Dry	Dry
14/12/2020	N/A	0.026	N/A	0.007	-	-	-	0.001	-	-
15/12/2020	-	-	-	-	-	-	-	-	-	-
16/12/2020	-	-	-	-	9.245	0.019	9.198	0.001	Dry	Dry
21/12/2020	N/A	0.046	N/A	0.031	-	-	9.341	N/A	Dry	Dry
22/12/2020	-	-	-	-	9.275	0.086	-	-	-	-
24/02/2021	-	-	-	-	9.250	0.023	-	-	Dry	Dry
25/02/2021	N/A	0.044	N/A	0.017	-	-	9.275	0.0003	-	-
06/04/2021	-	-	-	-	9.235	0.009	9.282	N/A	Dry	Dry
07/04/2021	N/A	0.005	Dry	Dry	-	-	-	-	-	-

3.4.2 Figure 3-5 displays the velocity data from Table 3-52 over the period between July 2020 and April 2021.

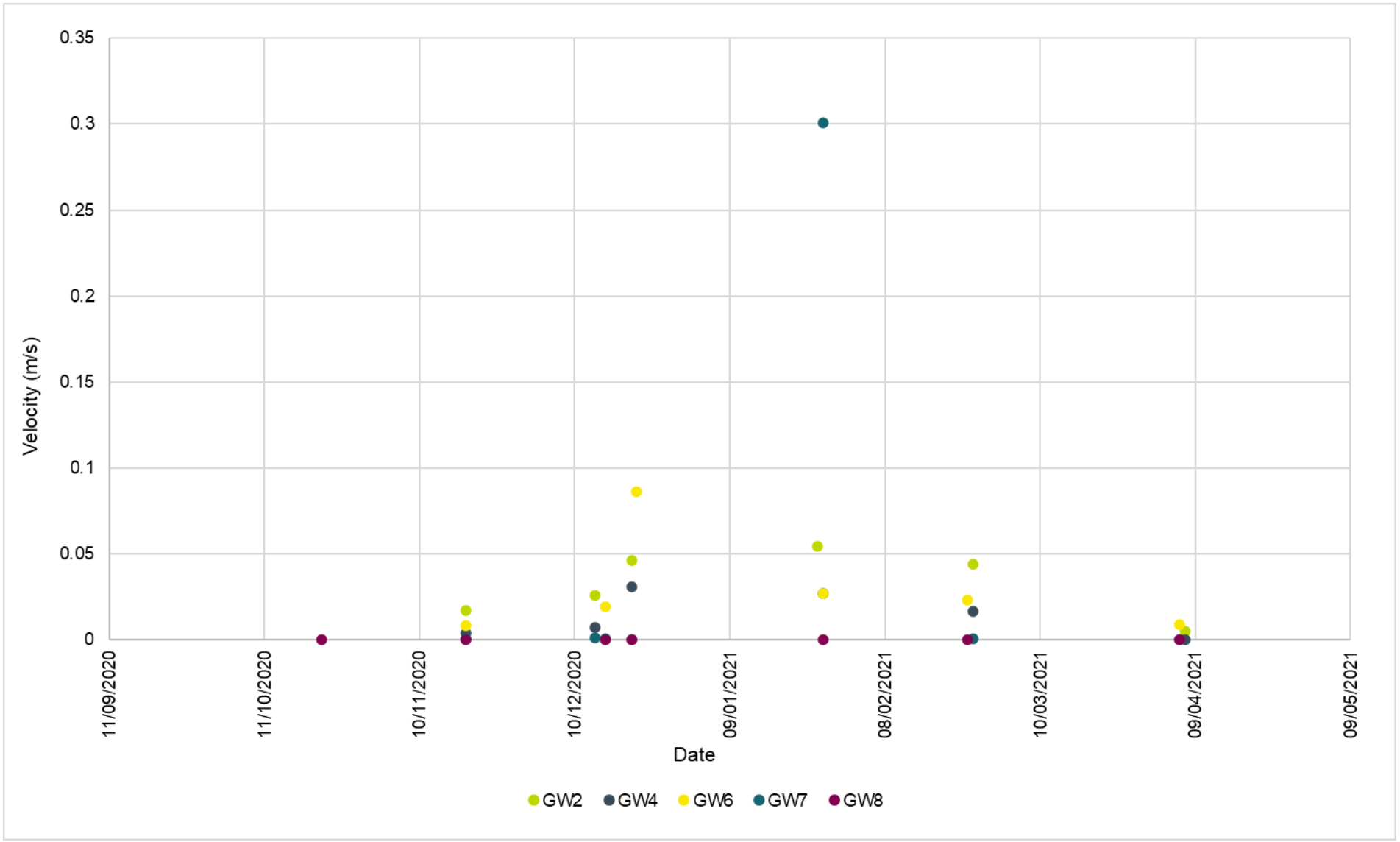


Figure 3-5 Spring water manual flow data between July 2020 and April 2021

3.5 Rainfall

Figure 3-6 and Figure 3-7 show Daily Rainfall (mm) data obtained from R1 and R2, respectively

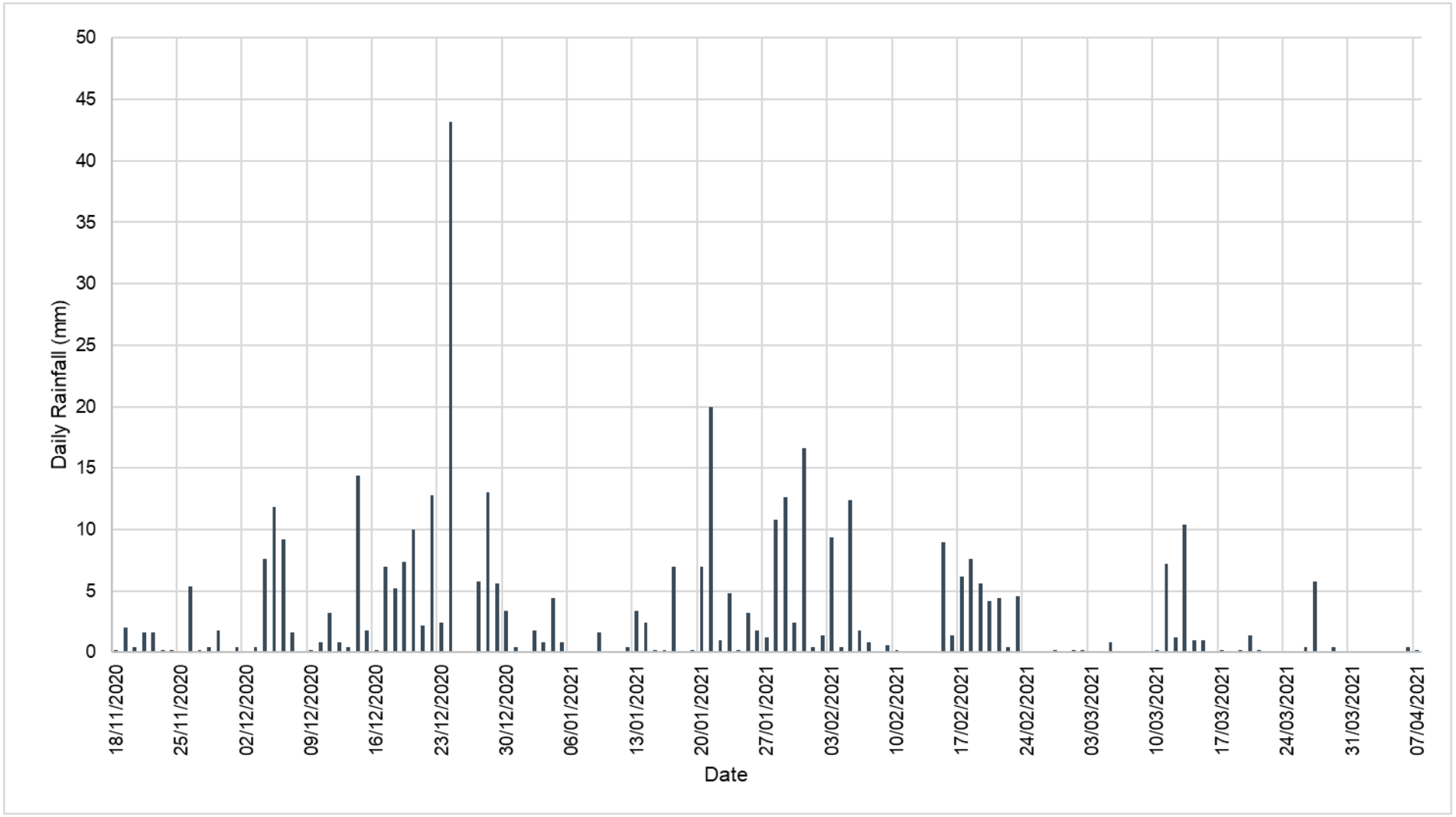


Figure 3-6 Rainfall data for R1 between November 2020 and April 2021

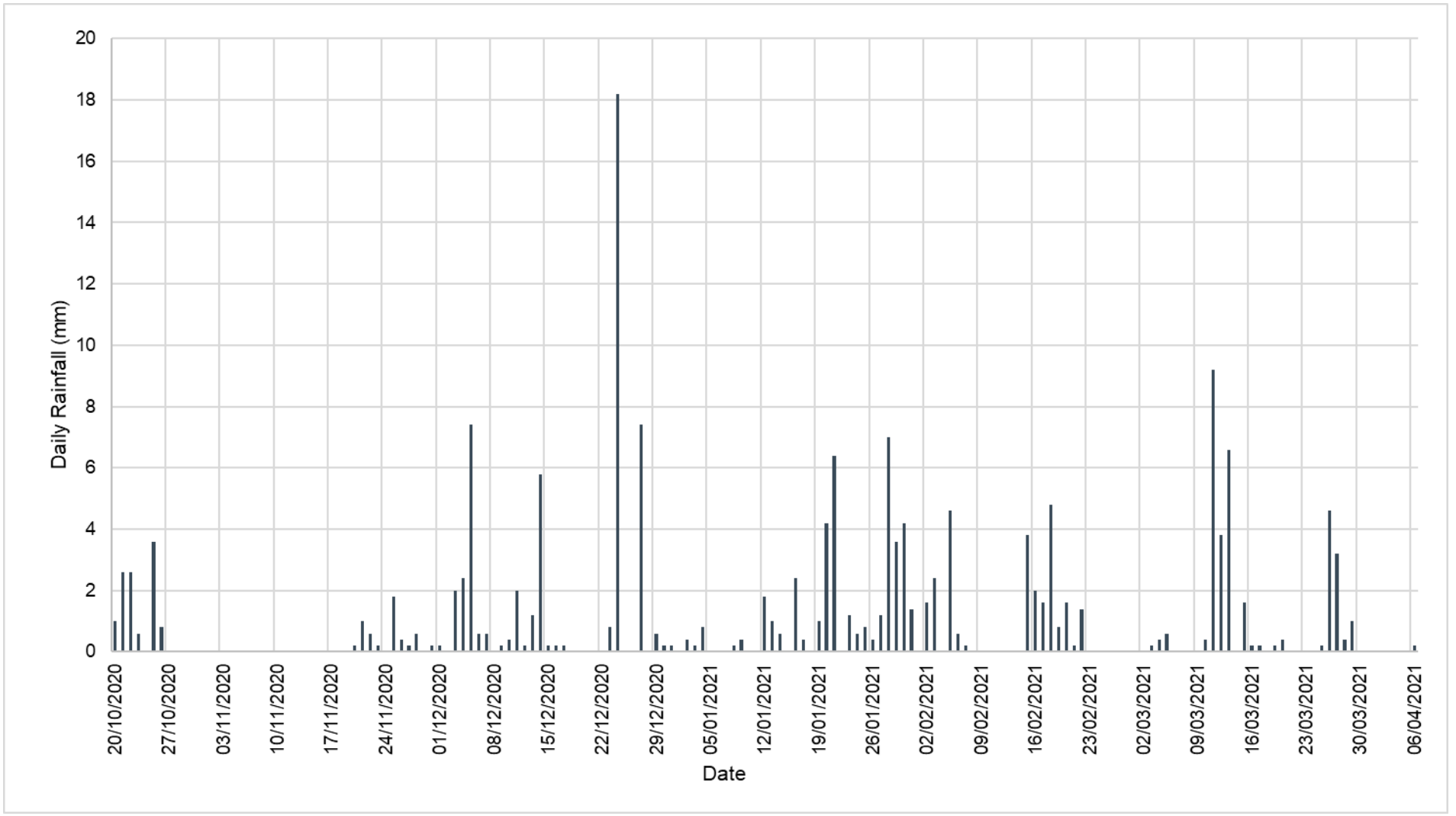


Figure 3-7 Rainfall data for R2 between November 2020 and April 2021

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