

# **High Speed Rail (Crewe – Manchester)**

## **Background information and data**

### **Water resources and flood risk**

BID WR-004-0MA05

MA05: Risley to Bamfurlong

Water resources assessment baseline data

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## Department for Transport

High Speed Two (HS2) Limited has been tasked by the Department for Transport (DfT) with managing the delivery of a new national high speed rail network. It is a non-departmental public body wholly owned by the DfT.

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# 1 Introduction

- 1.1.1 This document presents baseline data relating to the water resources assessment that has been undertaken for the Proposed Scheme.
- 1.1.2 The data has been collected in relation to the Risley to Bamfurlong area (MA05).
- 1.1.3 The Environmental Statement<sup>1</sup> should be referred to for details of:
- the Water Framework Directive (WFD) assessment (Volume 3, Route-wide effects and Volume 5: Appendix WR-001-00000);
  - the water resources assessments and flood risk assessments that are reported per community area (Volume 5: Appendices WR-003-0MA05 and WR-005-0MA05);
  - the hydraulic modelling reports that support the flood risk assessment (Volume 5: Appendices WR-006-00003, WR-006-00004, WR-006-00005 and WR-006-00006);
  - a groundwater modelling report that supports the water resources assessment (Volume 5: Appendix WR-008-00001); and
  - a Draft water resources and flood risk operation and maintenance plan (Volume 5: Appendix WR-007-00000).
- 1.1.4 Additional information is also included in Background Information and Data (BID) WFD compliance assessment baseline data that is reported for the Proposed Scheme (BID WR-002-00001).
- 1.1.5 Maps referred to throughout this document are set out in the in Volume 5, Water resources and flood risk Map Book, Map Series WR-01 and WR-02<sup>2</sup>.
- 1.1.6 Unless indicated otherwise, the spatial scope of the assessment (the study area) is based upon the identification of surface water and groundwater features within 1km of the route of the Proposed Scheme. In the Risley to Bamfurlong area, the study area has been extended to include the Risley Moss Site of Special Scientific Interest (SSSI) and Local Nature Reserve (LNR), which forms part of the Manchester Mosses Special Area of Conservation (SAC), and the whole of the Pennington Flash WFD lake water body (also designated as a Country Park, LNR and Site of Biological Importance (SBI)).

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<sup>1</sup> High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester) *Environmental Statement*. Available online at: <https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement>.

<sup>2</sup> High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement, Volume 5 Water resources and flood risk Map Book*. Available online at: <https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement>.

## 2 Baseline data

### 2.1 Surface water

2.1.1 The surface water features potentially affected by the Proposed Scheme, including their location, current overall WFD status, and future overall status objectives, are shown in Table 1. Further details are set out in Water Framework Directive compliance assessment baseline data (BID WR-002-00001). The receptor values attributed to each individual watercourse, based on the methodologies set out in the Environmental Impact Assessment Scope and Methodology Report (SMR)<sup>3</sup>, are also provided.

2.1.2 Those surface water features potentially affected by groundwater interactions are described in Section 2.3.

**Table 1: Surface water body receptors**

Water body name and location <sup>4</sup>	Type (at point closest to the Proposed Scheme) <sup>5</sup>	Q95 value (m <sup>3</sup> /s) <sup>6</sup>	Receptor value	Parent WFD water body name and identification number <sup>7</sup>	Current WFD status / objective <sup>8</sup>	2019 WFD status
M62 Drainage WR-01-306b – E7	Minor ditch	<0.002	Low	Glaze GB112069061420	Poor/Poor by 2015	Bad
Holcroft Lane Brook WR-01-306b – F6	Main river	<0.002	Moderate			
Tributary of Holcroft Lane Brook 1 WR-01-306b – E6	Ordinary watercourse	<0.002	Low			

<sup>3</sup> High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement, Environmental Impact Assessment Scope and Methodology Report*, Volume 5, Appendix CT-001-00001, Available online at: <https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement>.

<sup>4</sup> The feature locations are indicated by the grid coordinates on the relevant Volume 5, Water resources and flood risk Map Book, Map Series WR-01.

<sup>5</sup> The term ‘minor ditch’ has been used to denote a small trench or drain that has been constructed for the purpose of draining water from the land or roads and is isolated from the wider river network.

<sup>6</sup> This is the flow within the watercourse that is exceeded for 95% of the time. The Q95 has been provided as an indication of watercourse size but is only one of several criteria used to inform receptor value. Other criteria include the WFD watercourse classification which takes into account the value of any habitat which the watercourse supports. Details are provided in the SMR.

<sup>7</sup> The Environment Agency has attributed each surface water and groundwater body a unique water body identification (ID) number.

<sup>8</sup> Status and objectives are based on those set out in the 2015 river basin management plan (RBMP). See Environment Agency (2015), *River Basin Management Plan, North West River Basin District*. Available online at: <https://www.gov.uk/government/publications/north-west-river-basin-district-river-basin-management-plan>.

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Water body name and location <sup>4</sup>	Type (at point closest to the Proposed Scheme) <sup>5</sup>	Q95 value (m <sup>3</sup> /s) <sup>6</sup>	Receptor value	Parent WFD water body name and identification number <sup>7</sup>	Current WFD status / objective <sup>8</sup>	2019 WFD status
Tributary of Holcroft Lane Brook 2 <sup>9</sup> WR-01-306b – F6	Main river	<0.002	Low			
Tributary of Holcroft Lane Brook 3 WR-01-306b – F6	Ordinary watercourse	<0.002	Low			
Tributary of Holcroft Lane Brook 4 WR-01-306b – G5	Ordinary watercourse	<0.002	Low			
Tributary of Holcroft Lane Brook 5 WR-01-306b – G6	Ordinary watercourse	<0.002	Low			
Silver Lane Lake Drains WR-01-306b – G6	Minor ditch	<0.002	Low			
Warrington Road Drains WR-01-306b 2 G4	Minor ditch	<0.002	Low			
Culcheth Linear Park Drain 1 WR-01-306b – H5	Minor ditch	<0.002	Low			
Tributary of Cross Brook 1 WR-01-306b – H4	Ordinary watercourse	<0.002	Moderate	Spittle Brook GB112069061020	Moderate/Good by 2027	Moderate
Tributary of Glaze Brook 4 WR-01-306b – I5	Main river	0.002	Moderate	Glaze GB112069061420	Poor/Poor by 2015	Bad
Wigshaw Lane Drains WR-01-306b – I4	Minor ditch	<0.002	Low			
Culcheth Linear Park Drain 2 WR-01-306b – I4	Minor ditch	<0.002	Low			
Tributary of Cockshot Brook WR-01-307 – B4	Ordinary watercourse	<0.002	Low	Spittle Brook GB112069061020	Moderate/Good by 2027	Moderate

<sup>9</sup> Locally known as Silver Lane Brook.

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Water body name and location <sup>4</sup>	Type (at point closest to the Proposed Scheme) <sup>5</sup>	Q95 value (m <sup>3</sup> /s) <sup>6</sup>	Receptor value	Parent WFD water body name and identification number <sup>7</sup>	Current WFD status / objective <sup>8</sup>	2019 WFD status
Jibcroft Brook WR-01-307 – B5	Ordinary watercourse	<0.002	Moderate	Glaze GB112069061420	Poor/Poor by 2015	Bad
Tributary of Carr Brook 1 WR-01-307 – C6	Ordinary watercourse	<0.002	Low			
Tributary of Carr Brook 2 WR-01-307 – C7	Ordinary watercourse	<0.002	Low			
Carr Brook WR-01-307 – D6	Ordinary watercourse	0.003	Moderate			
Small Brook WR-01-307 – E7	Main river	<0.002	Low	Hey/Borsdane Brook GB112069064520	Moderate/Good by 2027	Moderate
Tributary of Pennington Flash 1 WR-01-307 – E7	Ordinary watercourse	<0.002	Moderate			
Pennington Flash WR-01-307 – E8	Static water body	N/A	High	Pennington Flash GB31232085	Moderate/Good by 2027	Moderate
Slag Lane Drains WR-01-307 – E6	Minor ditch	<0.002	Low	Hey/Borsdane Brook GB112069064520	Moderate/Good by 2027	Moderate
Sandy Lane Drain 1 WR-01-307 – E6	Minor ditch	<0.002	Low			
Tributary of Hey Brook 1 WR-01-307 – F6	Ordinary watercourse	0.003	Low			
Tributary of Hey Brook 3 WR-01-307 – F5	Main river	<0.002	Low			
Tributary of Hey Brook 2 WR-01-307 – F6	Ordinary watercourse	<0.002	Low			
Hey Brook WR-01-307 – H6	Main river	0.04	High			
Tributary of Hey Brook 4 WR-01-307 – F6	Ordinary watercourse	0.002	Moderate			
Lowton Road Drains WR-01-307 – G5	Minor ditch	<0.002	Low			
Tributary of Pennington Flash 2 WR-01-307 – F7	Ordinary watercourse	0.002	Moderate			



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Water body name and location <sup>4</sup>	Type (at point closest to the Proposed Scheme) <sup>5</sup>	Q95 value (m <sup>3</sup> /s) <sup>6</sup>	Receptor value	Parent WFD water body name and identification number <sup>7</sup>	Current WFD status / objective <sup>8</sup>	2019 WFD status
Leeds and Liverpool Canal WR-01-307 – F7	Canal	N/A	Very high			
Haydock Branch Junction Drains WR-01-307 – G4	Minor ditch	<0.002	Low			
Windy Bank Brook WR-01-307 – G5	Ordinary watercourse	<0.002	Moderate			
Wigan Road Drain WR-01-307 – H5	Minor ditch	<0.002	Low			
Tributary of Nan Holes Brook 1 WR-01-307 – H5	Ordinary watercourse	<0.002	Low			
Tributary of Nan Holes Brook 2 WR-01-307 – H5	Ordinary watercourse	<0.002	Low			
Nan Holes Brook WR-01-307 – H4	Main river	<0.002	Moderate			
Tributary of Hey Brook 5 WR-01-307 – H5	Ordinary watercourse	<0.002	Low			
Tributary of Coffin Lane Brook 2 WR-01-307 – H4	Ordinary watercourse	<0.002	Low			
Locker Lane Drain WR-01-307 – H5	Minor ditch	<0.002	Low			
Coffin Lane Brook WR-01-307 – I5	Main river	0.004	Moderate			
Tributary of Coffin Lane Brook 1 WR-01-307 – I6	Ordinary watercourse	<0.002	Low			
Tributary of Hey Brook 6 WR-01-307 – J6	Ordinary watercourse	<0.002	Moderate			
Bamfurlong Drains WR-01-307 – I6	Minor ditch	<0.002	Low			

2.1.3 There are no licensed surface water abstractions potentially affected by the Proposed Scheme. Records of private unlicensed surface water abstractions, that comprise those for quantities less than 20m<sup>3</sup> per day, have been obtained from the local authorities. These data indicate that there are no registered private unlicensed surface water abstractions within the study area. As there is no obligation to register private water supplies, unregistered private

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surface water supplies may be present. Private water supplies will be assessed as high value receptors unless details obtained from the owner indicate otherwise.

- 2.1.4 There are 16 permitted discharges to surface water potentially affected by the Proposed Scheme as shown in Table 2, four of which are within the land required for the construction of the Proposed Scheme. These have been assessed as low value receptors.

**Table 2: Permitted discharges to surface water**

Permit identifier (and map grid square) <sup>2</sup>	Distance and direction from route	Discharge type	Receiving water body
0174/1 WR-01-306b – E5	875m south-west of the route of the Proposed Scheme (535m south-west of the land required for construction of the Proposed Scheme)	Sewage discharge - final/treated effluent (not water company)	Tributary of Glaze Brook 2
016993444 WR-01-306b – G6	240m north of the route of the Proposed Scheme (located adjacent to the land required for construction of the Proposed Scheme)	Pumping station on unadopted sewerage network (not water company)	Holcroft Lane Brook
016992479 WR-01-307 – B6	880m north-east of the route of the Proposed Scheme (85m north of the land required for construction of the Proposed Scheme)	Sewage discharge - final/treated effluent (not water company)	Tributary of Carr Brook 1
01M/346 WR-01-307 – E7	380m north-east of the route of the Proposed Scheme (located within the land required for construction of the Proposed Scheme)	Domestic property (single) (including farmhouse)	Unknown
016992436 WR-01-307 – E7	540m north-east of the route of the Proposed Scheme (145m east of the land required for construction of the Proposed Scheme)	Domestic property (single) (including farmhouse)	Small Brook
016920140 WR-01-307 – F5	265m south-west of the route of the Proposed Scheme (located adjacent to the land required for construction of the Proposed Scheme)	Trade discharge - process effluent (not water company)	Tributary of Hey Brook 4
NPSWQD007848 WR-01-307 – G6	250m north-east of the route of the Proposed Scheme (located within the land required for construction of the Proposed Scheme)	Domestic property (single) (including farmhouse)	Hey Brook
EPRAP3320XC WR-01-307 – G6	210m north-east of the route of the Proposed Scheme (located within the land required for construction of the Proposed Scheme)	Domestic property (single) (including farmhouse)	Hey Brook
016993851 WR-01-307 – H6	730m north-east of the route of the Proposed Scheme (330m south-east of the land required for construction of the Proposed Scheme)	Sewage discharges- storm overflow/storm tank (water company)	Hey Brook

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Permit identifier (and map grid square) <sup>2</sup>	Distance and direction from route	Discharge type	Receiving water body
016992203 WR-01-307 – G5	60m south-west of the route of the Proposed Scheme (located within the land required for construction of the Proposed Scheme)	Sewage discharge - final/treated effluent (not water company)	Tributary of Nan Holes Brook 1
016991186 WR-01-307 – H4	690m south-west of the route of the Proposed Scheme (315m west of the land required for the construction of the Proposed Scheme)	Sewage discharge - final/treated effluent (not water company)	Nan Holes Brook
16992865 WR-01-307 – H4	820m south-west of the route of the Proposed Scheme (440m west of the land required for the construction of the Proposed Scheme)	Wastewater treatment works (not water company)	Nan Holes Brook
01WIG0117 WR-01-307 – I4	700m west of the route of the Proposed Scheme (590m south-west of the land required for the construction of the Proposed Scheme)	Sewage discharges- storm overflow/storm tank (water company)	Coffin Lane Brook
016992465 WR-01-307 – I6	620m north-east of the route of the Proposed Scheme (410m south-east of the land required for the construction of the Proposed Scheme)	Sewage discharge - final/treated effluent (not water company)	Hey Brook
016982904 WR-01-307 – I6	450m east of the route of the Proposed Scheme (200m south-east of the land required for the construction of the Proposed Scheme)	Sewage discharges - storm overflow/storm tank (water company)	Hey Brook
01WIG0130 WR-01-307 – I6	450m east of the route of the Proposed Scheme (200m north-east of the land required for the construction of the Proposed Scheme)	Pumping station on sewerage network (not water company)	Hey Brook

## 2.2 Groundwater

2.2.1 The groundwater features crossed by the Proposed Scheme within the study area, including their location, current overall WFD status and future overall status objectives, are shown in Table 3. Further details are set out in Water Framework Directive compliance assessment baseline data (BID WR-002-00001). The receptor values attributed to each individual feature are based on the methodologies set out in the SMR<sup>3</sup>.

2.2.2 Volume 5, Water resources assessment and flood risk Map Book: map WR-02-305<sup>2</sup> shows the superficial and bedrock formations within MA05.

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**Table 3: Summary of geology and hydrogeology in the study area**

Geology	Distribution	Formation description	Aquifer classification	WFD body (ID) and current overall status <sup>10</sup> /2019 status	WFD objective <sup>11</sup>	Receptor value
<b>Superficial deposits<sup>12</sup></b>						
Peat	Southern end of study area from Glazebrook Moss to 500m north of the M62	Peat	Unproductive	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Low
Alluvium	Not crossed by the route of the Proposed Scheme. In the valleys of Glaze Brook and Hey Brook, and some of their tributaries	Clay, silt, sand and gravel	Secondary A	Weaver and Dane Quaternary Sand and Gravel Aquifer (GB41202G99 1700) Poor/Poor	Good by 2027	Moderate
Lacustrine deposits	Not crossed by the route of the Proposed Scheme. Two isolated patches near Golborne and Croft.	Clay and silt	Unproductive	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Low
Head	Not crossed by the route of the Proposed Scheme. Isolated patch west of Abram	Clay, silt, sand and gravel	Secondary (Undifferentiated)	Weaver and Dane Quaternary Sand and Gravel Aquifer (GB41202G99 1700) Poor/Poor	Good by 2027	Moderate

<sup>10</sup> Based on the 2015 RBMP. Note that where the Environment Agency have not assigned an individual water body ID to a unit, it has been assumed that it is connected to the underlying/overlying water body.

<sup>11</sup> Status and objectives are based on those set out in the 2015 RBMP.

<sup>12</sup> Superficial deposits are not necessarily listed in the order of superposition. Other superficial deposits may be present between the deposits shown in the table and bedrock, including deposits that do not appear in the table.

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Geology	Distribution	Formation description	Aquifer classification	WFD body (ID) and current overall status <sup>10</sup> /2019 status	WFD objective <sup>11</sup>	Receptor value
Glaciofluvial deposits	Between Culcheth and Little Woolden Moss	Sand and gravel	Secondary A	Weaver and Dane Quaternary Sand and Gravel Aquifer (GB41202G99 1700) Poor/Poor	Good by 2027	Moderate
Glaciofluvial ice contact deposits	Not crossed by the route of the Proposed Scheme. Isolated patches around Kenyon	Sand and gravel	Secondary A	Weaver and Dane Quaternary Sand and Gravel Aquifer (GB41202G99 1700) Poor/Poor	Good by 2027	Moderate
Glaciofluvial sheet deposits	Some patches between the M62 and south of Culcheth	Sand and gravel	Secondary A	Weaver and Dane Quaternary Sand and Gravel Aquifer (GB41202G99 1700) Poor/Poor	Good by 2027	Moderate
Glaciolacustrine deposits	East of Culcheth and around Pocket Nook	Clay and silt	Unproductive	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Low
Glacial till	Across most of the study area, from south of Culcheth to the northern boundary	Sandy silty clay	Secondary (Undifferentiated)	Weaver and Dane Quaternary Sand and Gravel Aquifer (GB41202G99 1700) Poor/Poor	Good by 2027	Moderate
<b>Bedrock</b>						
Mercia Mudstone Group - Tarporley Siltstone Formation	Not crossed by the route of the Proposed Scheme. East of Gorse Covert	Siltstone, mudstone and sandstone	Secondary B	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate

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Geology	Distribution	Formation description	Aquifer classification	WFD body (ID) and current overall status <sup>10</sup> /2019 status	WFD objective <sup>11</sup>	Receptor value
Sherwood Sandstone Group - Helsby Sandstone Formation	From the southern end of the study area to south of Franks Farm	Pebbly sandstone	Principal	Lower Mersey Basin and Merseyside North Permo-Triassic Sandstone Aquifers (GB41201G10 1700) Poor/Poor	Good by 2027	High
Sherwood Sandstone Group - Wilmslow Sandstone Formation	South of Franks Farm to Lowton St Mary's	Sandstone	Principal	Lower Mersey Basin and Merseyside North Permo-Triassic Sandstone Aquifers (GB41201G10 1700) Poor/Poor	Good by 2027	High
Sherwood Sandstone Group - Chester Formation	Lowton St Marys to the A573 Wigan Road	Sandstone	Principal	Lower Mersey Basin and Merseyside North Permo-Triassic Sandstone Aquifers (GB41201G10 1700) Poor/Poor	Good by 2027	High
Kinnerton Sandstone Formation <sup>13 14</sup>	Thin band west of the A573 Wigan Road	Sandstone	Principal	Lower Mersey Basin and Merseyside North Permo-Triassic Sandstone Aquifers (GB41201G10 1700) Poor/Poor	Good by 2027	High

<sup>13</sup> Recent updates to the nomenclature used to describe these formations have removed the Kinnerton Sandstone Formation from the Sherwood Sandstone Group.

<sup>14</sup> Ambrose et al. (2014), *Lithostratigraphy of the Sherwood Sandstone Group of England, Wales and south-west Scotland*. British Geological Survey (RR/14/01).

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Geology	Distribution	Formation description	Aquifer classification	WFD body (ID) and current overall status <sup>10</sup> /2019 status	WFD objective <sup>11</sup>	Receptor value
Cumbrian Coast Group - Manchester Marls Formation	West of the A573 Wigan Road to Aye Bridge Farm	Mudstone	Secondary B	Lower Mersey Basin and Merseyside North Permo-Triassic Sandstone Aquifers (GB41201G10 1700) Poor/Poor	Good by 2027	Moderate
Appleby Group - Collyhurst Sandstone Formation	Aye Bridge Farm to Bryn Gates	Sandstone	Principal	Lower Mersey Basin and Merseyside North Permo-Triassic Sandstone Aquifers (GB41201G10 1700) Poor/Poor	Good by 2027	High
Pennine Coal Measures Group - Pennine Middle Coal Measures Formation	Bryn Gates to the northern end of study area	Mudstone, siltstone and sandstone with coal seams	Secondary A	Sankey and Glaze Carboniferous Aquifers (GB41202G10 0100) Poor/Poor	Good by 2027	Moderate

2.2.3 All alluvium, glaciofluvial deposits, glaciofluvial sheet deposits and glaciofluvial ice contact deposits in the study area are classified as Secondary A aquifers by the Environment Agency. Glacial till and head are classified as Secondary (Undifferentiated) aquifers by the Environment Agency. The peat, lacustrine deposits and glaciolacustrine deposits are classified as Unproductive by the Environment Agency.

2.2.4 There are six bedrock aquifers classified by the Environment Agency in the study area. The Sherwood Sandstone Group is classified as a Principal aquifer and consists of the Helsby, Wilmslow and Chester Formations. The Kinnerton Sandstone Formation and Appleby Group (Collyhurst Sandstone Formation) are also classified as Principal aquifers. The Pennine Coal Measures Group is classified as a Secondary A aquifer and consists of the Pennine Middle Coal Measures Formation. The Mercia Mudstone Group (Tarporley Siltstone Formation) and Cumbrian Coast Group (Manchester Marls Formation) are classified as Secondary B aquifers.

2.2.5 The structural geology of the study area is complex, with many major faults traversing the study area, some of which have vertical displacements of over 200m in places.

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2.2.6 There are five Environment Agency observation boreholes that monitor groundwater level in the Sherwood Sandstone Group within the study area. In addition, while Landside South and Landside North observation boreholes (both of which also monitoring groundwater levels in the Sherwood Sandstone Group) are located slightly outside the study area, groundwater level data have also been included for these boreholes. This is because long-term records of groundwater level data are available for the Landside South and Landside North observation boreholes, and the boreholes are located in the vicinity of Lowton cutting and groundwater abstraction boreholes for public water supply. The location of these boreholes is shown in Figure 1.

2.2.7 The total of seven observation boreholes included are:

- Taylors Industrial Estate: 150m north of the route of the Proposed Scheme, south-west of Culcheth (ground level at 29.3mAOD);
- Croft Pumping Station (PS): 320m south of the route of the Proposed Scheme, south-west of Culcheth (ground level at 37.1mAOD);
- Kenyon Farm: 650m south-west of the route of the Proposed Scheme, north of Croft (ground level at 39.8mAOD);
- Kenyon Lane: 430m west of the route of the Proposed Scheme, south of Lowton (ground level at 47.3mAOD);
- Landside South: 1.6km east of the route of the Proposed Scheme, east of Lowton (ground level at 20.1mAOD);
- Landside North: 1.6km east of the route of the Proposed Scheme, east of Lowton (and approximately 330m north of Landside South) (ground level at 38.5mAOD); and
- Slag Lane: 660m north of the route of the Proposed Scheme, north of Lowton (ground level at 19.3mAOD).



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2.2.8 Figure 2 presents the time-series of available groundwater level monitoring data from the seven monitoring locations in the 50-year period from 1970 to 2020. The following points are noted from Figure 2:

- for ease of comparison, all the graphs are plotted for the same time period, 1970 to 2020. The groundwater level intervals vary between graphs, but all graphs have the same total level range of 35m. The 0mAOD level is highlighted in each graph;
- the data for Landside South and Landside North are plotted on the same graph due to their similarity in groundwater level trends, in turn a result of their proximity with each other;
- one anomalous data point is present in the record for Taylors Industrial Estate on 12 December 2012. The recorded groundwater level was approximately 10m below other data points in the months before and after December 2012. Therefore, the data point for 12 December 2012 is assumed to have been incorrectly recorded;
- much lower water levels were recorded at Croft PS in late April and early May 1982 than both before and after this period. These lower water levels range from -33 to -35mAOD. They are assumed to be pumping water levels rather than rest water levels as for the remainder of the record and therefore, are not shown in Figure 2;
- the data record for Kenyon Lane is limited in comparison with other borehole sites and is only available for the period June 2011 to November 2020;
- some or all of the data for six of the seven observation boreholes comprise groundwater levels that are below Ordnance Datum, i.e. below 0mAOD. Historically, there has been major abstractions from the Sherwood Sandstone Group in the area that reduced groundwater levels significantly. The lowest groundwater levels are evident in the boreholes at Slag Lane and Landside (Landside North and Landside South), to the north and east of Lowton respectively. The minimum groundwater levels occurred at Slag Lane in 1995 to 1999 and at Landside North and Landside South in 1993 to 1997; and
- over the past 20 to 30 years, or longer at some borehole sites, groundwater levels have recovered substantially. It has been assumed that this is due to reductions in groundwater abstraction in the area. A continuing rising trend is evident in all areas where the observation boreholes are located, with groundwater levels in most areas now above Ordnance Datum. However, at Slag Lane, the most recently available groundwater levels (from 2019) are still approximately 5m below Ordnance Datum.

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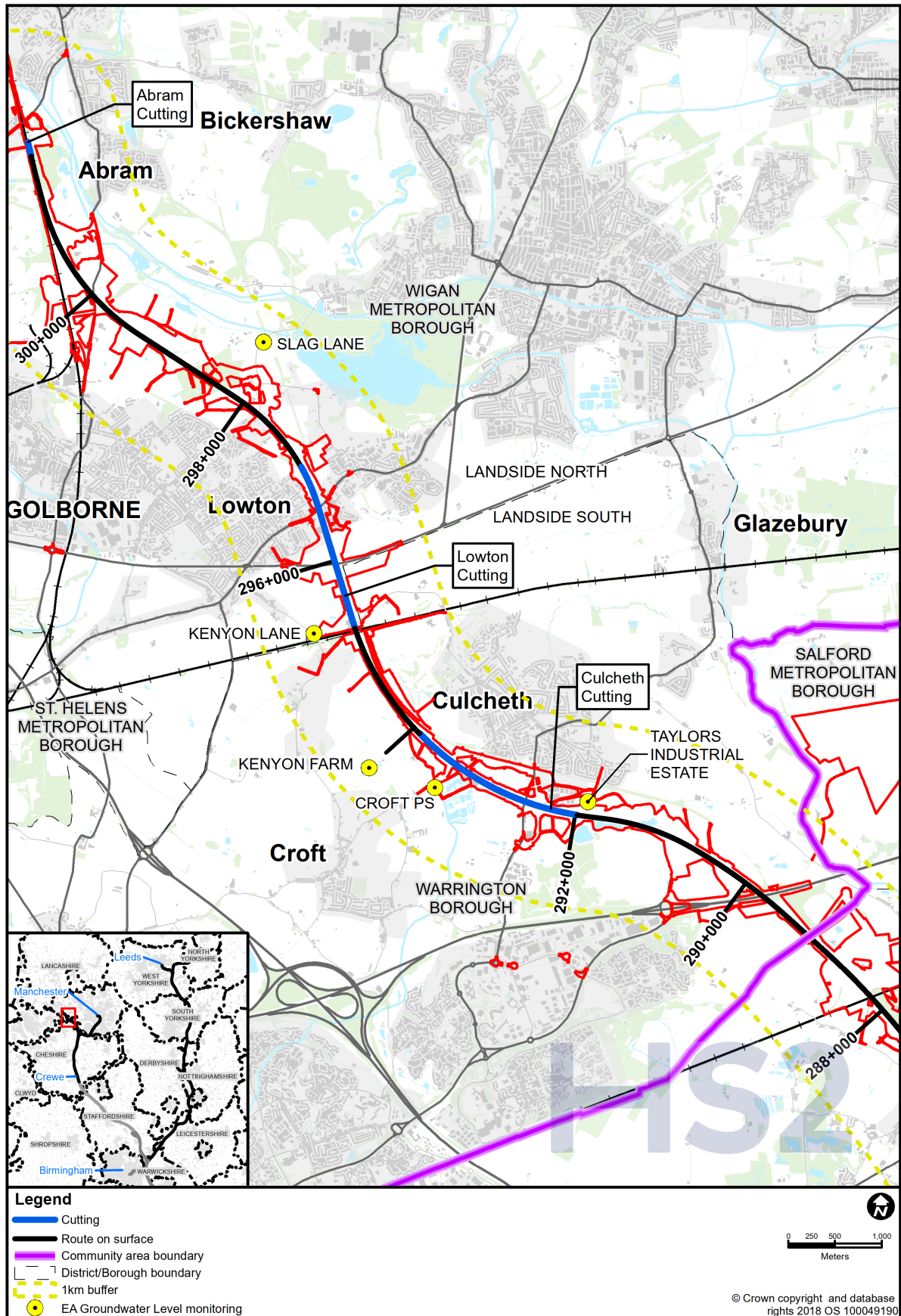
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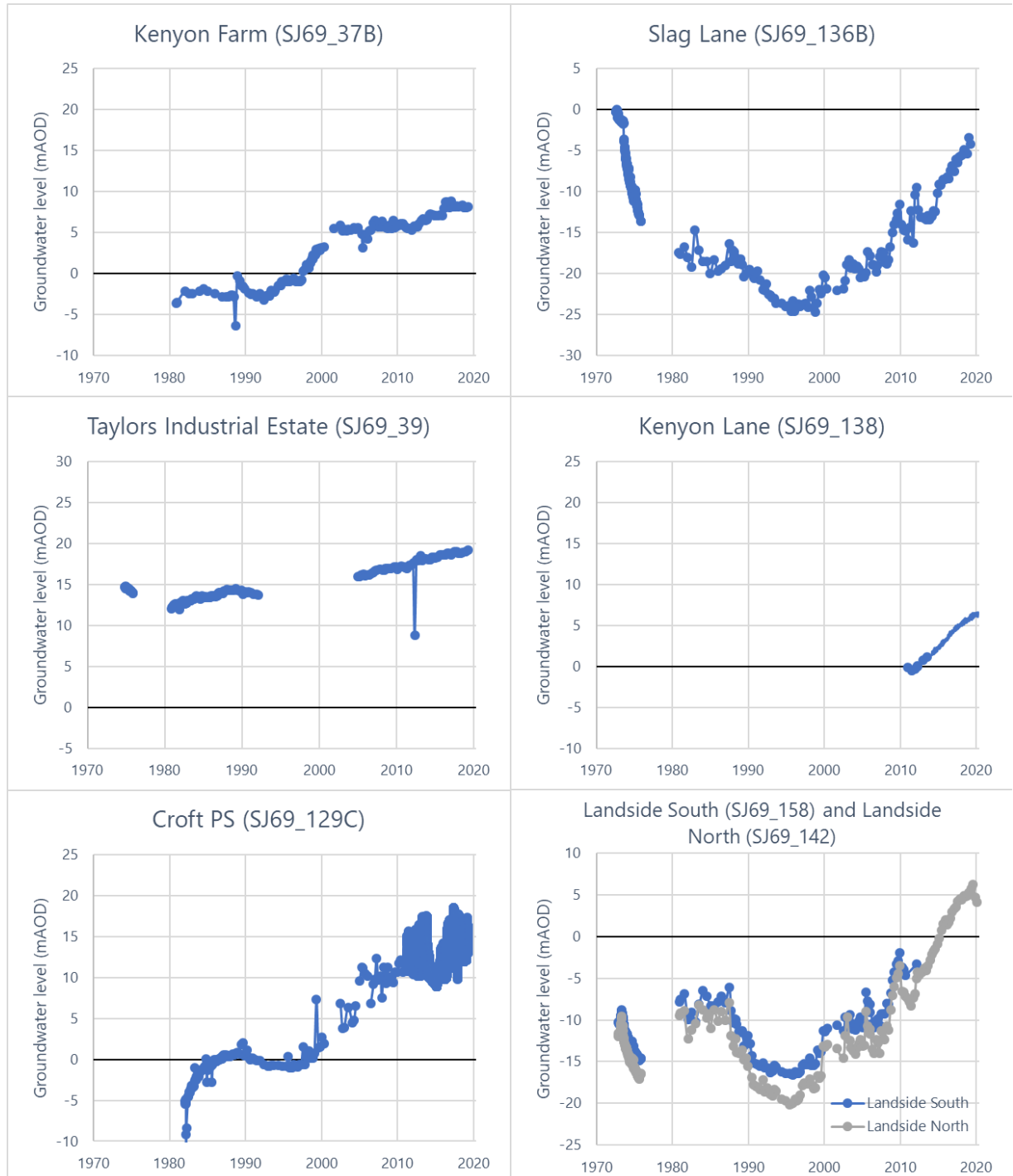
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Figure 1: Location of Environment Agency groundwater level monitoring boreholes



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**Figure 2: Environment Agency groundwater level monitoring data**



Data provided by the Environment Agency

2.2.9 No groundwater monitoring data are available for the other Principal, Secondary A and Secondary B bedrock aquifers in the study area, or for any of the aquifers in superficial deposits. For these aquifers, water strikes recorded on borehole logs available in British Geological Society (BGS) records have been referred to for the purpose of the assessment.

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- 2.2.10 Groundwater in the superficial aquifers is expected to be shallow and the direction of groundwater flow is likely to follow the general topography. The surface watercourses are likely to act as discharge locations for converging groundwater flow in the area.
- 2.2.11 Some groundwater flow is expected in the Mercia Mudstone Group, although permeable horizons within this unit are expected to be laterally discontinuous and associated with thin siltstone and sandstone layers called skerries. There may also be a small component of fracture flow in the aquifer in the Mercia Mudstone Group.
- 2.2.12 Regional groundwater flow in the Sherwood Sandstone is expected to be approximately from east to west, based on hydrogeology maps available from the BGS<sup>15</sup>, although due to the limited groundwater level data it is not possible to confirm this at this time. In addition, groundwater flow in the area of the Proposed Scheme is likely to be influenced by:
- historical and current abstractions; and
  - the varying recovery in groundwater levels across the area as indicated by the observation borehole hydrographs.
- 2.2.13 Table 4 summarises groundwater abstractions and their locations are shown on Volume 5, Water resources assessment and flood risk Map Book: map WR-02-305.
- 2.2.14 There are seven groundwater abstraction licences for public water supplies (PWS) within the study area, protected by source protection zones (SPZ). In some areas, SPZ2 is either crossed by the route of the Proposed Scheme or include land required for the construction of the Proposed Scheme.
- 2.2.15 There is one private licensed abstraction and one private unlicensed abstraction from groundwater in the study area. Such abstractions do not have mapped SPZ but, where used for potable supply and some other purposes, have a nominal SPZ1 of 50m<sup>16</sup>. The two licences, one for commercial supply and one as potable supply, are assessed as high value receptors on a precautionary basis.
- 2.2.16 The private water supply information has been provided by the local authorities. Information regarding deregulated abstractions has been provided by the Environment Agency. Where land access has been available, surveys have been undertaken to confirm unlicensed abstraction details. Where the exact details of an unlicensed abstraction are not known, a precautionary assessment has been undertaken.

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<sup>15</sup> British Geological Survey (1989), *Hydrogeological map of Clwyd and the Cheshire Basin including parts of the hydrometric areas 54, 65, 66, 67, 68 69 and 70*. Available online at:

<https://webapps.bgs.ac.uk/data/maps/maps.cfc?method=viewRecord&mapId=11567>.

<sup>16</sup> Environment Agency (2017), *Protect groundwater and prevent groundwater pollution*. Available online at:

<https://www.gov.uk/government/publications/protect-groundwater-and-prevent-groundwater-pollution/protect-groundwater-and-prevent-groundwater-pollution>.

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2.2.17 There is the potential for further unlicensed abstractions to exist, as a licence is not required for abstraction volumes below 20m<sup>3</sup> per day and not all unlicensed abstractions are registered with the local authority. These may also need to be protected.

**Table 4: Summary of groundwater abstractions**

Name, licence number (and map grid square) <sup>17</sup>	Distance and direction from route	Abstraction source	Maximum annual abstraction quantity (m <sup>3</sup> )	Maximum daily abstraction quantity (m <sup>3</sup> )	Purpose	Number of boreholes
<b>Public water supplies (PWS)</b>						
United Utilities Ltd Licence identifier confidential WR-02-305 – D5, C5, C6, B6, B7, SPZ3 location	380m south-west of the route of the Proposed Scheme (within the land required for the construction of the Proposed Scheme)	Sherwood Sandstone	2,495,754	6,819	Public water supply	2
United Utilities Ltd Licence identifier confidential WR-02-305 – D4, SPZ1 location	1.1km south-west of the route of the Proposed Scheme (720m south-west of the land required for the construction of the Proposed Scheme)	Sherwood Sandstone	1,659,290	4,546	Public water supply	2
United Utilities Ltd Licence identifier confidential WR-02-305 – E5, SPZ1 location	410m east of the route of the Proposed Scheme (150m north of the land required for the construction of the Proposed Scheme)	Sherwood Sandstone	1,636,596	7,956	Public water supply	1
United Utilities Ltd Licence identifier confidential WR-02-305 – E6, SPZ1 location	670m east of the route of the Proposed Scheme (250m north of the land required for the construction of	Sherwood Sandstone	2,500,355**	9,092**	Public water supply	1

<sup>17</sup> Map grid squares on Volume 5, Water resources assessment and flood risk Map Book, map WR-02-305 for SPZ, licence numbers (for licensed abstractions) and unique map identification (ID) numbers (for unlicensed groundwater abstractions). Abstraction features in the study area are generally listed from south to north.

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Name, licence number (and map grid square) <sup>17</sup>	Distance and direction from route	Abstraction source	Maximum annual abstraction quantity (m <sup>3</sup> )	Maximum daily abstraction quantity (m <sup>3</sup> )	Purpose	Number of boreholes
	the Proposed Scheme)					
United Utilities Ltd Licence identifier confidential WR-02-305 – E6, SPZ1 location	1.5km east of the route of the Proposed Scheme (780m east of the land required for the construction of the Proposed Scheme)	Sherwood Sandstone	2,500,355**	9,092**	Public water supply	1
United Utilities Ltd Licence identifier confidential WR-02-305 – F5, SPZ1 location	630m south-west of the route of the Proposed Scheme (480m west of the land required for the construction of the Proposed Scheme)	Sherwood Sandstone	1,388,653	4,546	Public water supply	2
United Utilities Ltd Licence identifier confidential WR-02-305 – F6, SPZ1 location	470m north-east of the route of the Proposed Scheme (200m north of the land required for the construction of the Proposed Scheme)	Sherwood Sandstone	2,500,355	7,728	Public water supply	1
<b>Private licensed water supplies</b>						
Leigh Golf Club Ltd 2569016072 WR-02-305 – D5	580m north-east of the route of the Proposed Scheme (280m north-east of the land required for the construction of the Proposed Scheme)	Sherwood Sandstone	9,000	120	Commercial golf courses, spray irrigation	1
<b>Private unlicensed water supplies</b>						
Phillips Farm WR-02-305 – C5	40m south-west of the route of the Proposed Scheme (within the land required	Unknown	Unknown	Unknown	Household use (assumed potable on a	1

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Name, licence number (and map grid square) <sup>17</sup>	Distance and direction from route	Abstraction source	Maximum annual abstraction quantity (m <sup>3</sup> )	Maximum daily abstraction quantity (m <sup>3</sup> )	Purpose	Number of boreholes
	for the construction of the Proposed Scheme)				precautionary basis)	

\*\* Aggregated licence

2.2.18 There are two consented discharges to groundwater within the study area and these have been assessed as low value receptors. These are summarised in Table 5.

**Table 5: Discharge consents to groundwater**

Permit identifier (and map grid square) <sup>18</sup>	Distance and direction from route	Discharge type	Receiving water body
NPSWQD002147 WR-02-305 – C7	970m north of the route of the Proposed Scheme (640m north-east of the land required for the construction of the Proposed Scheme)	Soakaway (domestic final/treated effluent) single property	Underground strata
016993599 WR-02-305 – G5	440m east of the route of the Proposed Scheme (83m north of the land required for the construction of the Proposed Scheme)	Soakaway (Septic tank Food and Beverage/Pub)	Underground strata

## 2.3 Groundwater – surface water interactions

2.3.1 Table 6 summarises the potential groundwater – surface water interactions identified within the study area.

2.3.2 Along with the main surface watercourses, that could have connection with groundwater, potential springs and issues have been identified within the study area from Ordnance Survey (OS) maps and detailed river network data provided by the Environment Agency. Where land access has been available, these have been surveyed to check if they are true expressions of groundwater (and therefore could contribute to flows to surface water bodies), or if they are simply land drainage features. Where surveys have proved the latter, the features are recorded as such in Table 6, but are excluded from the groundwater – surface water interactions impact assessment in Volume 5: Water resources assessment, Appendix WR-003-0MA05 and they are not shown in the table below or on Volume 5, Water resources and flood risk Map Book: map WR-02-305<sup>2</sup>, because they are implicitly included in the assessment of surface waters. Where they are inflows to minor ditches, for example, then any related impacts will be identified as part of the assessment on surface water features. In the absence of site surveys, the potential spring features have been assumed to

<sup>18</sup> Volume 5, Water resources assessment and flood risk Map Book: map WR-02-305. Discharges in the study area are listed from south to north.

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comprise springs and to be high value receptors. Where a spring does not support water dependant habitat then the corresponding value of the receiving surface watercourse is applied.

**Table 6: Groundwater – surface water interactions**

Feature (and map grid square) <sup>19</sup>	Distance and direction from route	Formation	Elevation (mAOD)	Comments
<b>Watercourses</b>				
Glaze Brook WR-02-305 – B7	690m north of the route of the Proposed Scheme (on the boundary of the land required for construction of the Proposed Scheme)	Alluvium over Sherwood Sandstone Group (Wilmslow Sandstone Formation and Helsby Sandstone Formation)	19	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Tributary of Glaze Brook 2 WR-02-305 – B7	Crossed by the route of the Proposed Scheme	Peat, alluvium, glaciofluvial deposits and glacial till over Mercia Mudstone Group (Tarpurley Siltstone Formation) and Sherwood Sandstone Group (Helsby Sandstone Formation)	18	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Holcroft Lane Brook WR-02-305 – C6	30m north of the route of the Proposed Scheme (within the land required for the construction of the Proposed Scheme)	Glaciofluvial deposits, glaciolacustrine deposits and glacial till over Sherwood Sandstone (Wilmslow Sandstone Formation)	23	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Tributary of Holcroft Lane Brook 1 WR-02-305 – C6	20m south of the route of the Proposed Scheme (within the land required for the construction of the Proposed Scheme)	Peat and glacial till over Sherwood Sandstone Group (Helsby Sandstone Formation)	20	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Tributaries of Holcroft Lane Brook 2 and 3 WR-02-305 – C6	Crossed by the route of the Proposed Scheme	Peat, glaciofluvial deposits and glacial till over Sherwood Sandstone Group (Wilmslow Sandstone Formation and Helsby Sandstone Formation)	22	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.

<sup>19</sup> Volume 5, Water resources assessment and flood risk Map Book: map WR-02-305. Watercourses cross several map grid squares and are labelled. Map grid squares are provided for the springs and potential spring locations within the study area. These features are listed from south to north.



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Feature (and map grid square) <sup>19</sup>	Distance and direction from route	Formation	Elevation (mAOD)	Comments
Tributaries of Holcroft Lane Brook 5 and 6 WR-02-305 – C7	250m north of the route of the Proposed Scheme (on the boundary of the land required for construction of the Proposed Scheme)	Glaciofluvial deposits over Sherwood Sandstone Group (Wilmslow Sandstone Formation)	21	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Tributaries of Holcroft Lane Brook 4 WR-02-305 – C6	Crossed by the route of the Proposed Scheme	Glacial till over Sherwood Sandstone Group (Wilmslow Sandstone Formation)	23	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Tributary of Cross Brook 1 WR-02-305 – D5	Crossed by the route of the Proposed Scheme	Glacial till over Sherwood Sandstone Group (Wilmslow Sandstone Formation)	35	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Tributary of Glaze Brook 4 WR-02-305 – D5	430m north-east of the route of the Proposed Scheme (140m south-west of the land required for construction of the Proposed Scheme)	Glacial till over Sherwood Sandstone Group (Wilmslow Sandstone Formation)	32	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Tributary of Cockshot Brook WR-02-305 – D4	720m south-west of the route of the Proposed Scheme (540m south-west of the land required for construction of the Proposed Scheme)	Lacustrine deposits and glacial till over Sherwood Sandstone Group (Wilmslow Sandstone Formation and Chester Formation)	34	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Jibcroft Brook WR-02-305 – D5	100m east of the route of the Proposed Scheme (on the boundary of land required for construction of the Proposed Scheme)	Glacio-lacustrine deposits and glacial till over Sherwood Sandstone Group (Wilmslow Sandstone Formation)	35	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Tributary of Carr Brook 1 WR-02-305 – D5	130m north-east of the route of the Proposed Scheme (on the boundary of land required for construction of the Proposed Scheme)	Glacial till over Sherwood Sandstone Group (Wilmslow Sandstone Formation)	35	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.

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Feature (and map grid square) <sup>19</sup>	Distance and direction from route	Formation	Elevation (mAOD)	Comments
Tributary of Carr Brook 2 WR-02-305 – E6	960m east of the route of the Proposed Scheme (450m east of the land required for construction of the Proposed Scheme)	Glacio-lacustrine deposits and glacial till over Sherwood Sandstone Group (Wilmslow Sandstone Formation)	25	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Carr Brook WR-02-305 – E5	Crossed by the route of the Proposed Scheme	Alluvium, glacio-lacustrine deposits and glacial till over Sherwood Sandstone Group (Chester Formation and Wilmslow Sandstone Formation)	30	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Small Brook WR-02-305 – E5	Crossed by the route of the Proposed Scheme	Glacial till over Sherwood Sandstone Group (Chester Formation)	29	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Tributary of Pennington Flash 1 WR-02-305 – F6	940m north-east of the route of the Proposed Scheme (850m north-east from the land required for construction of the Proposed Scheme)	Glacial till over Sherwood Sandstone Group (Chester Formation)	20	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Pennington Flash WR-02-305 – F6	690m north-east of the route of the Proposed Scheme (70m east from the land required for construction of the Proposed Scheme)	Alluvium and glacial till over Sherwood Sandstone Group (Chester Formation)	19	Surface waterbodies are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Tributaries of Hey Brook 1 to 4 WR-02-305 – F5	Crossed by the route of the Proposed Scheme	Glacial till over Sherwood Sandstone Group (Chester Formation)	30	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Hey Brook WR-02-305 – G5	470m north-east of the route of the Proposed Scheme (within the land required for the construction of the Proposed Scheme)	Alluvium over Sherwood Sandstone Group (Chester Formation), Kinnerton Sandstone Formation, Cumbrian Coast Group (Manchester Marls Formation), Appleby Group (Collyhurst Sandstone Formation) and Pennine Coal Measures Group	29	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.

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Feature (and map grid square) <sup>19</sup>	Distance and direction from route	Formation	Elevation (mAOD)	Comments
		(Pennine Middle Coal Measures Formation)		
Windy Bank Brook WR-02-305 – G5	Crossed by the route of the Proposed Scheme	Alluvium and glacial till over Cumbrian Coast Group (Manchester Marls Formation), Appleby Group (Collyhurst Sandstone Formation), Pennine Coal Measures Group (Pennine Middle Coal Measures Formation), Kinnerton Sandstone Formation and Sherwood Sandstone Group (Chester Formation)	27	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Tributary of Nan Holes Brook 1 WR-02-305 – G5	Crossed by the route of the Proposed Scheme	Alluvium and glacial till over Kinnerton Sandstone Formation	34	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Tributary of Nan Holes Brook 2 WR-02-305 – G5	Crossed by the route of the Proposed Scheme	Glacial till over Cumbrian Coast Group (Manchester Marls Formation)	30	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Nan Holes Brook WR-02-305 – G5	Crossed by the route of the Proposed Scheme	Alluvium and glacial till over Cumbrian Coast Group (Manchester Marls Formation), Appleby Group (Collyhurst Sandstone Formation), Pennine Coal Measures Group (Pennine Middle Coal Measures Formation), Kinnerton Sandstone Formation and Sherwood Sandstone Group (Chester Formation)	28	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Tributary of Hey Brook 5 WR-02-305 – G5	Crossed by the route of the Proposed Scheme	Alluvium and glacial till over Sherwood Sandstone Group (Collyhurst Sandstone Formation) and Cumbrian Coast Group (Manchester Marls Formation)	30	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Tributary of Coffin Lane Brook 1 WR-02-305 – H5	Crossed by the route of the Proposed Scheme	Glacial till over Appleby Group (Collyhurst Sandstone Formation)	20	Watercourses are likely to be in hydraulic connection with the underlying and adjacent

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				permeable superficial deposits.
Coffin Lane Brook WR-05-305 – G5	Crossed by the route of the Proposed Scheme	Alluvium and glacial till over Appleby Group (Collyhurst Sandstone Formation) and the Pennine Coal Measures Group (Pennine Middle Coal Measures Formation)	26	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Tributary of Coffin Lane Brook 2 WR-02-305 – G5	60m west of the route of the Proposed Scheme (on the boundary of the land required for construction of the Proposed Scheme)	Glacial till over Appleby Group (Collyhurst Sandstone Formation) and Pennine Coal Measures Group (Pennine Middle Coal Measures Formation)	30	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Tributary of Hey Brook 6 WR-02-305 – H5	Crossed by the route of the Proposed Scheme	Alluvium, glaciofluvial deposits and glacial till over Appleby Group (Collyhurst Sandstone Formation) and the Pennine Coal Measures Group (Pennine Middle Coal Measures Formation)	30	Watercourses are likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
<b>Springs or potential spring features</b>				
Potential spring 370m east of New Hall Farm, Birchwood WR-02-305 – B6	830m south-west of the route of the Proposed Scheme (730m south-west of the land required for the construction of the Proposed Scheme)	Glacial till over Mercia Mudstone Group (Tarpurley Siltstone Formation)	23	Surveys confirmed this is a land drain that discharges to Tributary of Glaze Brook 2 and it is therefore included in the surface water assessment.
Potential spring at Bates Farm, A574 WR-02-305 – C5	270m south of the route of the Proposed Scheme (40m north of the land required for the construction of the Proposed Scheme)	Glaciolacustrine deposits and glacial till over Sherwood Sandstone Group (Wilmslow Sandstone Formation)	31	Surveys confirmed this is a land drain that discharges to an unnamed drainage ditch and it is therefore included in the surface water assessment.
Potential spring 175m north-west of St. Lewis Catholic Primary School WR-02-305 – D4	860m south-west of the route of the Proposed Scheme (590m west of the land required for the construction of	Glacial till over Sherwood Sandstone Group (Wilmslow Sandstone Formation)	38	Not surveyed. Assumed to be a high value receptor until this is verified by surveys. If present, the feature is likely to discharge from glacial till.

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	the Proposed Scheme)			
Potential spring at Leigh Golf Club WR-02-305 – D5	160m east of the route of the Proposed Scheme (within the land required for the construction of the Proposed Scheme)	Glacial till over Sherwood Sandstone Group (Wilmslow Sandstone Formation)	35	Surveys confirmed this is a land drain that discharges to Jibcroft Brook and it is therefore included in the surface water assessment.
Potential spring at Twiss Green draining to Jibcroft Brook WR-02-305 – D6	880m north-east of the route of the Proposed Scheme (400m north-east of the land required for the construction of the Proposed Scheme)	Glacial till over Sherwood Sandstone Group (Wilmslow Sandstone Formation)	30	Surveys confirmed this is a land drain that discharges to Jibcroft Brook and it is therefore included in the surface water assessment.
Potential spring at Diggle Green Farm WR-02-305 – D6	890m east of the route of the Proposed Scheme (310m north of the land required for the construction of the Proposed Scheme)	Glacio-lacustrine deposits over Sherwood Sandstone Group (Wilmslow Sandstone Formation)	26	Not surveyed. Assumed to be a high value receptor until this is verified by surveys. If present, the feature is likely to discharge from glacial till.
Potential spring at Edgerton Road, east Lowton WR-02-305 – E5	310m south-west of the route of the Proposed Scheme (200m west of land required for the construction of the Proposed Scheme)	Glacial till over Sherwood Sandstone Group (Chester Formation)	32	Surveys confirmed this is a land drain that discharges to Small Brook and it is therefore included in the surface water assessment.
Potential spring north of Lowton Civic Hall WR-02-305 – E5	120m west of the route of the Proposed Scheme (within the land required for the construction of the Proposed Scheme)	Glacial till over Sherwood Sandstone Group (Chester Formation)	31	Surveys confirmed this is a land drain that discharges to Small Brook and it is therefore included in the surface water assessment.
Potential spring 150m north of Water Treatment Works, north Golborne WR-02-305 – F5	370m south of the route of the Proposed Scheme (60m west of the land required for the construction of the Proposed Scheme)	Glacial till over Sherwood Sandstone Group (Chester Formation)	35	Not surveyed. Assumed to be a high value receptor until this is verified by surveys. If present, the feature is likely to discharge from glacial till.
Potential spring 330m west of Smith's Bridge,	710m north of the route of the Proposed Scheme	Alluvium over Sherwood Sandstone Group (Chester Formation)	21	Not surveyed. Assumed to be a high value receptor until this is verified by surveys. If

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Feature (and map grid square) <sup>19</sup>	Distance and direction from route	Formation	Elevation (mAOD)	Comments
Leeds and Liverpool Canal WR-02-305 – G5	(290m north of the land required for the construction of the Proposed Scheme)			present, the feature is likely to discharge from alluvium or nearby glacial till.
Potential sink 345m west of Smith's Bridge, Leeds and Liverpool Canal WR-02-305 – G5	700m north of the route of the Proposed Scheme (290m north of the land required for the construction of the Proposed Scheme)	Alluvium over Sherwood Sandstone Group (Chester Formation)	20	Not surveyed. Assumed to be a high value receptor until this is verified by surveys. If present, the feature is likely to be located in alluvium or nearby glacial till.
Potential spring 350m north of Lightshaw Hall, Ashton-in-Makerfield WR-02-305 – G5	630m north of the route of the Proposed Scheme (180m north of the land required for the construction of the Proposed Scheme)	Alluvium over Sherwood Sandstone Group (Chester Formation)	19	Not surveyed. Assumed to be a high value receptor until this is verified by surveys. If present, the feature is likely to discharge from glacial till.
Spring 450m east of Aye Bridge Farm WR-02-305 – G5	480m north-east of the route of the Proposed Scheme (150m east of the land required for the construction of the Proposed Scheme)	Alluvium over Sherwood Sandstone Group (Chester Formation)	21	Surveys confirmed this is a spring supporting a high value stream. This feature is therefore a high value receptor.
Spring at West Coast Mainline railway, 320m north-west of Aye Bridge Farm WR-02-305 – G5	40m west of the route of the Proposed Scheme (within the land required for the construction of the Proposed Scheme)	Glacial till over Appleby Group (Collyhurst Sandstone Formation)	32	Surveys confirmed this is a spring supporting local undesignated water dependent habitat. This feature is therefore a high value receptor.
Potential spring at Crankwood Road, 120m west of Chadwick's Farm WR-02-305 – G5	730m north-east of the route of the Proposed Scheme (330m east of the land required for the construction of the Proposed Scheme)	Glacial till over Sherwood Sandstone Group (Chester Formation)	23	Not surveyed. Assumed to be a high value receptor until this is verified by surveys. If present, the feature is likely to discharge from glacial till.
Spring at Nan Holes Brook, 310m west of Locker Lane Farm WR-02-305 – G4	390m south-west of the route of the Proposed Scheme (within the land required for the	Glacial till over Appleby Group (Collyhurst Sandstone Formation)	36	Surveys confirmed this is a spring (without water dependent habitat) supporting a moderate value stream. This feature is

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Feature (and map grid square) <sup>19</sup>	Distance and direction from route	Formation	Elevation (mAOD)	Comments
	construction of the Proposed Scheme)			therefore a moderate value receptor.
Potential spring at public car park, Bolton Road, Ashton-in-Makerfield WR-02-305 – H4	840m west of the route of the Proposed Scheme (780m west of the land required for the construction of the Proposed Scheme)	Glacial till over Pennine Coal Measures Group (Pennine Middle Coal Measures Formation)	35	Not surveyed. Assumed to be a high value receptor until this is verified by surveys. If present, the feature is likely to discharge from glacial till.
Potential spring 200m west of Viridor Wood, Bryn Gates WR-02-305 – H4	600m west of the route of the Proposed Scheme (560m west of the land required for the construction of the Proposed Scheme)	Glacial till over Pennine Coal Measures Group (Pennine Middle Coal Measures Formation)	33	Not surveyed. Assumed to be a high value receptor until this is verified by surveys. If present, the feature is likely to discharge from glacial till.
Potential spring north of Allotment Gardens at Bryn Gates WR-02-305 – H5	550m west of the route of the Proposed Scheme (540m north of the land required for the construction of the Proposed Scheme)	Glacial till over Pennine Coal Measures Group (Pennine Middle Coal Measures Formation)	34	Surveys have shown this is a land drain that discharges to Coffin Lane Brook and it is therefore included in the surface water assessment.
Potential spring 220m east of Bamfurlong Bridge WR-02-305 – H5	600m east of the route of the Proposed Scheme (330m east of the land required for the construction of the Proposed Scheme)	Head deposits over Pennine Coal Measures Group (Pennine Middle Coal Measures Formation)	26	Not surveyed. Assumed to be a high value receptor until this is verified by surveys. If present, the feature is likely to discharge from the head deposits or glacial till nearby.
Potential spring 220m east of Bamfurlong Bridge WR-02-305 – H5	600m east of the route of the Proposed Scheme (330m east of the land required for the construction of the Proposed Scheme)	Head deposits over Pennine Coal Measures Group (Pennine Middle Coal Measures Formation)	26	Not surveyed. Assumed to be a high value receptor until this is verified by surveys. If present, the feature is likely to discharge from the head deposits or glacial till nearby.
Potential spring 220m east of Bamfurlong Bridge WR-02-305 – H5	600m north-east of the route of the Proposed Scheme (330m east of the land required for the construction of the Proposed Scheme)	Head deposits over Pennine Coal Measures Group (Pennine Middle Coal Measures Formation)	26	Not surveyed. Assumed to be a high value receptor until this is verified by surveys. If present, the feature is likely to discharge from the head deposits or glacial till nearby.

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Feature (and map grid square) <sup>19</sup>	Distance and direction from route	Formation	Elevation (mAOD)	Comments
Spring at Bamfurlong Bridge WR-02-305 – H5	660m north of the route of the Proposed Scheme (within the land required for the construction of the Proposed Scheme)	Head deposits over Pennine Coal Measures Group (Pennine Middle Coal Measures Formation)	27	Surveys confirmed spring (collect <sup>20</sup> ) supporting tributary of Hey Brook 6. This feature is therefore a moderate value receptor.
Potential spring at Howard Road, Culcheth WR-02-305 – C6	420m north of the route of the Proposed Scheme (110m north of the land required for the construction of the Proposed Scheme)	Glaciolacustrine deposits over Sherwood Sandstone Group (Wilmslow Sandstone Formation)	23	Surveys have shown this to be a culvert that discharges to Tributary of Holcroft Lane Brook 5 and it is therefore included in the surface water assessment.
Potential spring at Jibcroft Brook, north of Leigh Hall WR-02-305 – D6	830m north-east of the route of the Proposed Scheme (440m north of the land required for the construction of the Proposed Scheme)	Glacial till over Sherwood Sandstone Group (Wilmslow Sandstone Formation)	27	Surveys have shown this to be a culvert that discharges to Jibcroft Brook and it is therefore included in the surface water assessment.
Potential spring at roundabout, north-east of Dover Bridge, Dover WR-02-305 – G5	620m east of the route of the Proposed Scheme (150m east of the land required for the construction of the Proposed Scheme)	Glacial till over Cumbrian Coast Group (Manchester Marls Formation)	28	Surveys have shown this to be a culvert, contributing to an unnamed watercourse (that in turn discharges to Leeds and Liverpool Canal), and it is therefore included in the surface water assessment.
Potential sink 270m east of Bamfurlong Recreation Ground WR-02-305 – H5	230m east of the route of the Proposed Scheme (10m south of the land required for the construction of the Proposed Scheme)	Glacial till over Appleby Group (Collyhurst Sandstone Formation)	23	Surveys have shown this to be a culvert that discharges to Tributary of Coffin Lane Brook 1 and it is therefore included in the surface water assessment.
Potential sink north of Public Car Park, Bolton Road, Ashton-in-Makerfield WR-02-305 – H4	780m west of the route of the Proposed Scheme (760m west of the land required for the construction of	Glacial till over Pennine Coal Measures Group (Pennine Middle Coal Measures Formation)	34	Surveys have shown this to be a culvert that conveys water from Coffin Lane Brook, and it is therefore included in the surface water assessment.

<sup>20</sup> A collect is where groundwater comes to ground level over an area of ground, before draining into a channel.



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Feature (and map grid square) <sup>19</sup>	Distance and direction from route	Formation	Elevation (mAOD)	Comments
	the Proposed Scheme)			
Potential spring at West Coast Mainline railway, east of Bamfurlong recreation ground WR-02-305 – H5	10m east of the route of the Proposed Scheme (within the land required for the construction of the Proposed Scheme)	Glacial till over Pennine Coal Measures Group (Pennine Middle Coal Measures Formation)	30	Surveys have shown this to be a culvert that discharges to Tributary of Coffin Lane Brook 1 and it is therefore included in the surface water assessment.

## 2.4 Water dependent habitats

2.4.1 Table 7 summarises the groundwater dependent habitats and surface water dependent habitats within the study area.

**Table 7: Water dependent habitats**

Name (and map grid square) <sup>21</sup>	Distance and direction from route	Designation	Comments
<b>Groundwater dependent habitats</b>			
Manchester Mosses SAC: Holcroft Moss SSSI EC-01-515 – B6	40m east of the route of the Proposed Scheme (within the land required for construction of the Proposed Scheme)	Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI)	The site has been included as a groundwater dependent habitat on a precautionary basis. The site is underlain by peat (Unproductive) that may be supported by groundwater flow from the glacial till (Secondary (Undifferentiated) aquifer) and glaciofluvial deposits (Secondary A aquifer).
Manchester Mosses SAC: Risley Moss SSSI EC-01-515 – C1	990m south-west of the route of the Proposed Scheme (520m south of the land required for construction of the Proposed Scheme)	SAC, SSSI, Local Nature Reserve (LNR)	The site has been included as a groundwater dependent habitat on a precautionary basis. The site is underlain by peat (Unproductive) that may be supported by groundwater flow from the glacial till (Secondary (Undifferentiated) aquifer).
Bryn Marsh and Ince Moss EC-01-518 – C1, C6	730m north of the route of the Proposed Scheme (adjacent to land required for construction of the Proposed Scheme)	SSSI, LNR (Wigan Flashes) and Site of Biological Interest (SBI) (Horrock's Flash)	Habitats present include open water, fen and swamp, and mire. Site is likely to be groundwater fed by the underlying alluvium and glaciofluvial deposits (Secondary A aquifers).
Pestfurlong Moss EC-01-515 – E4	670m south-west of the route of the Proposed Scheme (60m south of the	Local Wildlife Site (LWS)	The site has been included as a groundwater dependent habitat on a precautionary basis. The site is underlain

<sup>21</sup> High Speed Two Ltd (2022), *High Speed Rail (Crewe – Manchester), Environmental Statement, Volume 5 Ecology, Map Book, Map Series EC-01*. Available online at: <https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement>. Water dependent habitats often cross several grid squares. The Map grid square provided at the location closest to the Proposed Scheme.

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Name (and map grid square) <sup>21</sup>	Distance and direction from route	Designation	Comments
	land required for construction of the Proposed Scheme)		by peat (Unproductive strata) that may be supported by groundwater flow from the glacial till (Secondary (Undifferentiated) aquifer).
Lightshaw Lime Beds EC-01-517 – I4	180m south-west of the route of the Proposed Scheme (5m west of land required for the construction of the Proposed Scheme)	SBI	These former settling beds are unlikely to be supported by groundwater from the glacial till, although groundwater may support the surrounding reedbeds and wetland habitats. The site has been included as a groundwater dependent habitat on a precautionary basis.
Ponds Near Lightshaw Lane EC-01-518 – B6	Crossed by the route of the Proposed Scheme	SBI	The habitat is designated for fenland. It is potentially groundwater fed from the underlying glacial till. The site has been included as a groundwater dependent habitat on a precautionary basis.
<b>Surface water dependent habitats</b>			
Abram Flashes EC-01-518 – G6	180m east of the route of the Proposed Scheme (adjacent to land required for construction of the Proposed Scheme)	SSSI and SBI	Lowland open waters and wet grassland, the flashes are adjacent to the Leeds and Liverpool canal along the Hey Brook. The open water and wet grassland are supported by surface water flows.
Pennington Flash EC-01-517 – H9	730m north-east of the route of the Proposed Scheme (300m north-east of the land required for construction of the Proposed Scheme)	LNR, Country Park and SBI	Lake is fed by surface watercourses.
Silver Lane Ponds EC-01-515 – G6	Crossed by the route of the Proposed Scheme	LWS	Restored landfill site, consisting of four lakes with improved grassland, plantation blocks and rough grassland. The ponds are fed by surface water.

### 3 References

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