

High Speed Rail (Crewe – Manchester)

Background information and data

Water resources and flood risk

BID WR-004-OR003

Off-route works: Annandale depot

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 report presents baseline data relating to the water resources assessment which has been undertaken for the Proposed Scheme. The data have been collected in relation to the off-route works at Annandale depot.
- 1.1.2 The Environmental Statement¹ should be referred to for details of:
- the Water Framework Directive (WFD) preliminary compliance assessment (Volume 5: Appendix WR-001-OR003);
 - the Water resources assessment (Volume 5: Appendix WR-003-OR003); and
 - a Draft water resources and flood risk operation and maintenance plan (Volume 5: Appendix WR-007-00000).
- 1.1.3 Additional information is also included in Background Information and Data (BID) WFD preliminary compliance assessment baseline data which are reported for the off-route works (BID WR-002-OR003).
- 1.1.4 Maps referred to throughout this document are set out in the Volume 5, Water Resources and flood risk Map Book, Map Series WR-01 and WR-02².

¹ 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>.

² 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 WFD preliminary compliance assessment baseline data (BID WR-002-OR003). The receptor values attributed to each individual watercourse, based on the methodologies set out in the Environmental Impact Assessment Scope and Methodology Report (SMR)³ are also provided.
- 2.1.2 Those surface water features potentially affected by groundwater interactions are described in Paragraph 2.2.15.

Table 1: Surface water body receptors

Water body name and location ⁴	Type	Q95 value (m ³ /s) ⁵	Receptor value	Parent WFD water body name and identification number ⁶	Current WFD status / objective ⁷
Kirkpatrick Burn WR-01-803 – C5 and C6	Minor watercourse	0.013	Moderate	Kirtle Water d/s Waterbeck 10666	Poor/Good by 2027
Tributary of Kirkpatrick Burn WR-01-803 – C6	Minor watercourse	<0.002	Moderate	Kirtle Water d/s Waterbeck 10666	Poor/Good by 2027
Ewes Burn WR-01-803 – E6 and F6	Minor watercourse	0.004	Moderate	Kirtle Water d/s Waterbeck 10666	Poor/Good by 2027
Tributary of Ewes Burn 1 WR-01-803 – E6	Minor watercourse	<0.002	Moderate	Kirtle Water d/s Waterbeck 10666	Poor/Good by 2027

³ 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>.

⁴ 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.

⁵ 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. Details are provided in the SMR.

⁶ The Scottish Environment Protection Agency (SEPA) has attributed each surface water and groundwater body a unique water body identification (ID) number.

⁷ Status and objectives are based on those set out in the current 2015 River basin management plan. This is the latest plan and is due to be updated by SEPA in 2021.

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Water body name and location ⁴	Type	Q95 value (m ³ /s) ⁵	Receptor value	Parent WFD water body name and identification number ⁶	Current WFD status / objective ⁷
Tributary of Ewes Burn 2 WR-01-803 – F5 and F6	Minor watercourse	<0.002	Moderate	Kirtle Water d/s Waterbeck 10666	Poor/Good by 2027
Stand Burn WR-01-803 – F7 and F8	Minor watercourse	0.006	Moderate	Kirtle Water d/s Waterbeck 10666	Poor/Good by 2027
Tributary of Stand Burn WR-01-803 – F8	Minor watercourse	<0.002	Moderate	Kirtle Water d/s Waterbeck 10666	Poor/Good by 2027
Kirtle Water WR-01-803 – D7 and E8	River	0.14	High	Kirtle Water d/s Waterbeck 10666	Poor/Good by 2027
Tributary of Kirtle Water 1 (Irvington) WR-01-803 – B6	Minor watercourse	<0.002	Moderate	Kirtle Water d/s Waterbeck 10666	Poor/Good by 2027
Tributary of Kirtle Water 2 (Gretna services) WR-01-803 – G7	Minor watercourse	<0.002	Moderate	Kirtle Water d/s Waterbeck 10666	Poor/Good by 2027

- 2.1.3 Records provided by the Scottish Environment Protection Agency (SEPA) indicate that no surface water abstractions, licensed under the Water Environment (Controlled Activities) (Scotland) Regulations (CAR), are present in the study area. Further details for these Regulations are included in Section 2.2.
- 2.1.4 There is no obligation to register private water supplies, which comprise those for quantities less than 10m³ per day. Unregistered private surface water supplies may therefore be present in the study area. Any unregistered private surface water supplies present are considered high value receptors, until surveyed.
- 2.1.5 No data is available for the SEPA surface water monitoring points which monitor freshwater macrophytes and freshwater invertebrates respectively within the study area (349720, Kirtle Water d/s Hollee STW and 134646 Kirtle water d/s Kirkpatrick Fleming STE).
- 2.1.6 There are 12 authorised discharges to surface water are located in the study area, as shown in Table 2 one of which is located within the land required for the construction of the Proposed Scheme. These have been assessed as low value receptors.

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Table 2: Authorised discharges to surface water

Permit identifier (and map grid square)	Distance and direction from route	Discharge type	Receiving water body
CAR/R/1020736	10m west of the land required for construction of the Proposed Scheme	Sewage (private) primary	Unknown
CAR/R/1166981	Within the land required for construction of the Proposed Scheme	Sewage (private) primary	Unknown
CAR/R/1031741	25m north of the land required for construction of the Proposed Scheme	Sewage (private) primary	Kirkpatrick Burn
CAR/R/1122167	925m north of the land required for construction of the Proposed Scheme	Sewage (private) primary	Black Sark
CAR/R/1158767	986m north of the land required for construction of the Proposed Scheme	Sewage (private) primary	Rae Burn
CAR/R/1075228	901m southwest of the land required for construction of the Proposed Scheme	Sewage (private) primary	Tributary of Kirtle Water
CAR/L/1003549	500m south of the land required for construction of the Proposed Scheme	Sewage (water company) primary	Kirkpatrick Burn
CAR/L/1003540	540m south of the land required for construction of the Proposed Scheme	Sewage (private) primary	Tributary of River Esk
CAR/L/1003697	540m south of the land required for construction of the Proposed Scheme	Sewage (private) primary	Kirtle Water
CAR/R/1075354	740m southwest of the land required for construction of the Proposed Scheme	Sewage (private) primary	Tributary of Kirtle Water
CAR/R/1075331	710m southwest of the land required for construction of the Proposed Scheme	Sewage (private) primary	Tributary of Kirtle Water
CAR/R/1074792	710m southwest of the land required for construction of the Proposed Scheme	Sewage (private) primary	Tributary of Kirtle Water

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 WFD preliminary compliance assessment baseline data (BID WR-002-OR003). The receptor values attributed to each individual feature are based on the methodologies set out in the SMR.

2.2.2 Volume 5, Water resources and flood risk Map Book: map WR-02-803 shows the superficial and bedrock formations within the Annandale depot works area.

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

Geology	Distribution	Formation description	Aquifer classification	WFD body (ID) and current overall status ⁸	WFD status objective ⁸	Receptor value
Superficial deposits						
Peat	Several isolated patches of peat in the eastern and southern part of the study area, including the largest at Gretna Flow (about 13 ha).	Peat	Not a significant aquifer	None given by Scottish Environment Protection Agency	None given by Scottish Environment Protection Agency	Low
Alluvium	Main areas along Kirtle Water, Black Sark and River Sark. Small area along the Ewes Burn.	Sand, silt and clay	Moderate to High productivity	None given by Scottish Environment Protection Agency	None given by Scottish Environment Protection Agency	Moderate
Kilblane Sand and Gravel Formation	Towards the southern end of the study area, between Kirtle Water and the A74 (M). Along River Sark and Black Sark.	Sand and gravel, and sand, gravel and boulders	High productivity	None given by Scottish Environment Protection Agency	None given by Scottish Environment Protection Agency	High

⁸ As stated in the current River basin management plan. This is the latest plan and is due to be updated by Scottish Environment Protection Agency in 2021. Note that where Scottish Environment Protection Agency haven't assigned an individual water body ID to a unit, it has been assumed that it is connected to the underlying/overlying water body.

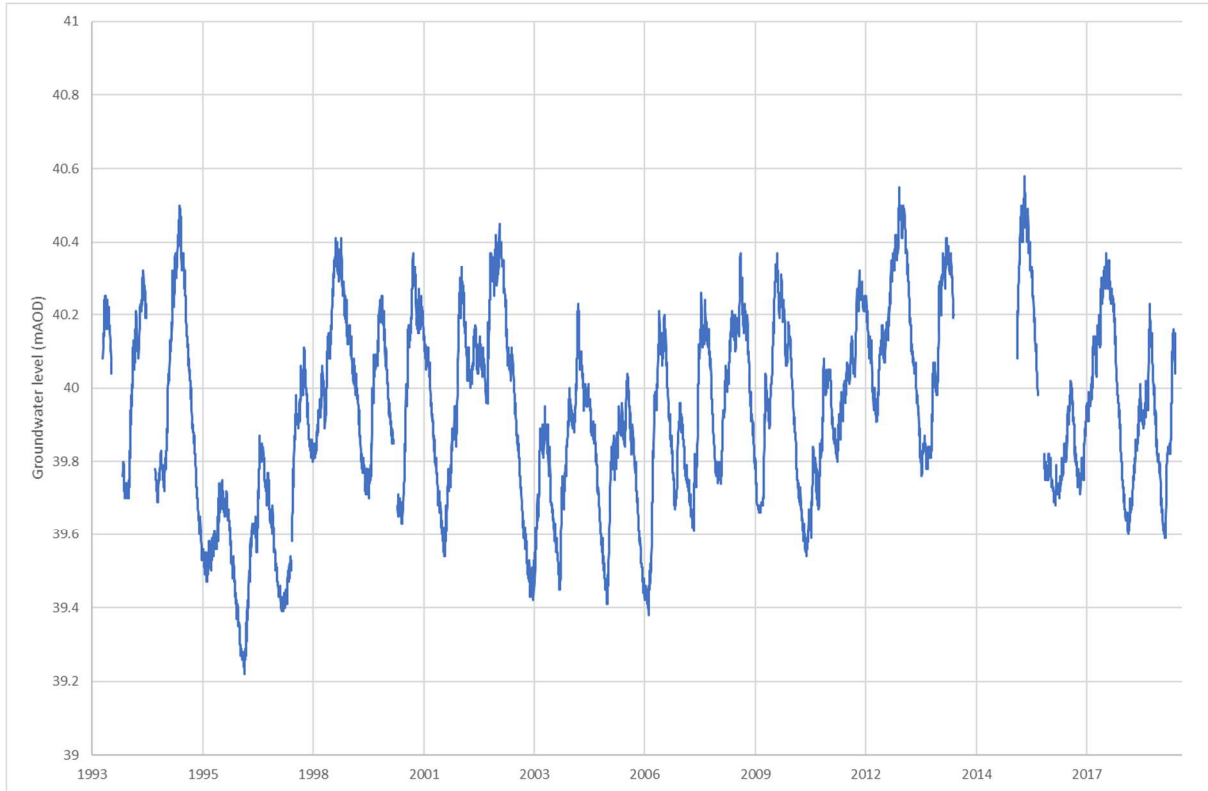
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Geology	Distribution	Formation description	Aquifer classification	WFD body (ID) and current overall status ⁸	WFD status objective ⁸	Receptor value
Plumpe Farm Sand Member Plumpe Sand and Gravel Formation	Isolated patch near Springfield.	Sand, silt and clay	High productivity	None given by Scottish Environment Protection Agency	None given by Scottish Environment Protection Agency	High
River terrace deposits (Undifferentiated)	Along River Sark and Black Sark.	Sand and gravel	Moderate to High productivity	None given by Scottish Environment Protection Agency	None given by Scottish Environment Protection Agency	Moderate
Kerr Moraine Formation	In the west of the study area, along the northern flank of Kirtle Water.	Clay, silt, sand and gravel	Not a significant aquifer	None given by Scottish Environment Protection Agency	None given by Scottish Environment Protection Agency	Low
Gretna Till Formation	Across most of the study area.	Sand, silt and clay	Not a significant aquifer	None given by Scottish Environment Protection Agency	None given by Scottish Environment Protection Agency	Low
Bedrock						
Sherwood Sandstone Group – Chester Formation – St Bees Sandstone Member	Underlies all the study area.	Sandstone	High productivity	Annan (150623) Good	Good by 2015	High

- 2.2.3 Alluvium and river terrace deposits (undifferentiated) are classified as moderate to high productivity aquifers by Scottish Environment Protection Agency. Kilbane Sand and Gravel Formation and Plumpe Sand and Gravel Formation are classified as high productivity aquifers by Scottish Environment Protection Agency. Peat, Kerr Moraine Formation and Gretna Till Formation are classified as not a significant aquifer by Scottish Environment Protection Agency.
- 2.2.4 There is one bedrock aquifer in the study area, the Sherwood Sandstone Group. The Sherwood Sandstone Group is classified as a high productivity aquifer by Scottish Environment Protection Agency. This aquifer underlies all of the study area.
- 2.2.5 There is one SEPA observation borehole which monitors groundwater level in the Sherwood Sandstone Group within the study area, at Douglas Tanks, Winney Rig, Gretna. The location of this monitoring borehole is shown in the Volume 5, Water resources and flood risk Map Book: map WR-02-803. Figure 1 presents the time-series of available groundwater level monitoring data from this location.

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Figure 1: Scottish Environment Protection Agency groundwater level monitoring data at Douglas Tanks, Winney Rig



Data provided by SEPA.

- 2.2.6 No groundwater monitoring data are available for the superficial aquifers in the study area. Water strikes recorded on borehole logs available via British Geological Society have been referred to for the purpose of the assessment.
- 2.2.7 Groundwater in the superficial aquifers in the study area 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 points for converging groundwater flow in the area.
- 2.2.8 The Sherwood Sandstone in this area is generally cross-bedded in nature and mudstone clasts are locally common but unlikely to be significant enough to dictate permeability. Groundwater flow is expected to be both laterally and vertically continuous within the Sherwood Sandstone Group. There is also likely to be an element of fracture flow. The overall groundwater flow direction is currently unknown but is likely to be towards the nearby tidal reaches of the River Esk in the upper Solway Firth, to the south west of the study area.

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- 2.2.9 The Water Environment (Controlled Activities) (Scotland) Regulations 2011⁹ (CAR) and their further amendments 2013¹⁰ and 2017¹¹ apply regulatory controls to activities which may affect Scotland's water environment. These regulations cover rivers, groundwater and groundwater dependant wetlands, and records are available for abstractions and discharges.
- 2.2.10 Records of CAR licensed sites provided by the Scottish Environment Protection Agency, indicate that one site in the study area is licensed to abstract groundwater (Lochinvar BH34 and BH35, Chapelknowe, Canonbie), although the data does not specify the purpose of the licence and the borehole reference could link this to exploratory works for the Lochinvar coal project. The Lochinvar coal project was carried out to investigate the presence of coal in the area and whether it would be economic to mine. On a precautionary basis, however, it is assumed that this site is licensed for groundwater abstraction as a drinking water supply. Table 4 summarises potential groundwater abstractions and their locations are shown in the Volume 5, Water resources and flood risk Map Book: map WR-02-803.
- 2.2.11 The Annan drinking water protection area (ground) covers all the study area, suggesting that a public water supply abstraction may exist in this area.
- 2.2.12 Private groundwater abstractions which do not require registration under CAR¹² comprise abstractions for quantities of less than 10m³ per day. There is no obligation to register these private water supplies. However, these supplies may also need to be protected if deemed to be potentially at risk from the Proposed Scheme.
- 2.2.13 A well is marked on the Ordnance Survey (OS) map to the south of North Lodge, 475m south-west of the land required for the construction of the Proposed Scheme. The Watchhill Well is marked close to the River Sark, 850m south-east of the land required for the construction of the Proposed Scheme. On a precautionary basis it has been assumed that these wells are in use for groundwater abstraction. In addition, small, unregistered groundwater abstractions, used for private water supply, might be located at some farms in the study area. However, unless either a potentially licensed or unregistered groundwater abstraction has been identified at any farms, the farms are not listed in Table 4.
- 2.2.14 There are three potential abstractions from groundwater (licensed and unregistered) which have been identified in the study area. No surveys or engagement have been undertaken due to land access constraints. As a result, a precautionary approach has been adopted and

⁹ Natural Scotland (2011), *The Water Environment (Controlled Activities) (Scotland) Regulations*. Available online at: <http://www.legislation.gov.uk/ssi/2011/209/contents/made>.

¹⁰ Natural Scotland (2013), *The Water Environment (Controlled Activities) (Scotland) Amendment Regulations 2013*. Available online at: <http://www.legislation.gov.uk/ssi/2013/176/contents/made>.

¹¹ Natural Scotland (2017), *The Water Environment (Controlled Activities) (Scotland) Amendment Regulations 2017*. Available online at: http://www.legislation.gov.uk/ssi/2017/389/pdfs/ssi_20170389_en.pdf.

¹² Private groundwater abstractions which fall under a general binding rule do not require authorisation from SEPA. General binding rules represent a set of mandatory rules which cover specific low risk activities.

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all potential abstractions, either licensed or unregistered, have been assessed as high value receptors.

Table 4: Summary of groundwater abstractions

Name, licence number (and map grid square) ¹³	Distance and direction from route	Abstraction source	Maximum annual abstraction quantity (m ³)	Maximum daily abstraction quantity (m ³)	Purpose	Number of boreholes
Potential public water supplies (PWS)						
Potential PWS abstraction outside of the study area Unknown	Unknown	St Bees Sandstone Member – Sherwood Sandstone Group	Unknown	Unknown	Potential groundwater supply. Assumed public water supply on a precautionary basis	Unknown
Private potentially licensed water supplies						
Potential abstraction at Lochinvar BH34 & BH35, Chapelknowe, Canonbie	845m east of land required for the construction of the Proposed Annandale depot works	Assumed St Bees Sandstone Member – Sherwood Sandstone Group	Unknown	Unknown	Potential private water supply for groundwater	Assumed 2
Private potentially unregistered water supplies						
Potential abstraction at Well south of North Lodge	475m south-west of land required for the construction of the Proposed Annandale depot works	Assumed St Bees Sandstone Member – Sherwood Sandstone Group	Unknown	Unknown	Potential private supply for farm	Unknown
Potential abstraction at Watchhill Well	850m south-east of land required for the construction of the Proposed Annandale depot works	Assumed Alluvium or River Terrace Deposits near River Sark	Unknown	Unknown	Not located near any property. May be disused	Likely to be a single well

¹³ Map grid squares on Volume 5, Water resources and flood risk Map Book: map WR-02-803 for unique map identification (ID) numbers for authorised and non-authorised abstractions. Abstraction features in the study area are generally listed from south to north.

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- 2.2.15 There are 20 authorised discharges to groundwater within the study area. These discharges are considered to be low value receptors. These are summarised in Table 5.

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Table 5: Authorised discharges to groundwater

Permit identifier (and map grid square) ¹⁴	Distance and direction from route	Discharge type
CAR/R/1149049	355m south of land required for the construction of the Proposed Annandale depot works	Soakaway - sewage (private) primary
CAR/R/1014575	340m southwest of land required for the construction of the Proposed Annandale depot works	Soakaway - sewage (private) primary
CAR/R/1072745	Adjacent to land required for the construction of the Proposed Annandale depot works	Soakaway - sewage (private) primary
CAR/R/1018788	520m southwest of land required for the construction of the Proposed Annandale depot works	Soakaway - sewage (private) secondary
CAR/R/1144373	974m south of land required for the construction of the Proposed Annandale depot works	Soakaway - sewage (private) primary
CAR/R/1107235	10m south of land required for the construction of the Proposed Annandale depot works	Soakaway - sewage (private) primary
CAR/R/1174732	22m south of land required for the construction of the Proposed Annandale depot works	Soakaway - sewage (private) primary
CAR/R/1092906	685m southwest of land required for the construction of the Proposed Annandale depot works	Soakaway - sewage (private) primary
CAR/R/1042271	700m southwest of land required for the construction of the Proposed Annandale depot works	Soakaway - sewage (private) primary
CAR/R/1074857	700m southwest of land required for the construction of the Proposed Annandale depot works	Soakaway - sewage (private) primary
CAR/R/1108794	340m west of land required for the construction of the Proposed Annandale depot works	Soakaway - sewage (private) primary
CAR/R/1139491	773m east of land required for the construction of the Proposed Annandale depot works	Soakaway - sewage (private) primary
CAR/R/1120513	640m southwest of land required for the construction of the Proposed Annandale depot works	Soakaway - sewage (private) primary

¹⁴ Volume 5, Water resources and flood risk Map Book: map WR-02-803. Discharges in the study area are listed from south to north.

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Permit identifier (and map grid square) ¹⁴	Distance and direction from route	Discharge type
CAR/R/1089006	620m southwest of land required for the construction of the Proposed Annandale depot works	Soakaway - sewage (private) primary
CAR/R/1054491	50m north of land required for the construction of the Proposed Annandale depot works	Soakaway - sewage (private) primary
CAR/R/1183454	22m south of land required for the construction of the Proposed Annandale depot works	Soakaway - sewage (private) primary
CAR/R/1026990	215m north of land required for the construction of the Proposed Annandale depot works	Soakaway - sewage (private) primary
CAR/R/1131470	544m northeast of land required for the construction of the Proposed Annandale depot works	Soakaway - sewage (private) primary
CAR/R/1107367	755m north of land required for the construction of the Proposed Annandale depot works	Soakaway - sewage (private) primary
CAR/R/1099737	730m northwest of land required for the construction of the Proposed Annandale depot works	Soakaway - sewage (private) primary

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, which could have connection with groundwater, potential springs and sinks have been identified within the study area from OS maps. In the absence of site surveys, the potential spring features have been assumed to comprise springs and to be high or very high value receptors.

Table 6: Groundwater – surface water interactions

Feature (and map grid square) ¹⁵	Distance and direction from route	Formation	Elevation (mAOD)	Comments
Watercourses				
Ewes Burn	Within the land required for the construction of the Proposed	Peat, alluvium and Gretna Till Formation over Sherwood Sandstone Group (St	Approximately 38	Watercourse is likely to be in hydraulic connection with the underlying and adjacent

¹⁵ Volume 5, Water resources and flood risk Map Book: map WR-02-803. 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) ¹⁵	Distance and direction from route	Formation	Elevation (mAOD)	Comments
	Annandale depot works.	Bees Sandstone Member).		permeable superficial deposits.
Tributary of Ewes Burn 1	Within the land required for the construction of the Proposed Annandale depot works.	Gretna Till Formation over Sherwood Sandstone Group (St Bees Sandstone Member).	Approximately 39	Watercourse is likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Tributary of Ewes Burn 2	Within the land required for the construction of the Proposed Annandale depot works.	Gretna Till Formation over Sherwood Sandstone Group (St Bees Sandstone Member).	Approximately 40	Watercourse is likely to be in hydraulic connection with the underlying and adjacent permeable superficial deposits.
Springs or potential spring features				
Potential spring in south of Gretna service area	691m south of land required for the construction of the Proposed Annandale depot works.	Kilblane Sand and Gravel Formation and Gretna Till Formation over the Sherwood Sandstone Group (St Bees Sandstone Member).	Approximately 38	Not surveyed. Assumed to be a high value receptor until verified by surveys. If present, it is likely to discharge from the glacial till.
Potential spring in south of Gretna service area	691m south of land required for the construction of the Proposed Annandale depot works.	Kilblane Sand and Gravel Formation and Gretna Till Formation over the Sherwood Sandstone Group (St Bees Sandstone Member).	Approximately 38	Not surveyed. Assumed to be a high value receptor until verified by surveys. If present, it is likely to discharge from the glacial till.
Potential spring in east of Gretna service area	623m south of land required for the construction of the Proposed Annandale depot works.	Kilblane Sand and Gravel Formation and Gretna Till Formation over the Sherwood Sandstone Group (St Bees Sandstone Member).	Approximately 39	Not surveyed. Assumed to be a high value receptor until verified by surveys. If present, it is likely to discharge from the glacial till.
Potential spring at Stand Burn ponds	275m south of land required for construction of the Proposed Annandale depot works.	Kilblane Sand and Gravel Formation and Gretna Till Formation over the Sherwood Sandstone Group (St Bees Sandstone Member).	Approximately 35	Not surveyed. Assumed to be a high value receptor until verified by surveys. If present, it is likely to discharge from the glacial till.
Potential spring 170m north east of Bensmoor Wood	Adjacent to land required for the construction of the Proposed	Gretna Till Formation over the Sherwood Sandstone Group (St Bees Sandstone Member).	Approximately 35	Not surveyed. Assumed to be a high value receptor until verified by surveys. If present, it

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Feature (and map grid square) ¹⁵	Distance and direction from route	Formation	Elevation (mAOD)	Comments
	Annandale depot works.			is likely to discharge from the glacial till.
Potential spring 220m west of Redhall Castle	375m south of land required for construction of the Proposed Annandale depot works.	Kilblane Sand and Gravel Formation and Gretna Till Formation over the Sherwood Sandstone Group (St Bees Sandstone Member).	Approximately 32	Not surveyed. Assumed to be a high value receptor until verified by surveys. If present, it is likely to discharge from the glacial till.
Potential spring 150m east of Fairyrow Wood	996m south of land required for the construction of the Proposed Annandale depot works.	Gretna Till Formation over the Sherwood Sandstone Group (St Bees Sandstone Member).	Approximately 33	Not surveyed. Assumed to be a high value receptor until verified by surveys. If present, it is likely to discharge from the glacial till.
Potential spring 300m north west of Redhall Castle	303m south of land required for construction of the Proposed Annandale depot works.	Kilblane Sand and Gravel Formation and Gretna Till Formation over the Sherwood Sandstone Group (St Bees Sandstone Member).	Approximately 32	Not surveyed. Assumed to be a high value receptor until verified by surveys. If present, it is likely to discharge from the glacial till.
Potential spring 200m south of Cranberry Farm	Within land required for construction of the Proposed Annandale depot works.	Alluvium and Gretna Till Formation over the Sherwood Sandstone Group (St Bees Sandstone Member).	Approximately 40	Not surveyed. Assumed to be a high value receptor until verified by surveys. If present, it is likely to discharge from the glacial till.
Potential spring 90m north of Cranberry Farm	Adjacent to land required for construction of the Proposed Annandale depot works.	Alluvium and Gretna Till Formation over the Sherwood Sandstone Group (St Bees Sandstone Member).	Approximately 42	Not surveyed. Assumed to be a high value receptor until verified by surveys. If present, it is likely to discharge from the glacial till.
Potential spring 274m east of Irvington	585m south of land required for construction on the Proposed Annandale depot works.	Gretna Till Formation over the Sherwood Sandstone Group (St Bees Sandstone Member).	Approximately 50	Not surveyed. Assumed to be a high value receptor until verified by surveys. If present, it is likely to discharge from the glacial till.
Potential spring 45m east of Irvington	530m southwest of land required for construction of the Proposed Annandale depot works.	Gretna Till Formation over the Sherwood Sandstone Group (St Bees Sandstone Member).	Approximately 50	Not surveyed. Assumed to be a high value receptor until verified by surveys. If present, it is likely to discharge from the glacial till.
Potential spring at Gretna Flow	245m north west of land required for	Gretna Till Formation and peat over the	Approximately 45	Not surveyed. Assumed to be a high value

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Feature (and map grid square) ¹⁵	Distance and direction from route	Formation	Elevation (mAOD)	Comments
	construction of the Proposed Annandale depot works.	Sherwood Sandstone Group (St Bees Sandstone Member).		receptor until verified by surveys. If present, it is likely to discharge from the glacial till
Potential spring at Sheepwash east of Williamsfield Cottage	265m north of land required for construction of the Proposed Annandale depot works.	Gretna Till Formation over the Sherwood Sandstone Group (St Bees Sandstone Member).	Approximately 47	Not surveyed. Assumed to be a high value receptor until verified by surveys. If present, it is likely to discharge from the glacial till.
Potential spring at Kirkpatrick Fleming	142m north of land required for the construction of the Proposed Annandale depot works.	Gretna Till Formation and peat over the Sherwood Sandstone Group (St Bees Sandstone Member).	Approximately 57	Not surveyed. Assumed to be a high value receptor until verified by surveys. If present, it is likely to discharge from the glacial till
Potential spring west of Newton	377m north west of land required for the construction of the Proposed Annandale depot works.	Kerr Moraine Formation over Sherwood Sandstone Group (St Bees Sandstone Member).	Approximately 69	Not surveyed. Assumed to be a high value receptor until verified by surveys. If present, it is likely to discharge from the Kerr Moraine Formation.

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) ¹⁶	Distance and direction from route	Designation	Comments
Groundwater dependent habitats			
Blacksike Wood and Bensmoor Wood EC-01-803 – F5 and G5	Adjacent to land required for construction of the proposed Annandale depot works.	Potential ancient woodland	Not surveyed. May be supported by groundwater from the underlying Gretna till and/or Sherwood Sandstone. Included on a precautionary basis.

¹⁶ 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>. Shows water dependent habitats with statutory designation.

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Name (and map grid square) ¹⁶	Distance and direction from route	Designation	Comments
Mossknowe Lodge Wood EC-01-804 – F6	Adjacent to land required for the construction of the Proposed Annandale depot works.	Potential ancient woodland	Not surveyed. May be supported by groundwater from the underlying Gretna till and/or Sherwood Sandstone. Included on a precautionary basis.
Unnamed woodland east of Grahamshill Railway Cottages EC-01-804 – I5	Adjacent to land required for construction of the proposed Annandale depot works.	Potential ancient woodland	Not surveyed. May be supported by groundwater from the underlying Gretna till and/or Sherwood Sandstone. Included on a precautionary basis.
Kirkpatrick Burn EC-01-804 – E6	57m south of land required for the construction of the Proposed Annandale depot works.	Potential ancient woodland	Not surveyed. May be supported by groundwater from the underlying Gretna till and/or Sherwood Sandstone. Included on a precautionary basis.
Billy's Wood North EC-01-804 – H5	Adjacent to land required for the construction of the Proposed Annandale depot works.	Potential ancient woodland	Not surveyed. May be supported by groundwater from the underlying Gretna till and/or Sherwood Sandstone. Included on a precautionary basis.

3 References

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