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HS2

High Speed Rail (Crewe – Manchester) Environmental Statement

Volume 5: Appendix WR-003-0MA02

Water resources and flood risk

MA02: Wimboldsley to Lostock Gralam

Water resources assessment

M307

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Department for Transport

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High Speed Two (HS2) Limited
Two Snowhill
Snow Hill Queensway
Birmingham B4 6GA

Telephone: 08081 434 434

General email enquiries: HS2enquiries@hs2.org.uk

Website: www.hs2.org.uk

A report prepared for High Speed Two (HS2) Limited:

ARUP+ ERM | FOSTER + PARTNERS | JACOBS
RAMBOLL | TYPSA | COSTAIN

MWJV
Mott MacDonald | WSP

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1 Introduction

1.1 Structure

1.1.1 This report is an appendix to the water resources and flood risk assessment. It presents the water resources assessment for the Proposed Scheme in relation to the Wimboldsley to Lostock Gralam area (MA02).

1.1.2 This appendix should be read in conjunction with:

- Volume 2, Community Area reports;
- Volume 3, Route-wide effects;
- Volume 4, Off-route effects; and
- Volume 5, Appendices.

1.1.3 The water resources and flood risk assessments include both route-wide and community area specific appendices. The route-wide appendices comprise:

- a Water Framework Directive (WFD) compliance assessment (Volume 5: Appendix WR-001-00000); and
- a Draft water resources and flood risk operation and maintenance plan (Volume 5: Appendix WR-007-00000).

1.1.4 For MA02, the Flood risk assessment (Volume 5: Appendix WR-005-0MA02) should also be referred to.

1.1.5 Additional information relevant to this assessment is set out in Background Information and Data (BID):

- Water resources assessment baseline data (BID WR-004-0MA02)[1]; and
- WFD compliance assessment baseline data (BID WR-002-00001)[2].

1.2 Scope, assumptions and limitations

1.2.1 The scope, assumptions and limitations for the water resources assessment are set out in the Environmental Impact Assessment Scope and Methodology Report (SMR) (see Volume 5: Appendix CT-001-00001).

1.2.2 The MA02 area covers a 14.6km long section of the Proposed Scheme. The spatial scope of the assessment is based initially on the identification of surface water and groundwater features within 1km of the route of the Proposed Scheme. However, within this area the spatial scope has been extended to include the granular MA02 Borrow Pit D. This borrow pit is located to the east of the Proposed Scheme, immediately west of the M6. For the purposes of this assessment this spatial scope is defined as the study area.

1.2.3 The assessment considers the construction and operational features of the Proposed Scheme within this study area. These are shown on Volume 2, MA02 Map Book: Map Series CT-05 and CT-06.

[1] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Background Information and Data, Water resources assessment baseline data,* BID WR-004-0MA02. Available online at: http://www.gov.uk/government/collections/hs2–phase–2b–crewe–manchester–environmental–statement.

[2] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Background Information and Data, Water Framework Directive compliance assessment baseline data,* BID WR-002-00001. Available online at: http://www.gov.uk/government/collections/hs2–phase–2b–crewe–manchester–environmental–statement.

1.2.4 This assessment covers the potential impacts of the Proposed Scheme on existing surface water and groundwater resources, including consideration of:

- surface waters[3];
- aquifers;
- abstractions (licensed and unlicensed) and consented discharges;
- springs and other groundwater-surface water interactions with implications for water resources; and
- water dependent habitats.

1.2.5 The route-wide WFD compliance assessment (Volume 5: Appendix WR-001-00000) provides a comprehensive review of the potential impacts of the Proposed Scheme on designated WFD surface water and groundwater bodies. The WFD compliance assessment, which involved extensive walkover surveys, informed both the value attributed to relevant receptors, such as watercourses, and the assessment of impacts and effects used in this assessment.

1.2.6 The water resources assessment considers the pollution risks associated with spillage and routine discharges of runoff from all roads within the study area that are affected by the Proposed Scheme during the construction and operational phases. Where background surface water quality data in the vicinity of the Proposed Scheme is not available to support the Highways England Water Risk Assessment Tool (HEWRAT)[4] assessment, an assumption has been made, on a precautionary basis, that there is still the potential to exceed environmental quality standards (EQS) in the receiving watercourse.

1.2.7 The risk to water resources associated with accidents or spillages from trains during the operation of the Proposed Scheme are considered on a route-wide basis within Volume 3, Route-wide effects, Section 16, Water resources and flood risk.

1.2.8 Mineral resources (operational or historical) and potential impacts to groundwater quality from existing land contamination, including Winsford Rock Salt and Holford Brine Fields, are presented in Land quality report, Volume 5: Appendix LQ-001-0MA02.

1.3 Study area description and key features

1.3.1 The study area is predominantly rural or suburban with a number of towns, villages, hamlets and farmsteads located within proximity to the Proposed Scheme. These include Wimboldsley, Middlewich, Winsford, Northwich and Lostock Gralam.

1.3.2 Within MA02, the Proposed Scheme would be constructed as a series of embankments. The only exceptions to this are the crossings of the Shropshire Union Canal, River Dane, Puddinglake Brook, Trent and Mersey Canal, Gad Brook, Smoker Brook, Peover Eye and Wade Brook where the Proposed Scheme will be constructed on viaduct. There are no tunnelled or ground level sections.

1.3.3 The main environmental features of relevance to water resources include:

- the Shropshire Union Canal, the Trent and Mersey Canal, the River Weaver, Gad Brook, Wade Brook, Wincham Brook, River Dane, Peover Eye, and their associated tributaries;
- one spring feature and one potential spring feature within the land required for construction of the Proposed Scheme;
- the Mercia Mudstone Group Secondary B aquifer;
- the permeable superficial deposits Secondary A and Secondary (Undifferentiated) aquifers; and
- Wimboldsley Wood Site of Special Scientific Interest (SSSI) and ancient woodland which is potentially a groundwater dependent habitat.

[3] Ponds are not included in the water resources assessment; these are assessed as ecological receptors in Volume 2.

[4] Standards for Highways (2020), *Design Manual for Roads and Bridges* (*DMRB) – LA 113 Road Drainage and the Water Environment Revision 1*. Available online at: https://www.standardsforhighways.co.uk/prod/attachments/d6388f5f-2694-4986-ac46-b17b62c21727?inline=true.

1.4 Stakeholder engagement

1.4.1 Discussions have been held with the following stakeholders to inform the water resources assessment:

- the Environment Agency particularly with regard to Winsford Rock Salt and Holford Brine Fields. Discussions with the Environment Agency have shown that there is unlikely to be a potential pathway for an impact on these sites from the Proposed Scheme. Therefore, these sites were not taken forward to the water resources assessment;
- Natural England with regards to Wimboldsley Wood SSSI. Engagement with Natural England highlighted a potential risk relating to drainage discharge from the Proposed Scheme on the saliferous habitat which forms part of the designation for this SSSI. Through engagement, the drainage outfall has been rerouted to another location to remove this risk to the SSSI site;
- Canal & River Trust with regard to the crossings of the Shropshire Union and Trent and Mersey Canals; and
- Cheshire West and Cheshire Council (CWCC) and Cheshire East Council (CEC) with regard to private unlicensed water abstractions.

2 Site specific surface water assessments

2.1 Summary of assessment

2.1.1 Table 1 presents the potential impacts and effects related to surface water resources and features potentially affected by the Proposed Scheme. Further baseline details for these receptors are provided in Water resources assessment baseline data (BID WR-004-0MA02). Those surface water features potentially affected by groundwater interactions are described in Section 3.1.

2.1.2 The WFD compliance assessment (Volume 5: Appendix WR-001-00000) provides a comprehensive review of the aspects of the Proposed Scheme that have potential to cause permanent impacts on water bodies, or which could constrain the future achievement of water body objectives. Temporary construction impacts, defined as those which would last less than three years, may not have implications for WFD compliance, but may nevertheless result in significant effects related to water resources. Such temporary effects have therefore been considered in this assessment, as shown in Table 1.

2.1.3 Construction compounds may have substantial water demands where they are associated with design elements, such as batching plants. At these locations the construction compounds may require water abstractions to augment other supply options. Where these are required, then an assessment will include location-specific engagement with the Environment Agency and other water undertakers on the availability of water at that location.

2.1.4 The draft Code of Construction Practice (CoCP) (see Volume 5: Appendix CT-002-00000) sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme to protect surface waters.

Table 1: Summary of potential impacts on surface water receptors

Surface water feature/receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
Surface water bodies									
Tributary of River Weaver 2	Moderate	• Coppenhall Moss North embankment • Walley's Green embankment • Park Hall culvert (110m) • Realignment (90m) including; – A530 Nantwich Road offline east culvert (25m); – A530 Nantwich Road offline west culvert (25m); and – Unnamed culvert south of the HS2 attenuation drainage pond (10m). • Watercourse crossing by proposed road and access road • Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		• Park Hall culvert (110m) • Realignment (90m) including;	Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements.	Magnitude of impact – Minor	Culvert lengths have been reduced during the design process and invert levels set	Magnitude of impact – Negligible	None required	Magnitude of impact – Negligible	Construction (permanent)

Surface water feature/receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
		– A530 Nantwich Road offline east culvert (25m); – A530 Nantwich Road offline west culvert (25m); and – Unnamed culvert south of the HS2 attenuation pond (10m). • Watercourse crossing by proposed road and access road • Drainage outfalls from HS2 attenuation pond and road drainage	Deterioration of water quality due to contamination of surface water from both routine discharges from the Proposed Scheme and associated infrastructure or from accidental spillages.	Significance of effect – Minor adverse, not significant	below the bed of the watercourse. Mitigation measures will include realignment of approximately 125m of the watercourse to avoid the proposed road and 10m of the watercourse to avoid the Coppenhall Moss North embankment. Measures to manage water quality will be adopted during the design process.	Significance of effect – Negligible, not significant		Significance of effect – Negligible, not significant	
River Weaver	Very high	• Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
The Dingle	Low	• Watercourse crossing by proposed access road • Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		• Watercourse crossing by proposed access road • Drainage outfalls from track drainage and two HS2 attenuation ponds	Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements. Deterioration of water quality due to contamination of surface water from both routine discharges from the Proposed Scheme and associated infrastructure or from accidental spillages.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Mitigation measures will include appropriate watercourse crossing and drainage design. Measures to manage water quality will be adopted during the design process.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
Tributary of River Wheelock 1	Moderate	None	There are no elements of the route of the Proposed Scheme likely to impact this waterbody. Impacts possible on groundwater – surface water interactions due to temporary works, ground level track, embankments, roads, utilities	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)

Surface water feature/receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
			diversions and stock depot (see Section 3.2).						
Tributary of River Weaver 3	Moderate	• Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
River Wheelock	Moderate	• Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Tributary of River Wheelock 2	Moderate	None	There are no elements of the route of the Proposed Scheme likely to impact this waterbody. Impacts possible on groundwater – surface water interactions due to temporary works, ground level track, embankments, roads, utilities diversions and stock depot (see Section 3.2).	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Tributary of River Wheelock 3	Moderate	None	There are no elements of the route of the Proposed Scheme likely to impact this waterbody. Impacts possible on groundwater – surface water interactions due to temporary works, ground level track, embankments, roads, utilities diversions and stock depot (see Section 3.2).	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Tributary of River Weaver 4	Low	• Realignment (56m) including Clive Green Lane offline culvert (20m) • Watercourse crossing by proposed road and temporary road • Utilities diversion • Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		• Realignment (56m) including Clive Green Lane offline culvert (20m) • Watercourse crossing by proposed road	Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements. Deterioration of water quality due to contamination of surface water from both	Magnitude of impact – Minor	Culvert lengths have been reduced during the design process and invert levels set below the bed of the watercourse.	Magnitude of impact – Negligible	None required	Magnitude of impact – Negligible	Construction (permanent)

Surface water feature/receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
		• Drainage outfall from highway attenuation pond and HS2 attenuation pond	routine discharges from the Proposed Scheme and associated infrastructure or from accidental spillages.	Significance of effect – Negligible, not significant	Mitigation measures will include minor realignment of approximately 26m of existing watercourse to avoid proposed road. Mitigation measures will include appropriate drainage design. Measures to manage water quality will be adopted during the design process.	Significance of effect – Negligible, not significant		Significance of effect – Negligible, not significant	
Tributary of River Wheelock 4	Moderate	• Temporary works such as compounds, stockpiles and access routes • Drainage outfall from highway attenuation pond and HS2 attenuation pond	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Shropshire Union Canal	Very high	• Shropshire Union Canal viaduct No.1 • Shropshire Union Canal viaduct No.2 • Shropshire Union Canal viaduct No.3 • Shropshire Union Canal offline overbridge • Watercourse crossing by proposed road and access road • Utilities diversion • Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		• Shropshire Union Canal viaduct No.1 • Shropshire Union Canal viaduct No.2 • Shropshire Union Canal viaduct No.3 • Shropshire Union Canal offline overbridge • Watercourse crossing by proposed road and access road • Drainage outfall from HS2 attenuation pond and highway attenuation pond	Deterioration, loss or change to the existing water environment and flow characteristics from the presence of the design elements. Deterioration of water quality due to contamination of surface water from both routine discharges from the Proposed Scheme and associated infrastructure or from accidental spillages.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Mitigation measures include avoiding the channel. Piers are set back to remove impacts on flows. Mitigation measures will include appropriate watercourse crossing by proposed road and appropriate drainage design. Measures to manage water quality will be adopted during the design process.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
Tributary of River Wheelock 5	Low	• Utilities diversion	Uncontrolled site runoff could impact the flow dynamics and water quality of the	Magnitude of impact – Minor	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible	None required	Magnitude of impact – Negligible	Construction (temporary)

Surface water feature/receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
		• Temporary works such as compounds, stockpiles and access routes	receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.	Significance of effect – Negligible, not significant		Significance of effect – Negligible, not significant		Significance of effect – Negligible, not significant	
		• Drainage outfalls from road drainage and HS2 attenuation pond	Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements. Deterioration of water quality due to contamination of surface water from both routine discharges from the Proposed Scheme and associated infrastructure or from accidental spillages.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Mitigation measures will include appropriate drainage design. Measures to manage water quality will be adopted during the design process.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
Middlewich Road Drains	Low	• Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Birch Lane Drain	Low	• Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		• Drainage outfall from highway attenuation pond	Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements. Deterioration of water quality due to contamination of surface water from both routine discharges from the Proposed Scheme and associated infrastructure or from accidental spillages.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Mitigation measures will include appropriate drainage design. Measures to manage water quality will be adopted during the design process.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
River Dane	Very high	• River Dane viaduct • Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)

Surface water feature/receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
			Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.						
		• River Dane viaduct • Drainage outfall from HS2 attenuation pond and road drainage	Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements. Deterioration of water quality due to contamination of surface water from both routine discharges from the Proposed Scheme and associated infrastructure or from accidental spillages.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Mitigation measures include avoiding the channel and floodplain, as far as reasonably practicable. Piers are set back to reduce impacts on flows. As far as reasonably practicable viaduct spans have been elongated and piers have been located to take account of possible future channel migration. Mitigation measures will include appropriate drainage design, and measures to manage water quality will be adopted during the design process.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
The Willowbeds	Low	• Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
A533 Drain	Low	• Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Tributary of River Dane 3	Low	• Stanthorne North embankment • Bank culvert (65m) • Realignment (55m) • Utility diversion • Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)

Surface water feature/receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
		• Bank culvert (65m) • Realignment (55m) • Drainage outfalls from track drainage and two HS2 attenuation ponds	Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements. Deterioration of water quality due to contamination of surface water from both routine discharges from the Proposed Scheme and associated infrastructure or from accidental spillages.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Mitigation measures will include minor realignment of watercourse to avoid embankment. Culvert lengths have been reduced during the design process and invert levels set below the bed of the watercourse. Mitigation measures will include appropriate drainage design. Measures to manage water quality will be adopted during the design process.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
Tributary of River Dane 4	Moderate	• Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Trent and Mersey Canal - First Crossing	Very high	• Dane Valley embankment • River Dane viaduct • Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		• River Dane viaduct • Drainage outfall from track drainage	Deterioration, loss or change to the existing water environment and flow characteristics from the presence of the design elements. Deterioration of water quality due to contamination of surface water from both routine discharges from the Proposed Scheme and associated infrastructure or from accidental spillages.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Mitigation measures include avoiding the channel. Piers are set back to remove impacts on flows. Mitigation measures will include appropriate drainage design, and measures to manage water quality will be adopted during the design process.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
River Croco – First Crossing	Moderate	• Temporary access routes • Utilities diversion	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)

Surface water feature/receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
River Croco – Second Crossing	Moderate	• Temporary access routes • Utilities diversion	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Tributary of River Wheelock 6	Moderate	None	There are no elements of the route of the Proposed Scheme likely to impact this waterbody. Impacts possible on groundwater-surface water interactions due to temporary works, ground level track, embankments, roads, utilities diversions and stock depot (see Section 3).	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Hill Wood Drain	Low	• Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Tributary of Trent and Mersey Canal	Low	• Dane Valley embankment • Realignment (340m) including; – Whatcroft culvert (25m); and – Unnamed culvert east of Whatcroft culvert (5m). • Watercourse crossing by proposed access road • Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		• Dane valley embankment • Realignment (340m) including; – Whatcroft culvert (25m); and – Unnamed culvert east of Whatcroft culvert (5m). • Watercourse crossing by proposed access road • Drainage outfall from track drainage and HS2 attenuation pond	Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements. Deterioration of water quality due to contamination of surface water from both routine discharges from the Proposed Scheme and associated infrastructure or from accidental spillages.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Mitigation measures will include minor realignment of watercourse to avoid embankment and appropriate watercourse crossing and drainage design. Measures to manage water quality will be adopted during the design process. Culvert lengths have been reduced during the design process and invert levels set below the bed of the watercourse.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)

Surface water feature/receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
Trent and Mersey Canal – Second Crossing	Very high	• Whatcroft embankment south • Puddinglake Brook viaduct • Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		• Puddinglake Brook viaduct • Drainage outfall from HS2 attenuation pond	Deterioration, loss or change to the existing water environment and flow characteristics from the presence of the design elements.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Mitigation measures include avoiding the channel. Piers are set back to remove impacts on flows. Mitigation measures will include appropriate watercourse crossing design and appropriate drainage design. Measures to manage water quality will be adopted during the design process.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
Puddinglake Brook	High	• Puddinglake Brook viaduct • Granular MA02 Borrow Pit D • Watercourse crossing by proposed temporary road • Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials. Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP. Mitigation measures will include appropriate watercourse crossing by the proposed temporary road.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		• Puddinglake Brook viaduct • Drainage outfalls from two HS2 attenuation ponds and road drainage	Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements. Deterioration of water quality due to contamination of surface water from both routine discharges from the Proposed Scheme and associated infrastructure or from accidental spillages.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Mitigation measures include avoiding the floodplain and channel. Piers are set back to remove impacts on flows. Mitigation measures will include appropriate watercourse crossing and appropriate drainage design. Measures to manage water quality will be adopted during the design process.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)

Surface water feature/receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
Byley Road Drain	Low	• Granular MA02 Borrow Pit D • Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Tributary of Gad Brook 1	Moderate	• Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Tributary of Gad Brook 2	High	• Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Trent and Mersey Canal – Third Crossing	Very high	• Trent and Mersey Canal viaduct • Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		• Trent and Mersey Canal viaduct	Temporary impacts to water quality due to construction of pier foundations close to or within the canal backwater.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		• Trent and Mersey Canal viaduct • Drainage outfall from HS2 attenuation pond	Deterioration, loss or change to the existing water environment and flow characteristics from the presence of the design elements.	Magnitude of impact – Minor	Mitigation measures include avoiding the channel as far as reasonably practicable. Piers are set back to remove impacts on flows.	Magnitude of impact – Negligible	None required	Magnitude of impact – Negligible	Construction (permanent)

Surface water feature/receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
			Deterioration of water quality due to contamination of surface water from both routine discharges from the Proposed Scheme and associated infrastructure or from accidental spillages.	Significance of effect – Moderate adverse, significant	Mitigation measures will include appropriate drainage design. Measures to manage water quality will be adopted during the design process.	Significance of effect – Negligible, not significant		Significance of effect – Negligible, not significant	
Gad Brook	Moderate	• Gad Brook viaduct • Utility diversion • Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		• Gad Brook viaduct • Drainage outfall from attenuation pond and proposed road	Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements. Deterioration of water quality due to contamination of surface water from both routine discharges from the Proposed Scheme and associated infrastructure or from accidental spillages.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Mitigation measures include avoiding the floodplain and channel. Piers are set back to remove impacts on flows. Mitigation measures will include appropriate drainage design, and measures to manage water quality will be adopted during the design process.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
Tributary of Gad Brook 3	Moderate	• Gad Brook viaduct • Utility diversion • Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		• Gad Brook viaduct • Drainage outfall from road drainage	Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements. Deterioration of water quality due to contamination of surface water from both routine discharges from the Proposed Scheme and associated infrastructure or from accidental spillages.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Mitigation measures include avoiding the floodplain and channel. Piers are set back to remove impacts on flows.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)

Surface water feature/receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
Tributary of Gad Brook 4	Moderate	• Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Broken Cross Drains	Low	• Demolition of residential properties • Rudheath embankment • Realignment (270m) including; – A556 Shurlach Road culvert (80m); – Unnamed culvert west of A556 Shurlach Road culvert (5m); and – Unnamed culvert north-west of A556 Shurlach Road culvert (5m). • Crossing by proposed road and access road • Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		• Rudheath embankment • Realignment (270m) including; – A556 Shurlach Road culvert (80m); – Unnamed culvert west of A556 Shurlach Road culvert (5m); and – Unnamed culvert north-west of A556 Shurlach Road culvert (5m). • Crossing by proposed road and access road • Drainage outfalls from two HS2 attenuation ponds and highway attenuation pond	Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements. Deterioration of water quality due to contamination of surface water from both routine discharges from the Proposed Scheme and associated infrastructure or from accidental spillages.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Mitigation measures will include minor realignment of watercourse to avoid embankment and appropriate drainage design. Any realignment will consider the drainage from the waste lime beds and ensure a barrier between the underlying superficial deposits and any poor-quality water is maintained. Measures to manage water quality will be adopted during the design process. Culvert lengths have been reduced during the design process and invert levels set below the bed of the watercourse.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)

Surface water feature/receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
Tributary of Wade Brook 1	Moderate	• Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Tributary of Wade Brook 2	Moderate	• Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Wade Brook	High	• Wade Brook viaduct • Wade Brook offline overbridge • Unnamed culvert west of Fieldshouse Farm (5m) • Watercourse crossing by A556 Shurlach Road and access road • Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		• Wade Brook viaduct • Wade Brook offline overbridge • Unnamed culvert west of Fieldhouse Farm (5m) • Watercourse crossing by A556 Shurlach Road and access road • Drainage outfalls from two HS2 attenuation ponds and two highway attenuation ponds	Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements. Deterioration of water quality due to contamination of surface water from both routine discharges from the Proposed Scheme and associated infrastructure or from accidental spillages.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Mitigation measures include avoiding the floodplain and channel. Piers are set back to remove impacts on flows. Mitigation measures will include appropriate watercourse crossing and appropriate drainage design. Measures to manage water quality will be adopted during the design process.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
Square Wood Drains	Low	• Utility diversion • Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
A556 Drainage	Low	• Utility diversion	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised	Magnitude of impact – Minor	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible	None required	Magnitude of impact – Negligible	Construction (temporary)

Surface water feature/receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
		• Temporary works such as compounds, stockpiles and access routes	contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Significance of effect – Negligible, not significant		Significance of effect – Negligible, not significant		Significance of effect – Negligible, not significant	
Wincham Brook	High	• Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Tributary of Peover Eye	Moderate	• Smoker Brook viaduct • Watercourse crossing by proposed temporary road • Realignment (46m) • Realignment (20m) • Utility diversion • Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials. Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Implementation of measures described in the draft CoCP. Mitigation measures will include appropriate watercourse crossing by the proposed temporary road.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		• Smoker Brook viaduct • Realignment (46m) • Realignment (20m) • Drainage outfall from HS2 attenuation pond	Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements. Deterioration of water quality due to contamination of surface water from both routine discharges from the Proposed Scheme and associated infrastructure or from accidental spillages.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Mitigation measures include avoiding the floodplain and channel as far as reasonably practicable. Piers are set back to remove impacts on flows. However, the exact location of the current channel is unclear. Mitigation measures will include minor realignment of watercourse to avoid pier, appropriate watercourse crossing and drainage design. Measures to manage water quality will be adopted during the design process.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
Peover Eye	High	• Smoker Brook viaduct • Realignment (44m) • Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)

Surface water feature/receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
			Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.						
		• Smoker Brook viaduct • Realignment (44m)	Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the viaduct piers.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Mitigation measures include avoiding the floodplain and channel. Piers are set back to remove impacts on flows. Mitigation measures will include minor realignment of watercourse to avoid the piers. Mitigation measures will include appropriate drainage design. Measures to manage water quality will be adopted during the design process.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
Tributary of Wincham Brook 2	Moderate	None	There are no elements of the route of the Proposed Scheme likely to impact this waterbody. Impacts possible on groundwater – surface water interactions due to temporary works and ground level track and roads (see Section 3.2).	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Tributary of Wincham Brook 3	Moderate	None	There are no elements of the route of the Proposed Scheme likely to impact this waterbody. Impacts possible on groundwater – surface water interactions due to temporary works and ground level track and roads (see Section 3.2).	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Smoker Brook	High	• Smoker Brook viaduct • Temporary works such as compounds, stockpiles and access routes	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		• Smoker Brook viaduct	Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Mitigation measures include avoiding the floodplain and channel. Piers are set back to remove impacts on flows.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)

Surface water feature/receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
Discharges to surface water									
Discharge 0169/1060	Low	• Temporary works such as compounds, stockpiles and access routes	Located within the land required for construction of the Proposed Scheme This discharge has potential to be physically impacted by construction work.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Discharge 016892135 Discharge 016892352	Low	• Temporary works such as compounds, stockpiles and access routes	Located adjacent to the land required for construction of the Proposed Scheme This area will be used for access only and no works will be undertaken in this area. Therefore, the potential for mobilisation of contaminants that could impact water quality at the discharge site is considered low.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Discharge NPSWQD003247	Low	• Temporary works such as compounds, stockpiles and access routes	Located within the land required for construction of the Proposed Scheme. This discharge has potential to be physically impacted by construction work.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Discharge 016890361 Discharge 016880974	Low	• Temporary works such as compounds, stockpiles and access routes	Located adjacent to the land required for construction of the Proposed Scheme. This area will be used for access only and no works will be undertaken in this area. Therefore, the potential for mobilisation of contaminants that could impact water quality at the discharge site is considered low.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Discharge NPSWQS009429 Discharge 016890854 Discharge 016810058 Discharge 016892112 Discharge NPSWQD009396 Discharge 016892042	Low	• Temporary works such as compounds, stockpiles and access routes • Granular Borrow Pit D	Located downstream of the Proposed Scheme and discharging into a watercourse considered within this assessment - these discharges have been included on a precautionary basis. The potential for mobilisation of contaminants that could impact water quality at the discharge site is considered low.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)

Surface water feature/receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
Discharge 01CON0060									
Discharge 016890943	Low	• Temporary works such as compounds, stockpiles and access routes	Located within the land required for construction of the Proposed Scheme. This discharge has potential to be physically impacted by construction work.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Discharge 016891589 Discharge 016892034 Discharge 016892558 Canals & Rivers Trust Discharge 1 Canals & Rivers Trust Discharge 2	Low	None	Located downstream of the Proposed Scheme and discharging into a watercourse considered within this assessment - the discharge has been included on a precautionary basis.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Discharge 016890401 Discharge 016891642	Low	None	Located upstream of the Proposed Scheme, however discharging into a watercourse considered within this assessment - the discharge has been included on a precautionary basis.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)

3 Site specific groundwater assessments

3.1 Summary of assessment

3.1.1 Table 2 presents all groundwater receptors within the study area and summarises potential impacts from the design elements of the Proposed Scheme which are relevant to the water environment. Further baseline details for these receptors are provided in Water resources assessment baseline data (BID WR-004-0MA02). Individual impact assessments for each design element are presented in Section 3.2.

3.1.2 Construction compounds may have substantial water demands where they are associated with design elements, such as batching plants. At these locations the construction compounds may require water abstractions to augment other supply options. Where these are required, then an assessment will include location-specific engagement with the Environment Agency and other water undertakers on the availability of water at that location.

3.1.3 The draft CoCP sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme to protect groundwaters. All above ground temporary works within construction compounds are included in design and mitigated by the draft CoCP.

3.1.4 The potential impacts of future ground investigations are considered negligible because of the measures outlined in the draft CoCP. As this assessment is applicable for all receptors it is not re-stated inTable 2.

3.1.5 In support of the groundwater impact assessment presented inTable 2 , further detail is provided in Section 3.2 to Section 3.3 to demonstrate the methodology and assumptions used in relation to viaducts and overbridges and borrow pits of the Proposed Scheme. The locations of these elements are shown in Volume 2, MA02 Map Book: Map Series CT-05 and CT-06.

Table 2: Summary of potential impacts on groundwater receptors

Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
Hydrogeology (aquifers)									
Alluvium – Secondary A aquifer	Moderate	Above ground elements and shallow excavation (<1mbgl) including: • ground level or embankment track and roads; • temporary works such as stockpiles and compounds; and • utilities diversions.	The temporary works have the potential to affect shallow groundwater quality, although this is likely to be localised and temporary.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
			Temporary works are above ground or shallow and of small areal extent compared to the aquifer therefore are likely to have a negligible impact on recharge and groundwater flow. No preferential flow pathways will be created so impacts on groundwater flow from utilities diversions are negligible.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		Deeper excavations (>1mbgl) including: • River Dane viaduct; • Gad Brook viaduct; • Wade Brook viaduct; and • Smoker Brook viaduct.	The permanent below ground features such as viaducts may alter groundwater flow and quality (see Section 3.2).	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
River terrace deposits – Secondary A aquifer	Moderate	Above ground elements and shallow excavation (<1mbgl) including: • ground level or embankment track and roads; • temporary works such as stockpiles and compounds; and • utilities diversions.	The temporary works have the potential to affect shallow groundwater quality, although this is likely to be localised and temporary.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
			Temporary works are above ground or shallow and of small areal extent compared to the aquifer therefore are likely to have a negligible impact on recharge and groundwater flow. No preferential flow pathways will be created so impacts on groundwater flow from utilities diversions are negligible.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect - Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		Deeper excavations (>1mbgl) including: • River Dane viaduct	The permanent below ground features, such as viaducts may alter groundwater flow and quality (see Section 3.2).	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)

Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
Glaciofluvial deposits – Secondary A aquifer	Moderate	Above ground elements and shallow excavation (<1mbgl) including: • ground level or embankment track and roads; • temporary works such as stockpiles and compounds; • utilities diversions; • Clive Green north embankment No.1 and No.2; • Clive Green North embankment retaining wall; • Stanthorne North embankment; • Dane Valley embankment; • Whatcroft embankment south; • Rudheath embankment; and • Lostock Gralam South embankment.	The temporary works have the potential to affect shallow groundwater quality, although this is likely to be localised and temporary.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
			Temporary works and permanent works are above ground or shallow and therefore are likely to have a negligible impact on recharge and groundwater flow. No preferential flow pathways will be created so impacts on groundwater flow from utilities diversions are negligible.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary and permanent)
		Deeper excavations (>1mbgl) including: • River Dane viaduct; • Wade Brook viaduct; and • Smoker Brook viaduct.	The construction works have the potential to affect groundwater quality, although this is likely to be localised and temporary.	Magnitude of impact – Moderate Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact - Negligible Significance of effect - Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
			Potential alteration of groundwater flow pathways may occur around viaduct piers. Due to the location and minor extent of the piers within the aquifer, the impact on groundwater flow pathways will be negligible.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
		Deeper excavations (>1mbgl) including: • Puddinglake Brook viaduct; and • Trent and Mersey Canal viaduct.	Potential alteration of groundwater flow pathways may occur around viaduct piers. Due to the location and minor extent of the piers within the aquifer, the impact on groundwater flow pathways will be negligible.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	None required.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	None required.	Magnitude of impact - Minor Significance of effect – Minor adverse, not significant	Construction (permanent)
Glaciofluvial sheet deposits –	Moderate	Deeper excavations (>1mbgl) including:	The temporary borrow pit works will require dewatering to allow for the	Magnitude of impact – Moderate	Implementation of measures described in the draft CoCP.	Magnitude of impact – Moderate	Mitigation measures will be	Magnitude of impact – Moderate	Construction (temporary)

Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
Secondary A aquifer		• granular MA02 Borrow Pit D.	excavation of granular material. This has the potential to have a minor impact on groundwater flow in this aquifer (see Section 3.2).	Significance of effect – Moderate adverse, significant		Significance of effect – Moderate adverse, significant	designed in detail following ground investigation and monitoring of surface water and groundwater levels to minimise any impacts on base flow to the brook	Significance of effect – Moderate adverse, significant	
			The Environment Agency have historically objected to dewatering at local quarry sites in the vicinity of this borrow pit. In this instance, wet working may be required during excavation of the borrow pit which could lead to localised changes in groundwater level which could impact on flood risk – further information in Flood risk assessment Volume 5, Appendix: WR-005-0MA02.						
			The temporary borrow pit works will permanently remove up to 5m depth of the glaciofluvial sheet deposits. Restoration of the pits is likely to include backfilling with lower permeability material which may change the groundwater recharge and flow in this area (see Section 3.2).	Magnitude of impact – Moderate Significance of effect – Moderate adverse, significant	Borrow pit restoration will include appropriately designed drainage systems to ensure no increase in groundwater flooding or surface water flooding at the infilled site and continued water discharge to surface water features. For example, drainage layers constructed from granular materials will be placed as necessary during backfilling (see the Borrow pit report, Volume 5, Appendix: CT-008-00000).	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
Glacial till – Secondary (Undifferentiated) aquifer	Moderate	Above ground elements and shallow excavation (<1mbgl) including: • ground level or embankment track and roads; • temporary works such as stockpiles and compounds; • utilities diversions; • Walley's Green embankment; • Clive Green South embankment No.1 and No.2; • Clive Green North embankment No.1 and No.2; • Clive Green North embankment retaining wall; • Stanthorne South embankment retaining wall;	The temporary works have the potential to affect shallow groundwater quality, although this is likely to be localised and temporary.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
			Temporary works and permanent works are above ground or shallow and of small areal extent compared to the aquifer therefore are likely to have a negligible impact on recharge and groundwater flow.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary and permanent)

Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
		• Stanthorne South embankment No.2; • Stanthorne North embankment; • Dane Valley embankment; • Whatcroft embankment south; • Whatcroft embankment north; • Rudheath embankment; • Lostock Gralam South embankment; and • Lostock Gralam North embankment.							
		Above ground elements and shallow excavation (<1mbgl) including: • Crewe North rolling stock depot; and • utilities diversions.	The temporary works are of small areal extent compared to the aquifer. While the temporary works have the potential to affect shallow groundwater quality, this is likely to be localised and temporary (see Section 3.2).	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
			Although covering only a small part of the aquifer as a whole, the Crewe North rolling stock depot extends over 62.5 hectares with substantial areas of hardstanding within the depot. The depot may therefore have a localised impact on recharge and groundwater flow. No preferential flow pathways will be created so impacts on groundwater flow from utilities diversions are negligible.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	None required.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Construction (temporary and permanent)
		Above ground elements and shallow excavation (<1mbgl) including: • Broken Cross Drain.	The realignment of Broken Cross Drain has the potential to affect groundwater quality in the glacial till aquifer. This potentially lined drain collects water from chemical settlement ponds. If this water is allowed to discharge into the underlying aquifer groundwater quality could be affected.	Magnitude of impact – Moderate Significance of effect – Moderate adverse, significant	Drain realignment will be designed to ensure poor quality surface water does not enter the aquifer.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		Deeper excavations (>1mbgl) including: • A530 Nantwich Road overbridge; • Clive Green Lane overbridge;	The construction works have the potential to affect groundwater quality, although this is likely to be localised and temporary.	Magnitude of impact – Moderate Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)

Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
		• Shropshire Union Canal viaduct No.1 to No.3; • Middlewich box structure; • A54 Middlewich Road viaduct; • River Dane viaduct; • Puddinglake Brook viaduct; • Trent and Mersey Canal viaduct; • Gad Brook viaduct; • utilities diversions (new pylons); • Wade Brook viaduct; • Lostock Gralam viaduct; and • Smoker Brook viaduct.	Potential alteration of shallow groundwater flow pathways may occur around new foundations/below ground structures. Due to the location and minor extent of the foundations/structures within the much larger area of the aquifer, the impact on groundwater flow pathways will be negligible.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
		Deeper excavation (>1mbgl) including: • cohesive MA02 Borrow Pit A, B and C.	The temporary borrow pit works will require dewatering to allow for the excavation of cohesive material. This has the potential to have a minor impact on groundwater flow in this aquifer (see Section 3.2).	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
			The temporary borrow pit works will permanently remove up to 5m depth of the glacial till at Borrow Pit A and up to 3m of glacial till at Borrow Pits B and C. Restoration of the pits is likely to include backfilling with material which differs in permeability from the glacial till. The backfill material may therefore change the groundwater recharge and flow in the borrow pit areas (see Section 3.2).	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Borrow pit restoration will include appropriately designed drainage systems to ensure no increase in groundwater flooding or surface water flooding at the infilled site and continued water discharge to surface water features. For example, drainage layers constructed from granular materials will be placed as necessary during backfilling.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
Mercia Mudstone Group - Sidmouth Mudstone Formation – Secondary B aquifer	Moderate	Above ground elements and shallow excavation (<1mbgl) including: • ground level or embankment track and roads; • temporary works such as stockpiles and compounds; • Walley's Green embankment; • Rudheath embankment; and	Temporary and permanent works are of very small areal extent compared to the aquifer and are generally separated from the aquifer by superficial deposits. Therefore, the works are likely to have a negligible impact on recharge.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary and permanent)

Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
		• Crewe North rolling stock depot.							
		Above ground elements and shallow excavation (<1mbgl) including: • Lostock Gralam South embankment; and • Lostock Gralam North embankment.	There is significant thickness of glacial till overlying the Sidmouth Mudstone Formation aquifer. Above ground features will only extend into the glacial till which will protect the Sidmouth Mudstone Formation aquifer in terms of both groundwater flow and quality, resulting in a negligible impact.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary and permanent)
		Deeper excavations (>1mbgl) including: • A530 Nantwich Road overbridge; • Gad Brook viaduct; • Wade Brook viaduct; • Lostock Gralam viaduct; and • Smoker Brook viaduct.	The construction works have the potential to affect groundwater quality and flow, although this is likely to be localised and temporary. Due to the location and minor extent of the piers within the much larger area of the aquifer, the impact on groundwater quality and flow pathways will be negligible.	Magnitude of impact – Moderate Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
			The permanent below ground features (such as piling for the viaduct piers) may alter groundwater flow around the viaduct piers. However, due to the location and minor extent of the piers within the much larger area of the aquifer, the impact on groundwater flow pathways will be negligible.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
Mercia Mudstone Group - Sidmouth Mudstone Formation – Northwich Halite Member – Unproductive strata	Low	Above ground elements and shallow excavation (<1mbgl) including: • ground level or embankment track and roads; • temporary works such as stockpiles and compounds; • Walley's Green embankment • Clive Green South embankment No.1 and No.2; • Clive Green North embankment No.1 and No.2; • Clive Green North embankment retaining wall;	There is significant thickness of glacial till overlying the Sidmouth Mudstone Formation aquifer. Above ground features will only extend into the glacial till which will protect the Sidmouth Mudstone Formation aquifer in terms of both groundwater flow and quality.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary and permanent)

Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
		• Stanthorne South embankment retaining wall; • Stanthorne South embankment No.2; • Stanthorne North embankment; • Whatcroft embankment south; • Whatcroft embankment north; and • Lostock Gralam North embankment.							
		Above ground elements and shallow excavation (<1mbgl) including: • Dane Valley embankment.	There is significant thickness of glacial till overlying the Sidmouth Mudstone Formation aquifer. Above ground features will only extend into the glacial till which will protect the Sidmouth Mudstone Formation aquifer in terms of both groundwater flow and quality, resulting in a negligible impact.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary and permanent)
			The Dane Valley embankment passes over the Winsford rock salt mine within the Northwich Halite Member. The impact of the Proposed Scheme on Winsford rock salt mine is assessed in the Land quality report, Volume 5: Appendix: LQ-001-0MA02.						
		Deeper excavations (>1mgbl) including: • Clive Green Lane overbridge; • Shropshire Union Canal viaduct No.1 to No.3; • A54 Middlewich Road viaduct; • River Dane viaduct; • Lostock Gralam viaduct; and • Smoker Brook viaduct.	Piling is not expected to occur in the Northwich Halite Member. During installation, there is a slight risk of temporary mobility of poor water quality in the Northwich Halite Member, however, this risk is considered to be negligible.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect - Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
			The River Dane viaduct passes over the Winsford rock salt mine within the Northwich Halite Member. The impact of the Proposed Scheme on Winsford rock salt mine is assessed in the Land quality report, Volume 5: Appendix: LQ-001-0MA02.						
		Deeper excavations (>1mgbl) including: • Middlewich box structure; • Puddinglake Brook viaduct; • Trent and Mersey Canal viaduct; and • Gad Brook viaduct.	There is significant thickness of glacial till overlying the bedrock aquifers in this area. Below ground features are expected to only extend into the glacial till which will protect the bedrock aquifer in terms of both groundwater flow and quality.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)

Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
Abstractions									
Mellor Knowl Farm	Moderate	Above ground elements and shallow excavation (<1mbgl) including: • ground level track, embankments and roads; • temporary works such as stockpiles and compounds; • Clive Green South embankment; and • Clive Green North embankment.	The temporary works have the potential to affect groundwater quality, although this is likely to be localised and temporary.	Magnitude of impact – Moderate Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		Deeper excavation (>1mbgl) including: • Shropshire Union Canal viaduct No.1 to No.3.	Construction of viaduct foundations has the potential to affect groundwater quality during construction, however this will be very localised and temporary. The works are located outside of the recharge areas for these boreholes and therefore the impact is assessed as negligible.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect - Negligible, not significant	Construction (temporary and permanent)
		Deeper excavation (>1mbgl) including: • cohesive MA02 Borrow Pit C.	Dewatering for the excavation of the cohesive borrow pit could reduce the yield to this abstraction (see Section 3.2).	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Bank Farm, Stanthorne, Middlewich	High	Above ground elements and shallow excavation (<1mbgl) including: • ground level track, embankments and roads; • temporary works such as stockpiles and compounds; • Stanthorne North embankment; and • utilities diversions.	The temporary works have the potential to affect groundwater quality, although this is likely to be localised and temporary.	Magnitude of impact – Moderate Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		Deeper excavation (>1mbgl) including: • Shropshire Union Canal viaduct No.1 to No.3; • A54 Middlewich Road viaduct; and • River Dane viaduct.	Construction of viaduct foundations has the potential to affect groundwater quality during construction, however this will be very localised and temporary (see Section 3.2). The works are located outside of the recharge areas for these	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary and permanent)

Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
			boreholes and therefore the impact is assessed as negligible.						
Lagoon at Rudheath Woods, Cranage, Knutsford	Moderate	Deeper excavations (>1mbgl) including: • granular MA02 Borrow Pit D.	Use of the borrow pits during construction has the potential to reduce groundwater yield in this abstraction. The abstraction is located across gradient from the borrow pit and the impact of dewatering is not expected to extend to the abstraction (see Section 3.2).	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Discharges to groundwater									
There are no discharges to groundwater in the study area.									
Groundwater – surface water interactions									
Spring 100m south of Wimboldsley Hall	Moderate	Above ground elements and shallow excavation (<1mbgl) including: • ground level track, embankments and roads; • temporary works such as stockpiles and compounds; • Walley's Green embankment; and • Crewe North rolling stock depot.	The spring is located within the land required for the construction of the Proposed Scheme and is therefore likely to be impacted during construction. Both during and following construction of the Crewe North rolling stock depot, there may be reduced groundwater baseflow to the spring due to the reduction in recharge from the superficial deposits. The temporary works and construction of the rolling stock depot also have the potential to affect groundwater quality, although this is likely to be localised and temporary.	Magnitude of impact – Moderate Significance of effect – Moderate adverse, significant	The spring will be incorporated into the facilities drainage system of the Proposed Scheme. A new drainage outfall will be constructed at the spring and water, which would otherwise recharge the superficial deposits, will be diverted via an attenuation pond to the spring. As such, the groundwater recharge will be returned to the same location. The timing may differ from the natural groundwater flow in the area, but the attenuation pond will act to regulate the flow to the spring. Any impact to water quality will be mitigated through implementation of measures described in the draft CoCP.	Magnitude of impact - Minor Significance of effect – Minor adverse, not significant	None required.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Construction (temporary and permanent)
Potential saliferous spring in Wimboldsley Wood SSSI	High	Above ground elements and shallow excavation (<1mbgl) including: • ground level track, embankments and roads; • temporary works such as stockpiles and compounds; and • Walley's Green embankment.	There should be no impact in the area on the Sidmouth Mudstone Formation – Northwich Halite Member, which is very likely to be the saliferous groundwater source for this potential spring. Additionally, the thickness of glacial till over the Northwich Halite Member will protect the bedrock feeding the potential spring in terms of groundwater flow and quality. Therefore, no impacts from construction are predicted at the potential spring.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary and permanent)
Potential spring south-west of Clive	High	Above ground elements and shallow excavation (<1mbgl) including:	The temporary works have the potential to affect groundwater quality as these springs are located downgradient from the Proposed	Magnitude of impact – Moderate	Implementation of measures described in the draft CoCP.	Magnitude of impact - Negligible	None required.	Magnitude of impact – Negligible	Construction (temporary)

Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
Potential spring at Mill Farm Coalpit Lane Potential sink at Bostock House, A54 Potential spring 230m west of Winnington Wood, at Lostock Gralam	High High High	• ground level track, embankments and roads; • temporary works such as stockpiles and compounds; • Clive Green South embankment No.1 and No.2; and • Clive Green North embankment No.1 and No.2.	Scheme, although this impact is likely to be localised and temporary.	Significance of effect – Moderate adverse, significant		Significance of effect - Negligible, not significant		Significance of effect – Negligible, not significant	
		Deeper excavation (>1mbgl) including: • Shropshire Union Canal viaduct; and • Stanthorne south embankment retaining wall.	The piling and other below ground works associated with these assets will be of small areal extent and as such are assessed to have a negligible impact on groundwater flow to these springs.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
Potential spring at pond 40m west of Coalpit Lane	High	Deeper excavation (>1mbgl) including: • cohesive MA02 Borrow Pit C.	Dewatering associated with the cohesive borrow pit has the potential to temporarily reduce groundwater flow to this potential spring (see Section 3.2).	Magnitude of impact – Moderate Significance of effect – Moderate adverse, significant	Ground investigation and pre-construction monitoring of the Secondary A and Secondary (Undifferentiated) aquifers, and the nearby surface water features, will be undertaken to inform the construction mitigation measures, and could include promoting groundwater recharge, such as discharging pumped water to recharge trenches around excavations to maintain baseline groundwater and surface water conditions.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Site survey during dry conditions to assess baseline flow and the likely impact of the borrow pit on the potential spring and the receiving waterbody.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Construction (temporary)
Potential spring 140m north of Yew-Tree Farm, Coalpit Lane	High	Deeper excavation (>1mbgl) including: • cohesive MA02 Borrow Pit C.	This potential spring is located within the Proposed Scheme cohesive borrow pit and will be lost during construction. Temporary and permanent works may require diversion of this potential spring feature.	Magnitude of impact – Major Significance of effect – Major adverse, significant	Site survey to determine whether the spring is present. Design of permanent structures will include groundwater control/drainage measures where required.	Magnitude of impact – Major Significance of effect – Major adverse, significant	If the spring is present, mitigation could include diversion and reestablishment of the spring elsewhere such that flows into downstream water bodies are not adversely impacted.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary and permanent)
Spring 215m west of Bostock House, A54	Low	Above ground elements and shallow excavation (<1mbgl) including:	The spring is located within the land required for the construction of the Proposed Scheme. Therefore, the spring is likely to be impacted during construction. The temporary and	Magnitude of impact – Moderate Significance of effect – Minor	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact - Moderate Significance of effect – Minor	None required.	Magnitude of impact – Moderate	Construction (temporary and permanent)

Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
		• ground level track, embankments and roads; and • temporary works such as stockpiles and compounds.	permanent works have the potential to affect groundwater quality although this is likely to be localised.	adverse, not significant		adverse, not significant		Significance of effect – Minor adverse, not significant	
Potential spring 215m south-east of Home Farm, Higher Wincham	High	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; and • temporary works such as stockpiles and compounds.	This feature is located upgradient of the Proposed Scheme and on the other side of the Smoker Brook valley and is unlikely to be affected by the construction of the Proposed Scheme.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact - Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Potential spring south-west of caravan park, Allostock Potential sink east of Woodside Farm, Allostock	High High	Deeper excavations (>1mbgl) including: • granular MA02 Borrow Pit D.	The borrow pits during construction have the potential to reduce groundwater flow in these springs. The springs are all located outside of the radius of influence of dewatering (see Section 3.2).	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact - Negligible Significance of effect - Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Tributary of River Weaver 2 and 3 The Dingle Tributary of River Wheelock 1, 2 and 3 River Wheelock Tributary of River Wheelock 6	Moderate Low Moderate Moderate Moderate	Above ground elements and shallow excavation (<1mbgl) including: • ground level track, embankments and roads; • temporary works such as stockpiles and compounds; • utilities diversions; • Walley's Green embankment; • Clive Green embankment; and • Crewe North rolling stock depot.	The temporary works have the potential to affect groundwater quality although this is likely to be localised and temporary.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
The Dingle Tributary of River Weaver 2	Low Moderate	Above ground elements and shallow excavation (<1mbgl) including: • Crewe North rolling stock depot.	The Crewe North rolling stock depot is located in the upper part of the catchments for these watercourses. The depot extends over 62.5 hectares and includes substantial areas of hardstanding. The depot may therefore have an impact on recharge and groundwater discharge to these watercourses.	Magnitude of impact – Minor Significance of effect - Minor adverse, not significant	None required, although Tributary of River Weaver 2 and The Dingle will receive some flow from the drainage network of the Proposed Scheme which may compensate for loss of groundwater discharge.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	None required.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Construction (temporary and permanent)

Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
Tributary of River Wheelock 4	Low	Above ground elements and shallow excavation (<1mbgl) including: • ground level track, embankments and roads; • temporary works such as stockpiles and compounds; and • Clive Green south embankment.	The temporary and permanent works have the potential to affect groundwater quality although this is likely to be localised and temporary.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	None required.	Magnitude of impact – Minor Significance of effect – Minor adverse, not significant	Construction (temporary and permanent)
Tributary of River Wheelock 5	Low	Deeper excavation (>1mbgl) including: • cohesive MA02 Borrow Pit C.	Dewatering associated with the cohesive borrow pit has the potential to reduce groundwater flow to this watercourse (see Section 3.2).	Magnitude of impact – Moderate Significance of effect – Minor adverse, not significant	Dewatering abstraction will be discharged into the Tributary of River Wheelock 5 to maintain flow.	Magnitude of impact - Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
			The cohesive borrow pit will remove the top section of this watercourse and the spring which feeds it, potentially reducing the flow into this watercourse (see Section 3.2).	Magnitude of impact – Moderate Significance of effect – Minor adverse, not significant	The watercourse will receive flow from the drainage network of the Proposed Scheme (new drainage outfall 30m downstream of the headwaters) which will compensate for the loss of groundwater baseflow thus will help to maintain flows.	Magnitude of impact - Minor Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Construction (temporary)
River Dane	Very high	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; • temporary works such as stockpiles and compounds; • Stanthorne North embankment; and • Dane Valley embankment.	The temporary works have the potential to affect groundwater quality although this is likely to be localised and temporary.	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		Deeper excavation (>1mbgl) including: • River Dane viaduct.	The Proposed Scheme crosses this watercourse. The permanent below ground features, such as piled foundations have the potential to alter groundwater flow locally (see Section 3.2). However, due to the small size of the piles and the large extent of the groundwater aquifer, it is not expected this will impact the waterflow in the watercourse overall.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)

Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
Tributary of River Dane 3	Low	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; • temporary works such as stockpiles and compounds; and • Stanthorne North embankment.	The temporary works and construction of the Stanthorne North embankment have the potential to affect groundwater quality although this is likely to be localised and temporary.	Magnitude of impact – Moderate Significance of effect – Minor adverse, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Tributary of River Dane 4	Moderate	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; • temporary works such as stockpiles and compounds; and • Stanthorne North embankment.	The temporary works and construction of the Stanthorne North embankment have the potential to affect groundwater quality although this is likely to be localised and temporary.	Magnitude of impact – Moderate Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Puddinglake Brook	High	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; • temporary works such as stockpiles and compounds; • Dane Valley embankment; and • Whatcroft embankment south.	The temporary works and construction of the embankments have the potential to affect groundwater quality although this is likely to be localised and temporary.	Magnitude of impact – Moderate Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		Deeper excavation (>1mbgl) including: • Puddinglake Brook viaduct.	The construction of the Proposed Scheme crosses the watercourse. The permanent ground features such as pile foundations have the potential to alter groundwater flow (see Section 3.2). However, due to the small size of the piles and the large extent of the groundwater aquifer, it is not expected this will impact the water flow in the watercourse overall.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
		Deeper excavation (>1mbgl) including: • granular MA02 Borrow Pit D.	Dewatering for borrow pits could reduce groundwater flow into the headwaters of the Puddinglake Brook (see Section 3.2).	Magnitude of impact – Moderate Significance of impact – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Dewatering abstraction will be discharged into Puddinglake Brook or returned to the ground in order to maintain flow.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)

Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
			The temporary borrow pit works will permanently remove up to 5m depth of granular material (sand and gravel). Restoration of the borrow pit is likely to include backfilling with material which is substantially lower in permeability than the sand and gravel. The backfill material may therefore affect the groundwater recharge and reduce groundwater discharge from the area to Puddinglake Brook (see Section 3.2).	Magnitude of impact – Moderate Significance of impact – Moderate adverse, significant	Following site investigation, a site-specific borrow pit restoration plan will include appropriately designed drainage systems to maintain the groundwater flow pattern and ensure connectivity between the groundwater regime and baseflow in surface watercourses. The restoration plan will include measures such as drainage layers constructed from granular materials, installed as necessary during backfilling.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
Gad Brook	Moderate	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; • temporary works such as stockpiles and compounds; • Whatcroft embankment north; and • utilities diversions.	The temporary works and construction of the embankments have the potential to affect groundwater quality although this is likely to be localised and temporary.	Magnitude of impact – Moderate Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		Deeper excavation (>1mbgl) including: • Gad Brook viaduct.	The construction of the Proposed Scheme crosses the watercourse. The permanent ground features such as pile foundations have the potential to alter groundwater flow (see Section 3.2). However, due to the small size of the piles and the large extent of the groundwater aquifer, it is not expected this will impact the waterflow in the watercourse overall.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
Tributary of Gad Brook 3 Tributary of Gad Brook 4	Moderate Moderate	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; • temporary works such as stockpiles and compounds; and • utilities diversions.	The temporary works and construction of the embankments have the potential to affect groundwater quality although this is likely to be localised and temporary.	Magnitude of impact – Moderate Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		Deeper excavation (>1mbgl) including: • Gad Brook viaduct.	The construction of the Proposed Scheme crosses the watercourse. The permanent ground features such as pile foundations have the potential to alter groundwater flow (see Section 3.2). However, due to the small size of	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)

Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
			the piles and the large extent of the groundwater aquifer, it is not expected this will impact the waterflow in the watercourse overall.						
Tributary of Gad Brook 1 Tributary of Gad Brook 2	Moderate High	Deeper excavation (>1mbgl) including: • granular MA02 Borrow Pit D.	Dewatering for borrow pits could reduce groundwater flow into the headwaters of Tributary of Gad Brook 1 and 2 (see Section 3.2).	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Tributary of Wade Brook 1 Tributary of Wade Brook 2	Moderate	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; • temporary works such as stockpiles and compounds; and • utilities diversions.	These features are located upgradient of the Proposed Scheme and are unlikely to be affected by the construction of the Proposed Scheme.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required though the draft CoCP will be implemented throughout construction.	Magnitude of impact - Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Wade Brook	High	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; • temporary works such as stockpiles and compounds; • Rudheath embankment; • Lostock Gralam South embankment; and • utilities diversions.	The temporary works and construction of the embankment has the potential to affect groundwater quality although this is likely to be localised and temporary.	Magnitude of impact – Moderate Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		Deeper excavation (>1mbgl) including: • Wade Brook viaduct.	The construction of the Proposed Scheme crosses the watercourse. The permanent ground features such as pile foundations have the potential to alter groundwater flow (see Section 3.2). However, due to the small size of the piles and the large extent of the groundwater aquifer, it is not expected this will impact the waterflow in the watercourse overall.	Magnitude of impact – Negligible Significance of impact – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
Tributary of Peover Eye	Moderate	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads;	The temporary works and construction of the embankments have the potential to affect groundwater quality although this is likely to be localised and temporary.	Magnitude of impact – Moderate Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)

Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
		• temporary works such as stockpiles and compounds; • Lostock Gralam North embankment; and • utilities diversions.							
		Deeper excavation (>1mbgl) including: • Smoker Brook viaduct.	The construction of the Proposed Scheme crosses the watercourse. The permanent ground features such as pile foundations have the potential to alter groundwater flow (see Section 3.2). However, due to the small size of the piles and the large extent of the groundwater aquifer, it is not expected this will impact the flow in the watercourse overall.	Magnitude of impact – Negligible Significance of impact – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
Peover Eye	High	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; and • temporary works such as stockpiles and compounds.	The temporary works and construction of the embankments have the potential to affect groundwater quality although this is likely to be localised and temporary.	Magnitude of impact – Moderate Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
		Deeper excavation (>1mbgl) including: • Smoker Brook viaduct.	The construction of the Proposed Scheme crosses the watercourse. The permanent ground features such as pile foundations have the potential to alter groundwater flow (see Section 3.2). However, due to the small size of the piles and the large extent of the groundwater aquifer, it is not expected this will impact the waterflow in the watercourse overall.	Magnitude of impact – Negligible Significance of impact – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
Tributary of Wincham Brook 2 Tributary of Wincham Brook 3 Wincham Brook	Moderate Moderate High	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; and • temporary works such as stockpiles and compounds.	The temporary works and construction of the embankments have the potential to affect groundwater quality although this is likely to be localised and temporary.	Magnitude of impact – Moderate Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)
Smoker Brook	High	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; and	The temporary works and construction of the embankments have the potential to affect groundwater quality although this is likely to be localised and temporary.	Magnitude of impact – Moderate Significance of effect – Moderate adverse, significant	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)

Receptor	Receptor value	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact and effect	Avoidance and mitigation measures included in design	Magnitude of remaining impact and effect	Other mitigation measures	Residual effects	Duration of effect
		• temporary works such as stockpiles and compounds.							
		Deeper excavation (>1mbgl) including: • Smoker Brook viaduct	The construction of the Proposed Scheme crosses the watercourse. The permanent ground features such as pile foundations have the potential to alter groundwater flow (see Section 3.2). However, due to the small size of the piles and the large extent of the groundwater aquifer, it is not expected this will impact the flow in the watercourse overall.	Magnitude of impact – Negligible Significance of impact – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)

3.2 Impacts to groundwater quality from viaduct and overbridge piling

3.2.1 Piling can affect groundwater quality where the works have hydraulic connection to an aquifer or are in the aquifer itself. Potential impacts may occur from losses of circulation fluid, turbidity resulting from the breakdown of in-situ aquifer material, and possible contamination by hydraulic fluids and greases from machinery. There is likely to be a more rapid transfer of these materials through fracture or fissure flow if present. If within a catchment for a groundwater abstraction, then degraded groundwater quality may render the abstraction unsuitable for use. Catchments for groundwater abstraction are indicated by the source protection zone (SPZ)1 and SPZ2 areas and are defined by the Environment Agency around all licenced abstraction sites.

3.2.2 In MA02 there are no viaducts or overbridges on the Proposed Scheme within any SPZ1 or SPZ2 defined areas.

3.2.3 Piling can impact groundwater flow in an aquifer if the capacity of pathways are reduced during the action of piling or migration of grout into the aquifer. Potential impact from piled structures depends on the spacing of piles and the aquifer type. For example, fissure flow may be impeded if a fracture pathway is intercepted by a pile but matrix flow is less likely to be impeded as groundwater will divert around the structure.

Overbridges

3.2.4 The following overbridges are located within MA02:

- A530 Nantwich Road overbridge;
- Clive Green Lane overbridge;
- Shropshire Union Canal offline overbridge; and
- Wade Brook offline overbridge.

3.2.5 Foundations for these overbridges will comprise of reinforced concrete piles with pile caps. The depths of the piles are between 17m and 25m. The piles are expected to penetrate through the glacial till into the underlying bedrock. Therefore, these piles may obstruct the flow of groundwater in the superficial deposits and bedrock in the immediate vicinity of the piles. However, glacial till is a largely poor aquifer and flow is generally isolated in sandy bands within the aquifer and considering the scale of the viaduct piles, the impact is likely to be highly localised and the impact on the glacial till and bedrock aquifers will be negligible.

Shropshire Union Canal viaducts and A54 Middlewich Road viaduct

3.2.6 Foundations for these viaducts will comprise of reinforced concrete bored piles and pile caps. The depths of the piles are up to 34m for the Shropshire Union Canal viaducts (No.1 to No.3) and 30m for the A54 Middlewich Road viaduct. The piles are expected to penetrate through the glacial till into the underlying Northwich Halite Member of the Sidmouth Mudstone Formation (Unproductive). These piles may obstruct the

flow of groundwater in the glacial till superficial deposits in the immediate vicinity of the foundations for the viaducts. The impact is likely to be highly localised and the impact on the glacial till aquifer will be negligible.

3.2.7 There is a risk of piling works forming a conduit for groundwater movement during construction, as piles are expected to extend into the Northwich Halite Member. This groundwater movement could potentially lead to halite dissolution in the Northwich Halite Member. Active aquifer protection measures will be deployed during piling to mitigate this risk. This along with the application of the draft CoCP, leads to a negligible impact with negligible effect after embedded mitigation.

3.2.8 The viaduct piles are of small areal extent compared to the superficial aquifers and it is assessed that the impact on flow in nearby watercourses is negligible, resulting in a negligible effect which is not significant. The foundation for the A54 Middlewich Road viaduct is located outside of the recharge area for the abstraction at Bank Farm, Stanthorne, Middlewich and therefore the impact is assessed as negligible, leading to a negligible effect which is not significant.

River Dane viaduct

3.2.9 Foundations for this viaduct will comprise of reinforced concrete bored piles and pile caps. The depth of the piles is up to 32m, so they are expected to penetrate through the alluvium, river terrace deposits and glacial till and into the underlying Northwich Halite Member of the Sidmouth Mudstone Formation (unproductive strata). These piles may obstruct the flow of groundwater in the superficial deposits in the immediate vicinity of the foundations for the viaduct. The impact is likely to be highly localised and the impact is assessed to be negligible on these aquifers, leading to negligible effects which are not significant.

3.2.10 There is a risk of piling works forming a conduit for groundwater movement during construction, as piles are expected to extend into the Northwich Halite Member. This groundwater movement could potentially lead to halite dissolution in the Northwich Halite Member. Active aquifer protection measures will be deployed during piling to mitigate this risk. This along with the application of the draft CoCP, leads to a negligible impact with negligible effect after embedded mitigation.

3.2.11 The foundations for the River Dane viaduct are located outside of the recharge area for the abstraction at Bank Farm, Stanthorne, Middlewich and therefore the impact is assessed as negligible, leading to a negligible effect which is not significant.

3.2.12 The potentially groundwater dependent habitat Oak Clump has potential to be adversely impacted by the piling from River Dane viaduct in terms of baseflow to the habitats. However, considering the habitat is located upgradient of the Proposed Scheme, it is unlikely that flow to the habitat will be affected adversely by the viaduct (further information in Section 4).

3.2.13 The permanent piled foundations of the River Dane viaduct have the potential to obstruct groundwater flow locally towards the River Dane. These effects are likely to be highly localised and may cause very localised increases and decreases in the baseflow into the river over approximately 1km. However, these localised changes will balance each other out and overall, there is no expected change in the baseflow to the river. The impact is therefore assessed to be negligible leading to a negligible effect, which is not significant.

3.2.14 The viaduct piles are of small areal extent compared to the aquifers and it is assessed that the impact on flow in other nearby watercourses is negligible, resulting in a negligible effect which is not significant.

Puddinglake Brook and Trent and Mersey Canal viaducts

3.2.15 Foundations for these viaducts will comprise of reinforced concrete bored piles and reinforced concrete pile caps. The depth of the piles are up to 36m and 37m for Puddinglake Brook viaduct and Trent and Mersey Canal viaduct respectively. The piles are expected to be bored in superficial glaciofluvial deposits and glacial till and are not expected to extend into the underlying Northwich Halite Member of the Sidmouth Mudstone Formation. The piles may obstruct the flow of groundwater in the superficial deposits in the immediate vicinity of the foundations for the viaducts. The impact is likely to be localised and on the scale of the glacial till aquifer the impact will be negligible. Due to the small extent of the glaciofluvial deposits in this area, this is assessed to be a minor impact leading to a minor adverse effect, which is not significant.

3.2.16 The Puddinglake Brook viaduct crosses Puddinglake Brook so has the potential to impact baseflow into the watercourse. However, the aquifer area is large in comparison to the viaduct piles, therefore water will still flow around the piles. It is assessed that the impact on flow in Puddinglake Brook is negligible, resulting in a negligible effect which is not significant.

3.2.17 Potentially surface water and groundwater dependent habitat Whatcroft Lane Wetlands Local Wildlife Site (LWS) and Site of Biological Interest (SBI) is located adjacent to the Proposed Scheme, and the foundations of one of the viaduct piers may encroach into the habitat (further information in Section 4).

Gad Brook viaduct

3.2.18 Foundations for Gad Brook viaduct will comprise of concrete piles, pile caps and support piers. The depth of the piles is up to 37m. In the southern part of the Gad Brook viaduct, the piles are expected to be bored in glacial till and are not expected to extend into the underlying Northwich Halite Member of the Sidmouth Mudstone Formation. In the northern part of the Gad Brook viaduct, the piles are expected to be bored through the alluvium and glacial till into the underlying Sidmouth Mudstone Formation. These piles may obstruct the flow of groundwater in the superficial deposits and an upper section of the bedrock in the immediate vicinity of the foundations for the viaduct. The impact is likely to be localised and on the scale of these aquifers the impact will be negligible, leading to a negligible effect which is not significant.

3.2.19 The Gad Brook viaduct crosses Gad Brook and Tributary to Gad Brook 3 so has the potential to impact baseflow into the watercourses. This may cause minor changes in baseflow upgradient or downgradient of the Proposed Scheme crossing. However, these changes are likely to be highly localised and will balance out each other and overall, there is no expected change in the baseflow to the river. It is assessed that the impact on flow is negligible, resulting in a negligible effect which is not significant.

Wade Brook viaduct

3.2.20 Foundations for Wade Brook viaduct will comprise of reinforced concrete bored piles and reinforced concrete pile caps. The depth of the piles is up to 25m, so they are expected to penetrate through the alluvium, glaciofluvial deposits and glacial till into the Sidmouth Mudstone Formation. These piles may obstruct the flow of groundwater in the superficial deposits and an upper section of the bedrock in the immediate vicinity of the foundations for the viaduct. The impact is likely to be localised and on the scale of these aquifers the impact will be negligible. Due to the significant thickness of Sidmouth Mudstone Formation, the piles are not expected to extend into the Mercia Mudstone Group (Northwich Halite Member of the Sidmouth Mudstone Formation).

3.2.21 The viaduct crosses Wade Brook so has the potential to impact baseflow into this watercourse. Groundwater flow in the superficial deposits is likely to follow topography and flow towards the watercourse. Therefore, groundwater flow is expected to be parallel to the route, and piles are not expected to have a significant impact on groundwater flow. It is assessed that the impact on groundwater flow to the Wade Brook is negligible, resulting in a negligible effect which is not significant.

Lostock Gralam and Smoker Brook viaducts

3.2.22 Foundations for Lostock Gralam viaduct will comprise of concrete piles, pile caps and support piers. Foundations for Smoker Brook viaduct will comprise of reinforced concrete bored piles and reinforced concrete pile caps. The depth of the piles is up to 36m for Lostock Gralam viaduct and 26m for Smoker Brook viaduct. The piles are expected to penetrate through the superficial deposits (alluvium, glaciofluvial deposits and glacial till). For the Lostock Gralam viaduct, the Sidmouth Mudstone Formation is located directly below the superficial deposits, and the piles are expected to extend on into the underlying Northwich Halite Member. For the Smoker Brook viaduct, the Northwich Halite Member underlies the superficial deposits. The piles may obstruct the flow of groundwater in the superficial deposits and in the upper section of the bedrock in the immediate vicinity of the foundations for the viaducts. The impact is likely to be localised and on the scale of these aquifers the impact will be negligible, leading to a negligible effect which is not significant.

3.2.23 There is a risk of piling works forming a conduit for groundwater movement during construction, possibly leading to halite dissolution, as piles are expected to reach the Northwich Halite Member. This is assessed as a minor impact, leading to a negligible effect in the unproductive strata. Active aquifer protection measures will be deployed during piling to mitigate the geotechnical risk of subsidence, in addition to the application of the draft CoCP. Hence, with mitigation measures, the impact is assessed as negligible, leading to a negligible effect which is not significant.

3.2.24 The Smoker Brook viaduct crosses the Smoker Brook, Peover Eye and Tributary of Peover Eye so has the potential to impact baseflows into these watercourses. Groundwater flow in the superficial deposits is likely to follow topography and flow towards the watercourses. Therefore, groundwater flow is expected to be parallel to the route, and piles are not expected to have a significant impact on groundwater flow. It is assessed that the impact on groundwater flow to the Smoker Brook, Peover Eye and Tributary of Peover Eye is negligible, resulting in a negligible effect which is not significant.

3.3 Impacts to groundwater from borrow pits

3.3.1 There are four borrow pits within MA02 as shown in Table 3. The granular borrow pit will be used to extract sand and gravel and the cohesive borrow pits to extract cohesive material with which to construct embankments. Maximum and assumed average depths for each borrow pit are presented in Table 3.

Table 3: Extraction depths of borrow pits

Location	Assumed average extraction depth (m)	Maximum extraction depth (m)
Granular MA02 Borrow Pit D	3	5
Cohesive MA02 Borrow Pit C	2	3
Cohesive MA02 Borrow Pit B	2	3
Cohesive MA02 Borrow Pit A	2	5

3.3.2 For the granular MA02 Borrow Pit D, the excavations will be in glaciofluvial sheet deposits, a Secondary A aquifer. Therefore, the borrow pit has the potential to impact on this aquifer and receptors which rely on the aquifer as a water resource. Receptors within 1km of the boundary of the MA02 Borrow Pit D include up to four potential springs, two potential sinks, Puddinglake Brook, tributaries of Gad Brook, a possible unlicensed private groundwater abstraction (Lagoon at Rudheath Woods, Cranage), Shakerley Mere LWS, SBI and Rudheath SBI.

3.3.3 For the cohesive borrow pits the excavations will be in glacial till, a Secondary (Undifferentiated) aquifer, and therefore the borrow pits have the potential to impact on this aquifer and receptors which rely on it as a water resource. Receptors within 1km of the boundary of the borrow pits include up to 11 potential springs, four potential sinks, Hoggins Brook, The Dingle, tributaries of River Wheelock 1, 2, 3, 5 and 6, an unlicensed private groundwater abstraction at Mellor Knowl Farm, and Weaver Bank ancient woodland.

3.3.4 There is no groundwater level monitoring data available in the vicinity of the borrow pits. It is therefore conservatively assumed that groundwater levels within the glaciofluvial sheet deposits and glacial till are shallow and at ground level. It is also assumed that the shallow groundwater is in hydraulic continuity with the surface water features.

Temporary construction impacts to groundwater and associated receptors from the borrow pits

Granular MA02 Borrow Pit D

3.3.5 The Environment Agency have historically objected to dewatering at local quarry sites in the vicinity of this borrow pit, which have led to planning restrictions on dewatering. However, for this assessment it is assumed, on a precautionary basis, that dewatering will take place during excavation of the sand and gravels. The measures outlined in the draft CoCP will be implemented throughout the works to manage drainage and protection of water quality. Dewatering of the excavations may reverse the hydraulic gradient between the aquifer and surface water features and without additional mitigation the surface water bodies could lose water to the ground. If restricts on dewatering are applied, then wet working of this borrow pit would be required. Wet working of the borrow pit could lead to localised changes in groundwater level. The groundwater level is known to be high in the area, as is evidenced by the headwaters of watercourses and marshy ground shown on the OS mapping. An increase in groundwater level on the downgradient side of the granular borrow pit (western side) could lead to an increased risk of groundwater flooding. The change in groundwater level is assessed as a minor impact on the glaciofluvial sheet deposits, leading to a minor adverse effect which is not significant. The impact and effect of a potential change in groundwater levels on groundwater flood risk is presented in Flood risk assessment, Volume 5: Appendix WR-005-0MA02.

3.3.6 Assuming a hydraulic conductivity value of $3x10^{-4}$m/s for the glaciofluvial deposits[5], the maximum zone of drawdown from the borrow pit is 182m. This is based on a maximum excavation depth of 5m and a maximum dewatering depth of up to 6m and a rest water level at ground surface. As the borrow pit is in an area which is located above the local surface watercourses, rather than in a river valley, the direct impact on the watercourses should be minimal. It should be noted that this calculation assumes the total area of the borrow pit is dewatered at one time. This is a conservative assessment as it is likely that the borrow pit would likely be worked in separate sections rather than being dewatered as a whole.

3.3.7 Dewatering could reduce groundwater flow in approximately 20% of the catchment which feeds into the headwaters of the Puddinglake Brook. This would result in a moderate impact which, for this high value receptor, leads to a moderate short-term effect, which is significant. Additional mitigation measures will be required for the management of groundwater baseflows into Puddinglake Brook during excavation and dewatering of MA02 Borrow Pit D. Mitigation measures will be designed in detail following ground investigation and monitoring of surface water and groundwater levels to minimise any impacts on baseflow to the brook, as far as reasonably practicable. Mitigation measures could include a wider buffer strip or shallower batter on the excavations, installation of a groundwater cut-off structure, adoption of wet working techniques to avoid the need for dewatering, and recirculation of intercepted water to Puddinglake Brook at an appropriate rate and location. Any such additional measures will be designed in consultation with the Environment Agency, during the passage of the hybrid Bill, to ensure that any potential impact is fully mitigated and there is a negligible effect on flow in Puddinglake Brook. However, on a precautionary basis to ensure long term compliance to WFD, until such time as these investigations are carried out, a residual significant effect will remain.

[5] On a precautionary basis, high-end sand and gravel conductivity values are assumed for glaciofluvial deposits to allow for potential presence of middle sands: Hydraulic conductivity from Domenico, P.A and Schwartz, F. W. (1990), *Physical and Chemical Hydrogeology*. John Wiley & Sons.

3.3.8 The headwaters to the Tributary of Gad Brook 1 and 2 are located outside of the radius of influence and are not expected to be affected by dewatering. The impact on the abstraction are assessed as negligible, leading to negligible effect which is not significant.

3.3.9 The potential unlicensed private groundwater abstraction Lagoon at Rudheath Woods, Cranage, is located approximately 450m north of the granular MA02 Borrow Pit D. The abstraction was used for spray irrigation, but it is not clear if this abstraction is still in use. The abstraction horizon is listed as a Secondary aquifer and is likely to be from the glaciofluvial deposits. The abstraction is located across gradient from the borrow pit and the impact of dewatering is not expected to extend to the abstraction. Therefore, the impact on the potential abstraction is assessed as negligible, leading to negligible effect, which is not significant.

3.3.10 The four potential springs and two potential sinks, Rudheath SBI and Shakerley Mere SBI, together with the other surface watercourses, are also outside the calculated zone of influence and are not expected to be affected by the granular MA02 Borrow Pit D.

Cohesive MA02 Borrow Pits A to C

3.3.11 It is assumed that during excavation of the cohesive material, dewatering will be undertaken to allow for safe working, if necessary. The measures outlined in the draft CoCP will be implemented throughout the works to manage drainage and protection of water quality. Dewatering of the excavations may reverse the hydraulic gradient between the aquifer and surface water features and without additional mitigation the surface water bodies could lose water to the ground.

3.3.12 Overall, the hydraulic conductivity of the glacial till is expected to be lower than for sands and gravels of the glaciofluvial deposits. However, there may be sand layers within the glacial till and, therefore, a hydraulic conductivity value of $3x10^{-4}$m/s is assumed for the glacial till[6]. The zone of drawdown from Borrow Pit A is calculated to be up to 182m, and up to 91m for borrow pits B and C. For Borrow Pit A, this is based on a maximum excavation depth of 5m, a maximum dewatering depth of up to 6m and a rest water level at ground surface. For borrow pits B and C, this is based on a maximum excavation depth of 3m, a maximum dewatering depth of up to 4m and a rest water level at ground surface. It should be noted that these calculations assume the total area of the borrow pits is dewatered at one time. This is a conservative assessment as it is likely that the borrow pits would likely be worked in separate sections rather than being dewatered as a whole.

3.3.13 The unlicensed groundwater abstraction at Mellor Knowl Farm is approximately 500m south-east from the construction of the cohesive MA02 Borrow Pit C. The abstraction supplies an average daily volume of $10m^3$ as part of a commercial activities. This abstraction is located a significant distance from the borrow pit and is outside of the radius of influence and is not expected to be affected by dewatering. The impacts on the abstraction are assessed as negligible, leading to negligible effect which is not significant.

3.3.14 The potential spring at pond 40m west of Coalpit Lane is located 30m east of the cohesive MA02 Borrow Pit C. The potential spring is within the calculated zone of influence and dewatering during excavation of the cohesive borrow pit has the potential to reduce groundwater flow to this spring. This would result in a moderate impact, leading to a moderate impact which is significant. Dewatering abstraction will be discharged to the Tributary of River Wheelock 5 upstream of the spring will help to maintain flows, leading to a minor impact.

3.3.15 The potential spring 140m north of Yew-Tree Farm, Coalpit Lane is located within the boundary of the cohesive MA02 Borrow Pit C and will be lost during material excavation. This potential spring forms the headwaters of Tributary of River Wheelock 5. This borrow pit has the potential to reduce groundwater flow into this watercourse. This would result in a moderate impact to the watercourse, leading to minor impact which is not significant. Dewatering abstraction will be discharged to the Tributary of River Wheelock 5 which will mitigate this impact leading to a negligible effect, which is not significant. The impact on the potential spring is discussed under the section 'Permanent construction impacts to groundwater and associated receptors from the borrow pits' below.

3.3.16 If required, additional mitigation will be proposed following ground investigation and pre-construction monitoring of the Secondary (Undifferentiated) aquifer in the vicinity of the abstraction. The design of mitigation measures would be discussed with the landowner.

3.3.17 The remaining nine springs, four sinks, Hoggins Brook, The Dingle, tributaries of River Wheelock 1, 2, 3, and 6, The Willowbeds SBI and Weaver Bank ancient woodland are outside the calculated zone of influence and are not expected to be affected by the three cohesive borrow pits.

Mitigation

3.3.18 Ground investigation and pre-construction monitoring of the Secondary A and Secondary (Undifferentiated) aquifers, and the nearby surface water features, will be undertaken to inform the construction mitigation measures that will protect the surface water features from loss of water. Avoidance and mitigation measures could include:

- widening the buffer strip between the borrow pit and surface water feature;
- recirculate abstracted water back into local watercourses to maintain flows at the appropriate locations;

- installation of cut-off structures around excavations;
- ensuring that cut-off structures are driven to sufficient depths to meet an underlying strata or zone of lower permeability;
- promoting groundwater recharge, such as discharging pumped water to recharge trenches around excavations to maintain baseline groundwater and surface water conditions;
- incorporating passive bypasses within the design, which could comprise a 'blanket' of permeable material, such as gravel, placed around temporary structures, allowing groundwater to bypass the below-ground works without a rise in groundwater levels on the upstream side; and
- extracting material from below the standing water level in the borrow pit using wet working techniques, so as not to require dewatering.

3.3.19 The exact requirements will be refined, and the method of mitigation will be designed following ground investigation at borrow pit locations. Mitigation measures will be designed in consultation with the Environment Agency.

Permanent construction impacts to groundwater and associated receptors from the borrow pits

3.3.20 The borrow pits will be restored to current ground levels and land use. Following site investigations, site specific borrow pit restoration plans will be implemented at each site, as indicated in the Borrow pit report, Volume 5, Appendix: CT-008-00000. As it is assumed that the areas of permeable sand and gravel and, possibly, cohesive material will be replaced with material of lower permeability, the restoration plans will include land drainage measures to ensure no increase in groundwater flooding or surface water flooding at the infilled site and continued water discharge to the surface water features. The details of this drainage design will be outlined following the ground investigation, monitoring of the hydraulic gradient across the borrow pit areas, and hydrometric monitoring of the appropriate surface water features, to assess the requirements for mitigation measures. If required, the borrow pit restoration will include groundwater control measures including drainage blankets or barriers to ensure groundwater flow is sufficiently managed and there is no adverse effect on flood risk or baseflow to local watercourses. The resulting impact of the Proposed Scheme on the surface water features and the groundwater abstractions due to the borrow pits will be negligible, leading to a negligible effect which is not significant.

3.3.21 The potential spring 140m north of Yew-Tree Farm, Coalpit Lane is located within the boundary of the cohesive MA02 Borrow Pit C and will be lost during material excavation. This spring forms part of the headwaters of Tributary of River Wheelock 5. It has not been possible to access this feature, so it is assumed to be of high value. The impact on this spring is assessed to be major, leading to major adverse effect which is significant. Although this feature may be lost, the restoration plans will include land drainage measures to ensure the flow to Tributary of River Wheelock 5 is maintained.

3.3.22 The permanent loss of the area of Secondary A and Secondary (Undifferentiated) aquifers is assessed as a negligible impact, leading to a negligible effect which is not significant. This is because mitigation will be included in the design and construction methodology to protect the surface water receptors of importance for which the Secondary A and Secondary (Undifferentiated) aquifers may provide a source of baseflow.

4 Site specific water dependent habitats assessments

4.1 Summary of assessment

4.1.1 Table 4 summarises the potential hydrological impacts (for example, changes to flow, level, regime, or quality) related to surface water and groundwater dependent habitats. Further details of the ecology of these sites and the assessment of the local level ecological effects arising from water impacts, are provided in the Ecology register of local level effects, Volume 5: Appendix EC-015-0MA02. Where there are significant effects, the ecological effects and associated mitigation are reported in Volume 2, Community Area report: Wimboldsley to Lostock Gralam (MA02) Section 7, Ecology and biodiversity.

Table 4: Summary of potential water dependent habitat impacts

Receptor	Design element	Discussion of potential impact to water receptor
Surface water dependent habitats		
Shropshire Union Canal (Middlewich branch) – LWS	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; • temporary works such as stockpiles and compounds; • utilities diversions; • Clive Green South embankment No.2; and • Clive Green North embankment No.2. Deeper excavation (>1mbgl) including: • Shropshire Union Canal viaduct No.2.	The Proposed Scheme has the potential to alter surface water quality during the temporary construction works. This will be mitigated through the implementation of the draft CoCP. Any permanent discharges to the watercourse could affect water quality, however appropriate drainage design and measures to manage water quality will be adopted during the design process, and the impact is assessed to be negligible.
Trent and Mersey Canal – LWS	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; • temporary works such as stockpiles and compounds; and • Dane Valley embankment. Deeper excavation (>1mbgl) including: • River Dane viaduct.	The Proposed Scheme has the potential to alter surface water quality during the temporary construction works. This will be mitigated through the implementation of the draft CoCP. Any permanent discharges to the watercourse could affect water quality, however appropriate drainage design and measures to manage water quality will be adopted during the design process, and the impact is assessed to be negligible.
Surface water and groundwater dependent habitats		
River Dane, Bostock – LWS	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; • temporary works such as stockpiles and compounds; • utilities diversions; • Stanthorne North embankment; and • Dane Valley embankment. Deeper excavation (>1mbgl) including: • River Dane viaduct.	It is likely that the River Dane is supported by groundwater flow from the alluvium and river terrace deposits. The temporary construction works have the potential to affect groundwater and surface water quality although this will be mitigated through the implementation of the draft CoCP, resulting in a negligible impact. The permanent below ground features, such as piled foundations of the River Dane viaduct, have the potential to locally alter groundwater flow in the superficial and bedrock aquifers. Due to the location and minor extent of the piers within the much larger area of the aquifers, the impact on groundwater flow pathways will be negligible.
Whatcroft Lane Wetlands – LWS	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; • temporary works such as stockpiles and compounds; • Whatcroft embankment south; and	The pond is adjacent to the Proposed Scheme and the foundation of one of the viaduct piers may encroach into the habitat. Therefore, there is the potential to alter groundwater and surface water quality during construction near to this site. This will be mitigated through the implementation of the draft CoCP resulting in a negligible impact. The permanent below ground features, such as piled foundations of five of the piers for the Trent and Mersey Canal viaduct, have the potential to locally alter groundwater flow in the superficial and bedrock aquifers. Due to the location and minor extent of the piers within the much larger area of the aquifers, the impact on groundwater flow pathways will be negligible. Therefore, there is not expected to be an impact on any groundwater flow to the habitat overall.

Receptor	Design element	Discussion of potential impact to water receptor
	• Whatcroft embankment north. Deeper excavation (>1mbgl) including: • Trent and Mersey Canal viaduct.	
Wincham Brook Valley & Mill Wood – LWS	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; and • temporary works such as stockpiles and compounds. Deeper excavation (>1mbgl) including: • Smoker Brook viaduct.	It is currently unclear if this site is supported by groundwater from the glacial till (Secondary (Undifferentiated) aquifer) underlying the site. The site has therefore been included as both groundwater and surface water dependent on a precautionary basis. The Proposed Scheme has the potential to alter groundwater and surface water quality during construction since the site is downstream of Smoker Brook viaduct. This will be mitigated through the implementation of the draft CoCP resulting in a negligible impact.
Wade Brook – LWS	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; • temporary works such as stockpiles and compounds; and • utilities diversions.	It is currently unclear if this surface water habitat is supported by groundwater from the glacial till and it has therefore been included as both groundwater and surface water dependent on a precautionary basis. The habitat will be crossed by two utilities diversions therefore, there is the potential to alter groundwater and surface water quality during construction. This will be mitigated through the implementation of the draft CoCP resulting in a negligible impact. The utilities diversions will be carried out in order to ensure no impact on surface water and groundwater flow and therefore the impact on flow is assessed to be negligible.
Groundwater dependent habitats		
Wimboldsley Wood – SSSI and ancient woodland	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; • temporary works such as stockpiles and compounds; and • Crewe North rolling stock depot.	Wimboldsley Wood SSSI is likely to be partially supported by groundwater from the Northwich Halite Member of the Sidmouth Mudstone Formation (Mercia Mudstone Group) which crops out between areas of glacial till underlying the upper parts of the SSSI and alluvium along the valley of the River Weaver. The habitat includes a brackish marsh fed by a saliferous spring which is likely to be issuing from the Northwich Halite Member. Wimboldsley Wood SSSI may also be partially supported by groundwater from the glacial till (Secondary (Undifferentiated) aquifer). A part of the Crewe North rolling stock depot will be located on glacial till in the upper catchment for Tributary of River Weaver 3. The tributary runs through the SSSI downgradient of the depot. It is possible that baseflow in Tributary of River Weaver 3, and any features in the SSSI which are dependent on groundwater discharge from the glacial till, may be affected by a reduction in groundwater recharge due to the extensive areas of hardstanding within the depot. On a precautionary basis, this is assessed as a minor impact on Wimboldsley Wood SSSI. No impact is expected on the Northwich Halite Member from the Crewe North rolling stock depot and, hence, the saliferous spring and the brackish marsh are not expected to be impacted.
Boundary Wood and Weaver Bank Wood – LWS and ancient woodland	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; • temporary works such as stockpiles and compounds; and • Walley's Green embankment.	It is currently unclear if this site is supported by groundwater from the glacial till (Secondary (Undifferentiated) aquifer) underlying the site. The site has therefore been included on a precautionary basis. Ground improvement works associated with the Proposed Scheme have the potential to alter groundwater and surface water quality during construction since the site is downstream of the Proposed Scheme. This will be mitigated through the implementation of the draft CoCP resulting in a negligible impact.
Stanthorne Hall Farm – ancient woodland	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; • temporary works such as stockpiles and compounds; • utilities diversions; and • Stanthorne South embankment No.2.	It is currently unclear if this site is supported by groundwater and it has therefore been included on a precautionary basis. Stanthorne Hall Farm is located within land required for construction of the Proposed Scheme and there is potential for impacts on water quality during the construction phase. This will be managed through implementation of the draft CoCP resulting in a negligible impact. The route of the Proposed Scheme is on embankment (Stanthorne South embankment No.2) adjacent to Stanthorne Hall Farm. The embankment has no deep, below ground structures to affect any groundwater flow in the area.
Greenhays Farm Pasture – LWS	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; • temporary works such as stockpiles and compounds; and • Stanthorne North embankment.	It is currently unclear if this site is supported by groundwater and therefore it has been included on a precautionary basis. Ground improvement works associated with the Proposed Scheme have the potential to alter groundwater and surface water quality during construction since the site is downstream of the Proposed Scheme. This will be mitigated through the implementation of the draft CoCP resulting in a negligible impact. It is unlikely groundwater flow to this site will be impacted as the site is downstream of Stanthorne North embankment which required only shallow excavation.

Receptor	Design element	Discussion of potential impact to water receptor
Oak Clump – ancient woodland	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; and • temporary works such as stockpiles and compounds. Deeper excavation (>1mbgl) including: • River Dane viaduct.	It is currently unclear if this site is supported by groundwater and it has therefore been included on a precautionary basis. Oak Clump is located adjacent to land required for construction of the Proposed Scheme and there is potential for impacts on water quality during the construction phase. This will be managed through implementation of the draft CoCP resulting in a negligible impact. The habitat is located 300m west of proposed River Dane viaduct, upgradient of the route of the Proposed Scheme. Therefore, it is unlikely that groundwater flow to the habitat will be impacted by the permanent below ground structures of the Proposed Scheme which is assessed as a negligible impact.
Bull's Wood and Meadow – LWS and ancient woodland	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; and • temporary works such as stockpiles and compounds. Deeper excavation (>1mbgl) including: • River Dane viaduct.	It is currently unclear if this site is supported by groundwater and it has therefore been included on a precautionary basis. The temporary construction works, and ground improvement works associated with the Proposed Scheme have the potential to alter groundwater and surface water quality during construction since the site is downstream of the Proposed Scheme. This will be mitigated through the implementation of the draft CoCP resulting in a negligible impact. The habitat is directly adjacent to the proposed River Dane viaduct. The habitat is upgradient of the route of the Proposed Scheme. Therefore, it is unlikely that groundwater flow to the habitat will be impacted by the permanent below ground structures of the Proposed Scheme, which is assessed as a negligible impact.
Long Wood – LWS	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads; • temporary works such as stockpiles and compounds; • utilities diversions; and • Lostock Gralam North embankment.	It is currently unclear if this site is supported by groundwater and it has therefore been included on a precautionary basis. The Proposed Scheme has the potential to alter groundwater quality during construction however this will be mitigated through the application of the draft CoCP resulting in a negligible impact. Lostock Gralam North embankment will permanently cut across the habitat however the shallow excavation of the embankment will not impact groundwater flow to the remaining habitat.
Shakerley Mere Country Park – LWS	The route of the Proposed Scheme is over 4km west and MA02 Borrow Pit D location is 510m south.	Groundwater flow through the glaciofluvial sheet deposits (Secondary A aquifer) underlying the site is likely to support this habitat. It is unlikely that the groundwater quality or flow will be impacted as this site is located outside of the radius of influence of the borrow pit dewatering. Therefore, the Proposed Scheme is assessed as having a negligible impact on the habitat.
Rudheath – LWS	Proposed Scheme is over 5km west and MA02 Borrow pit D location is 690m south.	Groundwater flow through the glaciofluvial sheet deposits (Secondary A aquifer) underlying the site is likely to support this habitat. It is unlikely that the groundwater quality or flow will be impacted as this site is located outside of the radius of influence of the borrow pit dewatering. Therefore, the Proposed Scheme is assessed as having a negligible impact on the habitat.

5 Site specific highways drainage assessments

5.1 Introduction

5.1.1 Roads are designed to drain freely to prevent the build-up of standing water on the carriageway whilst avoiding exposure to or causing flooding. Contaminants deposited on the road surface are quickly washed off during rainfall. Where traffic levels are high, the level of contamination increases and therefore the potential for unacceptable harm being caused to the receiving water also increases. There are many circumstances in which runoff from roads is likely to have no discernible effect, however a precautionary and best practice approach indicates the need for the assessment of the possible impact of pollutant discharges on the water environment from roads affected by the Proposed Scheme. These effects can either be through spillage and routine run-off pollution from new roads that are used during the construction and operational phases or changes in traffic movements on the existing road network.

5.1.2 The Proposed Scheme makes provision for two methods for draining new sections of highway: direct runoff to soakaway and drainage via an attenuation pond to an existing watercourse. Where changes in traffic volumes have been identified along the existing road network, steps have been taken to identify the type of drainage in place and an assessment has been made of whether the highway works proposed have implications for pollution risk within MA02.

5.2 Methodology and assessment criteria

Routine runoff pollution risk

5.2.1 Where highway drainage is discharged to local watercourses, the assessment for determining whether routine runoff is likely to have a detrimental impact on water quality uses the HEWRAT. Where highway realignments are to discharge to kerb side ditches which do not have a baseflow, the Groundwater Assessment (Appendix C[4]) has been used.

5.2.2 The significance of the impact of the predicted effects on surface water and groundwater receptors has been assessed in accordance with the methodology described in the SMR.

Spillage pollution risk

5.2.3 In addition to assessing the potential for adverse effects of routine surface water runoff from highways, an assessment of the potential spillage risk to water quality has been undertaken for highway realignments. The methodology for assessing spillage risk follows the Spillage Risk Assessment (Appendix D[4]).

5.3 Detailed assessment

Screening results

5.3.1 A screening exercise has identified the need for a routine runoff and pollution risk assessment and a spillage pollution risk assessment in MA02. This is related to the A530 King Street, during the construction phase, shown in Figure 1.

5.3.2 A screening exercise identified the need for routine runoff and pollution risk assessments in MA02 during the operational phase. This is related to the modifications to the A556 Chester Road and Clive Green Lane, A530 Nantwich Road and Penny's Lane, shown in Figures 2, 3, 4 and 5 respectively. The screening exercise identified the need for a spillage pollution risk assessment in MA02 during the operational phase, associated with the A556 Chester Road realignment.

Figure 1: A530 King Street

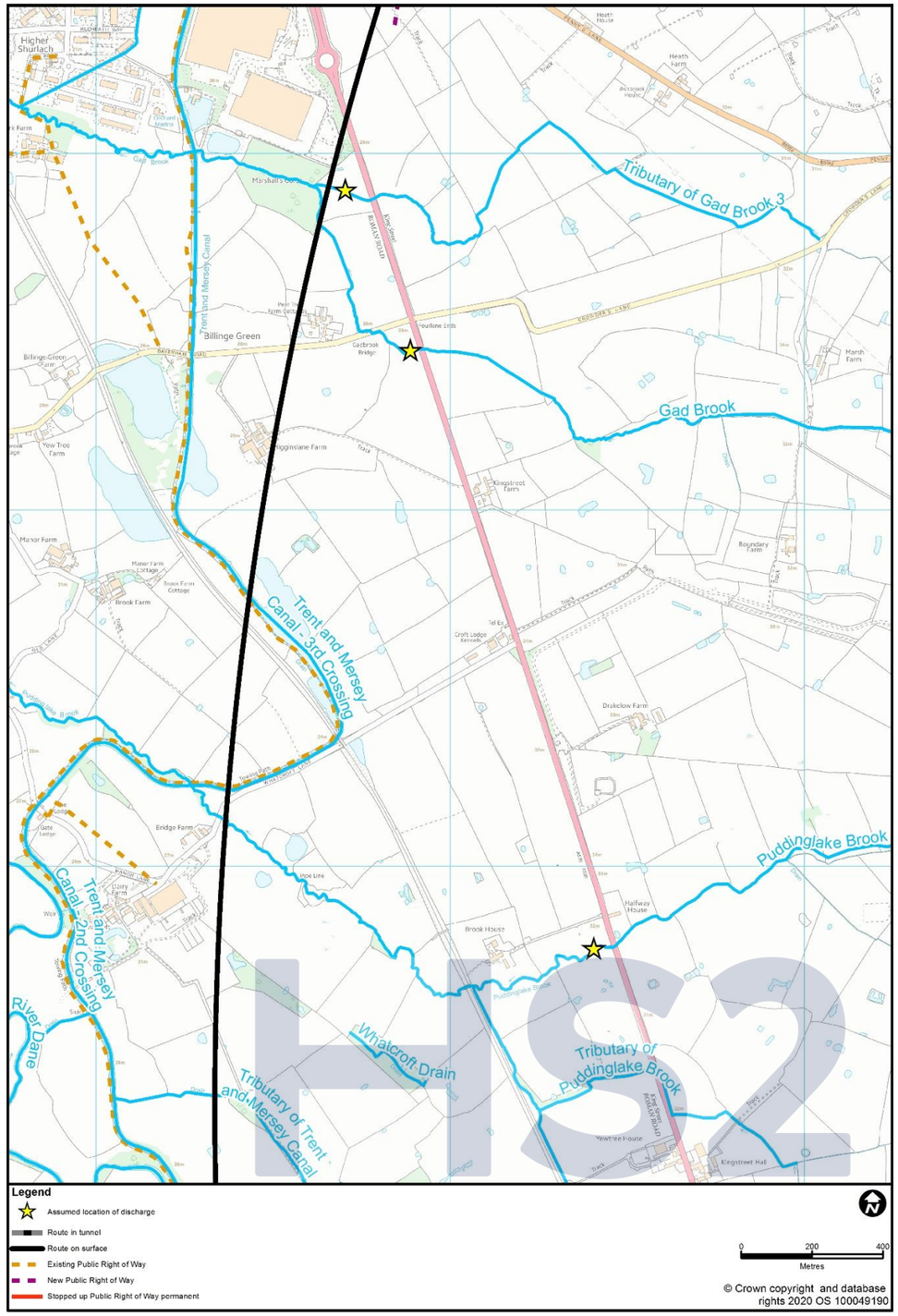


Figure 2: A556 Shurlach Road realignment

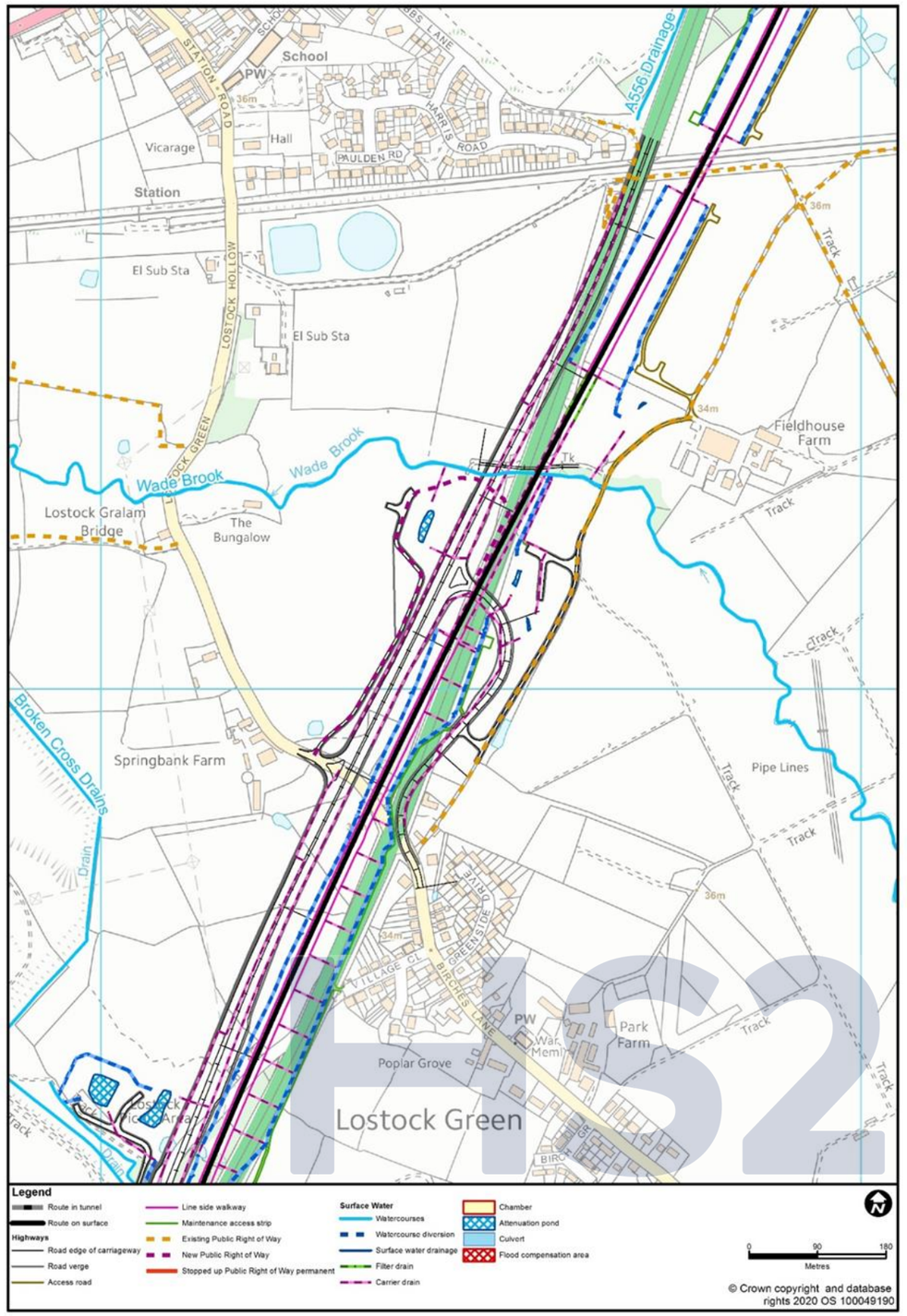


Figure 3: Clive Green Lane realignment

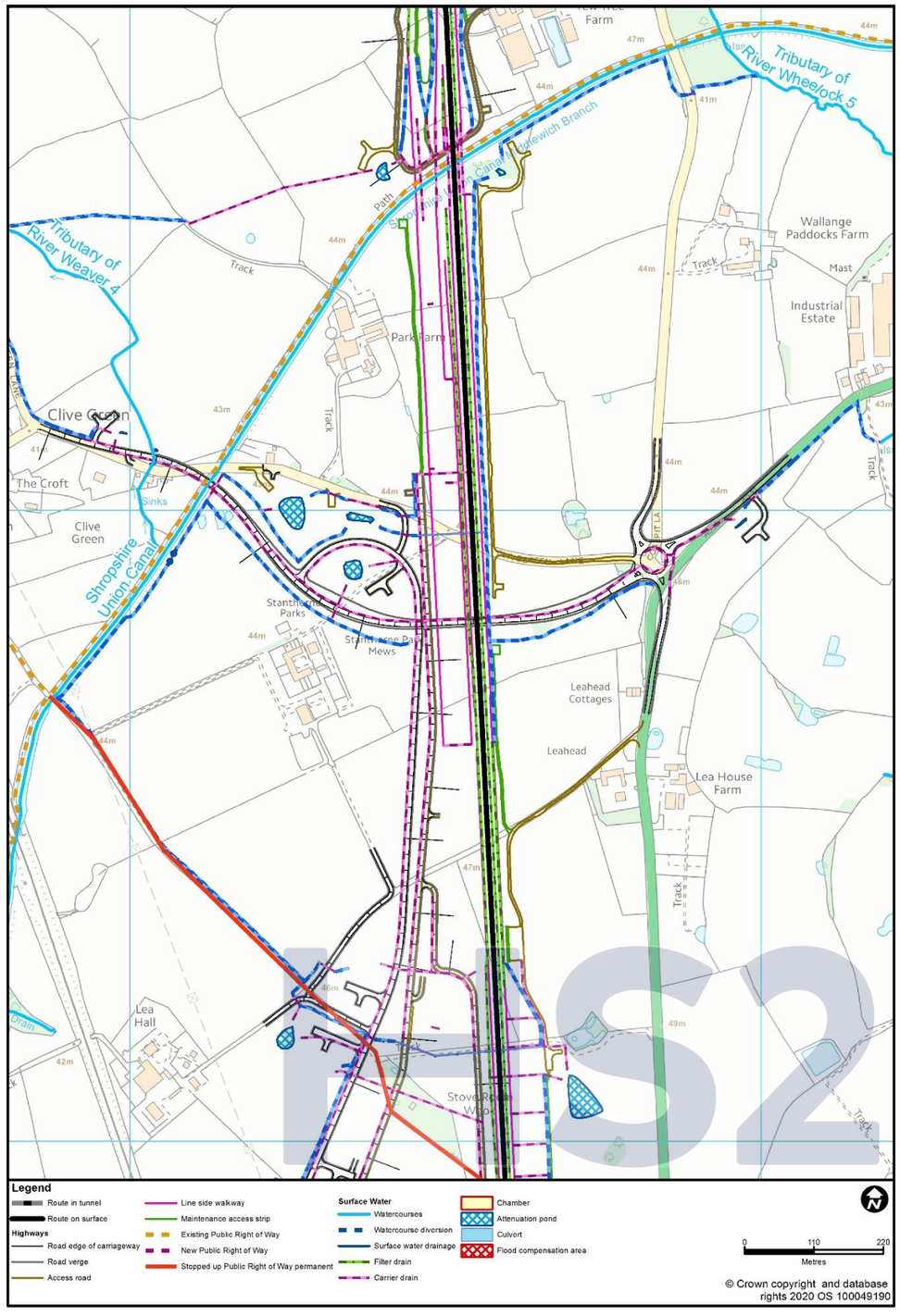


Figure 4: A530 Nantwich Road realignment

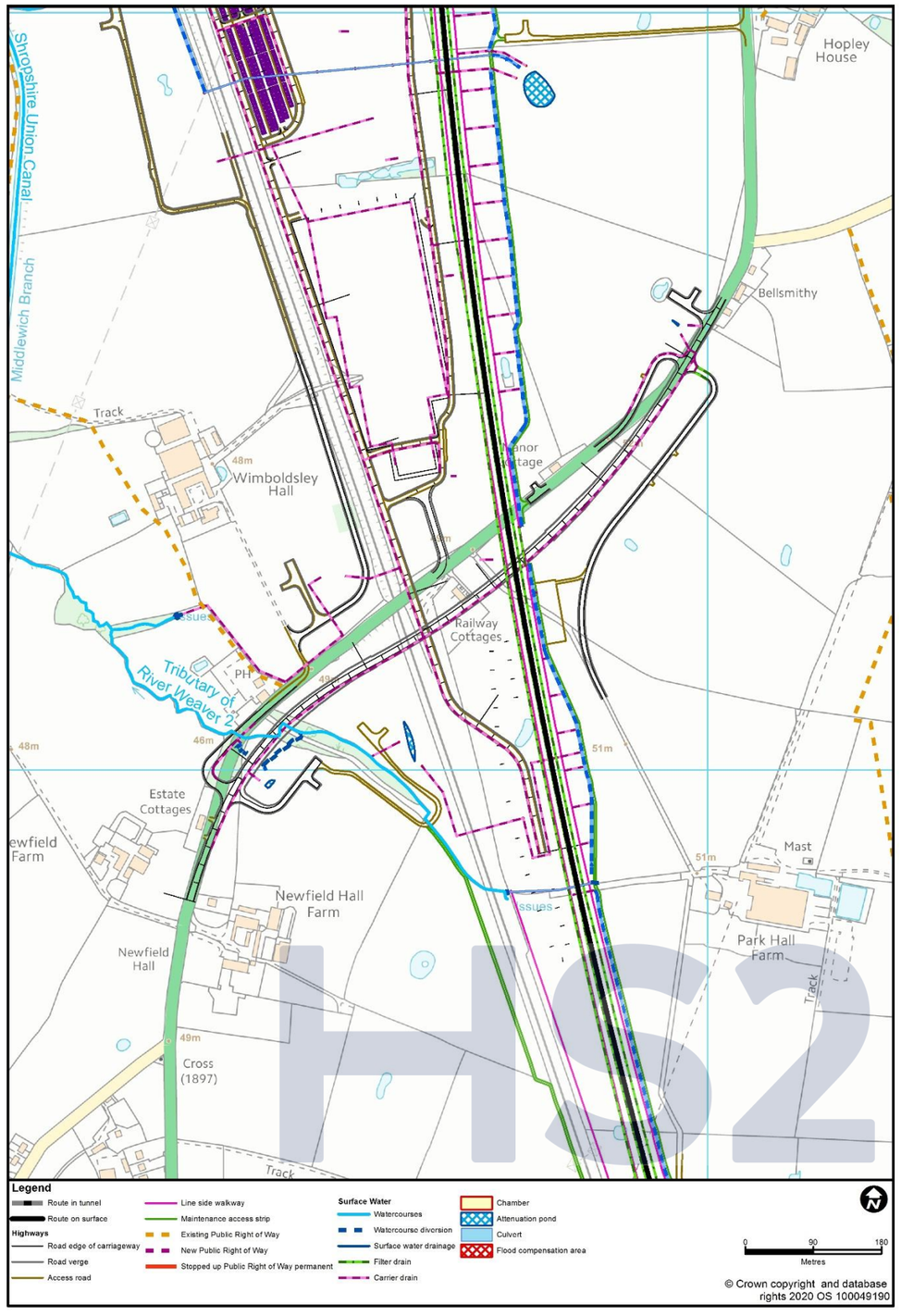
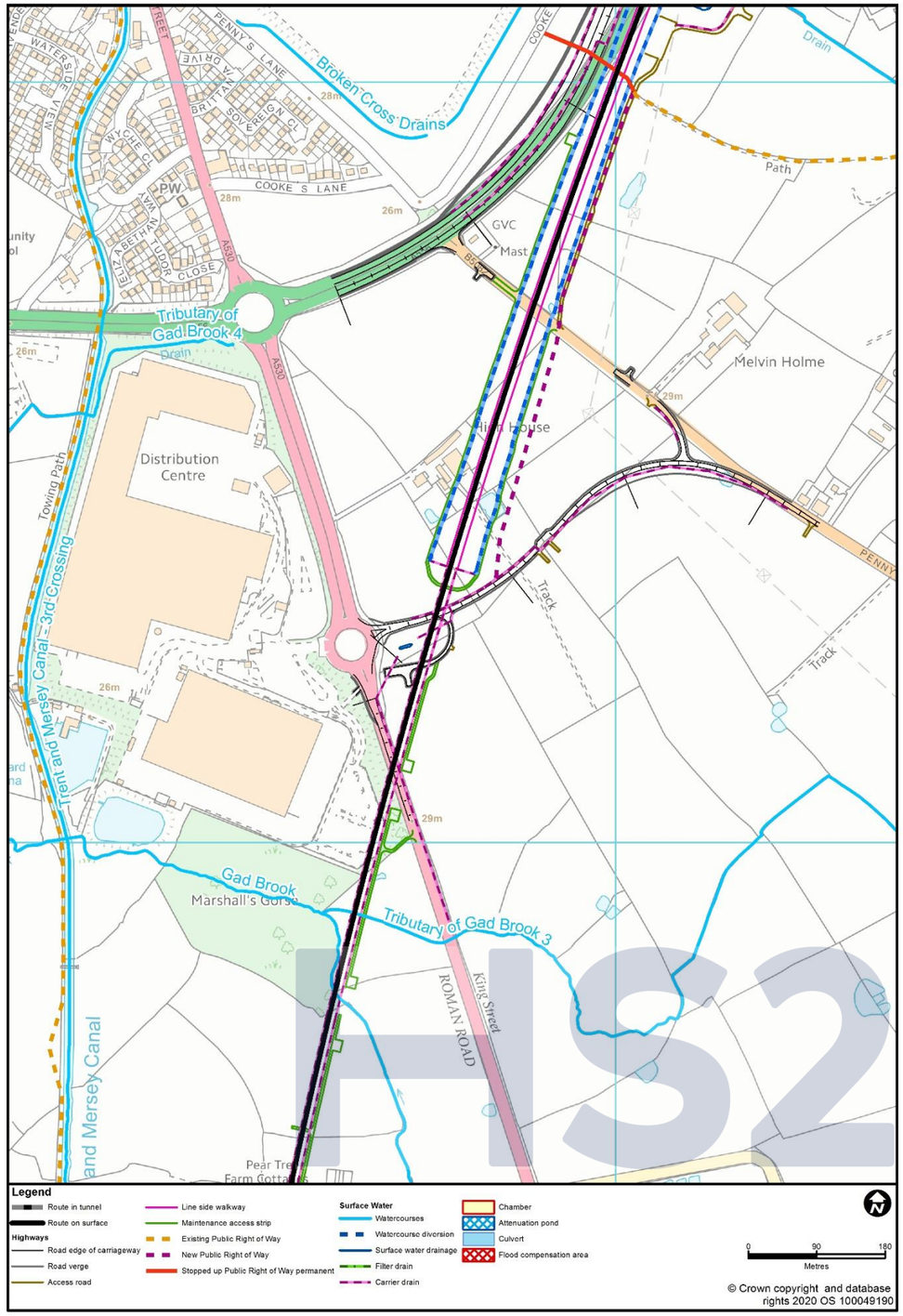


Figure 5: Penny's Lane diversion



Routine runoff pollution risk

A530 King Street

5.3.3 During the construction phase, increased traffic on the A530 King Street is assessed. At this time no information is available on the drainage arrangements on the existing A530 King Street. Therefore, on a precautionary basis it is assumed that drainage goes to local watercourses (at the low points in the road) and that no mitigation is in place. For the A530 King Street, the outfalls are assumed to be to Puddinglake Brook (known as outfall 1), Gad Brook (known as outfall 2) and Tributary of Gad Brook 3 (known as outfall 3).

5.3.4 The tier 2 surface water assessment for outfall 1 identified that both the acute soluble and sediment-bound pollutants assessments passed and there are no environmental quality standards (EQS) exceedances of copper and zinc in the discharge. No data is currently available with regards to the background concentrations of copper in the watercourse (upstream of the discharge), therefore sensitivity testing has been carried out. This testing shows if background concentrations for copper exceed 0.7µg/l the water quality in the receiving watercourse after discharge would exceed the EQS. During the passage of the Bill further investigations, such as monitoring and analysis of the bioavailability of metals and dilution, will be carried out, where reasonably practicable, to identify whether additional mitigation measures are required. If mitigation is required these will be designed in consultation with the Environment Agency and other stakeholders to mitigate any significant effects on water quality. On a precautionary basis, pending results from the additional investigations, this is assessed to be a moderate impact, on this high value receptor, resulting in a moderate effect, which is significant.

5.3.5 The tier 2 surface water assessment results for outfall 2, identified that both the acute soluble and sediment-bound pollutants assessments passed and there are no EQS exceedances of copper and zinc in the discharge. No data is currently available with regards to the background concentrations of copper in the watercourse (upstream of the discharge), therefore sensitivity testing has been carried out. This testing shows that if background concentrations for copper exceed 0.7µg/l the water quality in the receiving watercourse after discharge would exceed the EQS. During the passage of the Bill further investigations, such as monitoring and analysis of the bioavailability of metals and dilution, will be carried out, where reasonably practicable, to identify whether additional mitigation measures are required. If mitigation is required these will be designed in consultation with the Environment Agency and other stakeholders to mitigate any significant effects on water quality. On a precautionary basis, pending results from the additional investigations, this is assessed to be a moderate impact, on this moderate value receptor, resulting in a moderate effect which is significant.

5.3.6 The tier 2 surface water assessment results for outfall 3, identified that both the acute soluble for copper and sediment-bound pollutants aspects of the assessment failed and copper exceeds the EQS annual average concentration. This is assessed to be a major impact on this moderate value receptor, leading to a major adverse effect, which is significant. As the soluble and sediment bound pollutants fail the assessment, additional mitigation measures will need be considered at during design development, to mitigate the risk of deterioration in surface water quality. Mitigation measures may include the use of a swale and vortex grit separator or temporarily rerouting the drainage into a larger watercourse. It is assumed there is sufficient space available if such measures are required.

A556 Shurlach Road, Rudheath to Lostock Gralam

5.3.7 The modifications to the A556 Shurlach Road between Rudheath and Lostock Gralam involve the rebuilding of the carriageway along a total length of 2.3km adjacent to the HS2 alignment. The realignment includes two new junctions with Birches Lane (on the north-bound and south-bound carriageways). The existing drainage of the A556 Shurlach Road consists of kerb and gullies on both side of each carriageway. It is proposed to provide a new system of kerbs and gullies, discharging to three attenuation ponds under gravity. One pond is proposed approximately halfway along the diversion and will discharge to ground via Broken Cross drains. The other ponds are proposed to the north of the diversion and will both outfalls to Wade Brook. Drainage at the tie-in locations is assumed to tie-in to the existing highway drainage network.

5.3.8 Environment Agency water quality monitoring data is available for Wade Brook. This data shows that background concentrations of copper in Wade Brook are above the EQS of 1 µg/l and vary between 4.1µg/l and 6.2 µg/l (across the period of 2000 to 2021).

5.3.9 Applying this background concentration into the HEWRAT tool, the surface water assessment has been carried out for the two outfalls to the Wade Brook. The tier 2 assessment results identified that both the acute soluble and sediment-bound pollutants assessments are passed. However, an EQS exceedance of copper is recorded. A cumulative assessment was also undertaken for the two outfalls to the Wade Brook. The assessment results identified that the acute soluble pollutants aspect of the assessment is passed, however, an EQS exceedance of copper is recorded. The sediment-bound aspect of the assessment is not applicable, as the outfalls are more than 100m apart. This is assessed to be a moderate impact on this high value receptor, leading to a moderate effect, which is significant.

5.3.10 Broken Cross drains is expected to have a low flow and could be dry in some climatic conditions, therefore, a groundwater assessment has been carried out for this outfall. The assessment results identified that the magnitude of the impacts of routine runoff from this proposed highway realignment would be moderate adverse, to the moderate value glacial till aquifer. The proposal will therefore result in a moderate adverse effect, which is significant. The DMRB guidance[4] suggests that a precautionary approach should be adopted in such circumstances and a detailed assessment will be needed to identify if additional measures are

required to mitigate the risk of deterioration in groundwater quality. It is assumed there is sufficient space available if such measures are required. This assessment will be carried out in during design development and any mitigation measures will be considered in consultation with the relevant highway authority.

Clive Green Lane

5.3.11 The realignment of Clive Green Lane between Clive Green and A530 Nantwich Road involves the realignment of the carriageway along a total length of approximately 1.4km, approximately 165m south of where the existing highway is intersected by the route of the Proposed Scheme. The existing drainage arrangement is over the edge. The proposed drainage is kerb and gullies which will discharge to two attenuation ponds located at either end of the realignment. One pond, to the west, will outfall to Tributary of River Weaver 4 (known as outfall 1). The other pond, to the east, will outfall to Tributary of the River Wheelock 4 (known as outfall 2). Since flow in both of these watercourses is expected to be low, these assessments have been carried out as groundwater assessments.

5.3.12 The groundwater assessment results identified that the magnitude of the impacts of routine runoff from this proposed highway realignment would be minor adverse for both outfall 1 and outfall 2, to the moderate value glacial till aquifer. The proposal will therefore result in a minor adverse effect which is not significant. The DMRB guidance[4] suggests that a precautionary approach should be adopted in such circumstances and a detailed assessment will be needed to identify if additional measures are required to mitigate the risk of deterioration in groundwater quality. It is assumed there is sufficient space available if such measures are required. This assessment will be carried out in design development and any mitigation measures will be considered in consultation with the relevant highway authority.

A530 Nantwich Road

5.3.13 The realignment of Nantwich Road between Walley's Green and Occleston Green involves the realignment of the carriageway along a total length of approximately 1.1km and provide a replacement overbridge over both the WCML and the route of the Proposed Scheme situated approximately 66m south of the existing A530 Nantwich Road. The existing A530 Nantwich Road is on embankment and the drainage network consists of kerbs and gullies along the nearside of each carriageway. The proposed drainage is kerb and gullies along the new carriageway alignment which will discharge to two attenuation ponds. The highway attenuation pond located at the south west of the realignment will outfall via two discharges, to Tributary of River Weaver 2 (outfall 1 and outfall 2). The highway pond located at the north east of the realignment will connect to the existing highway drainage network.

5.3.14 The tier 2 surface water assessment results for outfall 1 identified that both the acute soluble and sediment-bound pollutants assessments passed and there are no EQS exceedances for copper and zinc in the discharge. The tier 2 surface water assessment results for outfall 2 identified that both the acute soluble and sediment-bound pollutants assessments are passed however copper exceeds the EQS annual average concentration in the discharge. This is assessed to be a moderate impact on this moderate value receptor, leading to a moderate effect, which is significant.

5.3.15 A cumulative assessment was also undertaken for the two outfalls to Tributary of River Weaver 2, as the outfalls are less than 100m apart. The assessment results identified that the sediment-bound assessment is passed, however the acute soluble pollutants assessment is failed for zinc and copper exceeds the EQS annual average concentration. This is assessed to be a moderate impact on this moderate value receptor, leading to a moderate adverse effect, which is significant.

5.3.16 As the soluble pollutants fail the assessment, additional mitigation measures will be considered during design development, to mitigate the risk of deterioration in surface water quality. Mitigation measures may include the use of a wet retention pond. It is assumed there is sufficient space available if such measures are required. No data is currently available with regards to the background concentrations of copper in the watercourse (upstream of the discharge), therefore sensitivity testing has been carried out. This testing found that, following the implementation of this mitigation, if background concentrations for copper exceed 0.5µg/l the water quality in the receiving watercourse after discharges would exceed the EQS. During the passage of the Bill further investigations, such as monitoring and analysis of the bioavailability of metals and dilution, will be carried out, where reasonably practicable, to identify whether additional mitigation measures are required. If mitigation is required these will be designed in consultation with the Environment Agency and other stakeholders to mitigate any significant effects on water quality On a precautionary basis, pending results from the additional investigations, this is assessed to be a moderate impact, on this moderate value receptor, resulting in a moderate effect which is significant.

Penny's Lane

5.3.17 The realignment of Penny's Lane between the A530 and Penny's Lane involves the diversion of Penny's Lane to join the A530, approximately 440m north of where the existing road is severed by the Proposed Scheme, along a total length of carriageway of approximately 500m. The offline realignment makes use of the Gad Brook Viaduct to avoid the need for an additional separate underbridge and connects into the existing roundabout on A530 King Street.

5.3.18 The existing drainage network for Penny's Lane is kerb and gullies, and this is also proposed for the road diversion. A combined carrier/filter drain will intercept sub-surface flows in the cutting under the viaduct. This will outfall to a highway attenuation pond located at the roundabout junction with the A530. The pond outfall is proposed to be piped along the King Street alignment down to Tributary of Gad Brook 3.

5.3.19 The tier 2 surface water assessment results identified that both the acute soluble and sediment-bound pollutants assessments are passed and there are no EQS exceedances of copper and zinc in the discharge. No data is currently available with regards to the background concentrations of copper in the watercourse (upstream of the discharge), therefore sensitivity testing has been carried out. This testing shows that if background concentrations for copper exceed 0.6µg/l the water quality in the receiving watercourse after discharge would exceed the EQS. During the passage of the Bill further investigations, such as monitoring and analysis of the bioavailability of metals and dilution, will be carried out, where reasonably practicable, to identify whether additional mitigation measures are required. If mitigation is required these will be designed in consultation with the Environment Agency and other stakeholders to mitigate any significant effects on water quality. On a precautionary basis, pending results from the additional investigations, this is assessed to be a moderate impact, on this moderate value receptor, resulting in a moderate effect which is significant.

Highways spillage risk assessment

5.3.20 The evaluation of spillage risk for the A530 King Street outfall 1 is presented in Table 5[6]. The risk of a serious pollution incident occurring is identified as negligible. The highway will not result in significant effects related to spillage risk and no further mitigation is required.

Table 5: Spillage risk assessment for A530 King Street – outfall 1

	No junction	Notes
Water body type	Surface	
Length of road draining to outfall (km)	1.97	The length of the road was measured based on OS mapping.
Road type (A-road or Motorway)	A Road	
If A road, is site urban or rural?	Urban	
Junction type	No junction	
Location	<20 mins	A response time of less than 1 hour is expected for emergency services.
Traffic flow (AADT two way)	11,536	The highest traffic flow (AADT two way) along the whole road was selected which represents a conservative approach.
% HGV	8	The corresponding HGV percentage value to the selected AADT value was chosen to represent the whole road. This represents a conservative approach.
Spillage factor (no/10^9HGVkm/year)	0.31	This spillage factor was taken from Table D.1 as presented in LA 113 Road Drainage and the Water Environment Revision 1[4].
Risk of accidental spillage	0.00021	This represents the total annual probability of a spillage.
Risk of pollution incident	0.00009	This represents the total annual probability of a spillage causing a pollution incident.
Is risk greater than 0.01?	No	This is the considered overall risk for the length of the road.
Total probability	0.0001	
Return period (years)	10,791	

5.3.21 The evaluation of spillage risk for the A530 King Street outfall 2 is presented in Table 6[6]. The risk of a serious pollution incident occurring is identified as negligible. The highway will not result in significant effects related to spillage risk and no further mitigation is required.

Table 6: Spillage risk assessment for A530 King Street – outfall 2

	No junction	Notes
Water body type	Surface	
Length of road draining to outfall (km)	1.03	The length of the road was measured based on OS mapping.
Road type (A-road or Motorway)	A Road	
If A road, is site urban or rural?	Urban	
Junction type	No junction	
Location	<20 mins	A response time of less than 1 hour is expected for emergency services.

[6] This table provides a summary of the spillage risk calculations carried out using the HEWRAT spillage risk spreadsheet. Available online at: http://www.hagdms.com/index.cfm?fuseaction=help.download.

	No junction	Notes
Traffic flow (AADT two way)	11,536	The highest traffic flow (AADT two way) along the whole road was selected which represents a conservative approach.
% HGV	8	The corresponding HGV percentage value to the selected AADT value was chosen to represent the whole road. This represents a conservative approach.
Spillage factor (no/109HGVkm/year)	0.31	This spillage factor was taken from Table D.1 as presented in LA 113 Road Drainage and the Water Environment Revision 14.
Risk of accidental spillage	0.00011	This represents the total annual probability of a spillage.
Risk of pollution incident	0.00005	This represents the total annual probability of a spillage causing a pollution incident.
Is risk greater than 0.01?	No	This is the considered overall risk for the length of the road.
Total probability	0.0000	
Return period (years)	20,661	

5.3.22 The evaluation of spillage risk for the A530 King Street outfall 3 is presented in Table 7[6]. The risk of a serious pollution incident occurring is identified as negligible. The highway will not result in significant effects related to spillage risk and no further mitigation is required.

Table 7: Spillage risk assessment for A530 King Street – outfall 3

	No junction	Roundabout	Notes
Water body type	Surface	Surface	
Length of road draining to outfall (km)	0.88	0.17	The length of the road was measured based on OS mapping.
Road type (A-road or Motorway)	A Road	A Road	
If A road, is site urban or rural?	Urban	Urban	
Junction type	No junction	Roundabout	
Location	<20 mins	<20 mins	A response time of less than 1 hour is expected for emergency services.
Traffic flow (AADT two way)	11,536	11,536	The highest traffic flow (AADT two way) along the whole road was selected which represents a conservative approach.
% HGV	8	8	The corresponding HGV percentage value to the selected AADT value was chosen to represent the whole road. This represents a conservative approach.
Spillage factor (no/10^9HGVkm/year)	0.31	5.35	This spillage factor was taken from Table D.1 as presented in LA 113 Road Drainage and the Water Environment Revision 1[4].
Risk of accidental spillage	0.00009	0.00031	This represents the total annual probability of a spillage.
Risk of pollution incident	0.00004	0.00014	This represents the total annual probability of a spillage causing a pollution incident.
Is risk greater than 0.01?	No	No	This is the considered overall risk for the length of the road.
Total probability	0.0002	0.0002	
Return period (years)	5,580	5,580	

5.3.23 The evaluation of spillage risk for the A556 Shurlach Road realignment outfall 1 is presented in Table 8[6]. The risk of a serious pollution incident occurring is identified as negligible. The highway realignment will not result in significant effects related to spillage risk and no further mitigation is required.

Table 8: Spillage risk assessment for A556 Shurlach Road realignment – outfall 1

	Side road	No junction	Notes
Water body type	Groundwater	Groundwater	
Length of road draining to outfall (km)	1.46	1.04	The length of the road was measured based on CP3.1 general arrangement drawings.
Road type (A-road or Motorway)	A Road	A Road	
If A road, is site urban or rural?	Urban	Urban	
Junction type	Side road	No junction	
Location	<20 mins	<20 mins	A response time of less than 1 hour is expected for emergency services.
Traffic flow (AADT two way)	19,307	21,838	The highest traffic flow (AADT two way) along the whole road realignment was selected which represents a conservative approach.
% HGV	4.98	4.98	The corresponding HGV percentage value to the selected AADT value was chosen to represent the whole road realignment. This represents a conservative approach.
Spillage factor (no/10^9HGVkm/year)	1.81	0.31	This spillage factor was taken from Table D.1 as presented in LA 113 Road Drainage and the Water Environment Revision 1[4].
Risk of accidental spillage	0.00093	0.00011	This represents the total annual probability of a spillage.
Risk of pollution incident	0.00042	0.00005	This represents the total annual probability of a spillage causing a pollution incident.
Is risk greater than 0.01?	No	No	This is the considered overall risk for the length of the realignment.
Total probability	0.0005	0.0005	
Return period (years)	2,136	2,136	

5.3.24 The evaluation of spillage risk for the A556 Shurlach Road realignment outfall 2 is presented in Table 9[6]. The risk of a serious pollution incident occurring is identified as negligible. The highway realignment will not result in significant effects related to spillage risk and no further mitigation is required.

Table 9: Spillage risk assessment for A556 Shurlach Road realignment – outfall 2

	Side road	No junction	Notes
Water body type	Surface	Surface	
Length of road draining to outfall (km)	1.1	0.29	The length of the road was measured based on CP3.1 general arrangement drawings.
Road type (A-road or Motorway)	A Road	A Road	
If A road, is site urban or rural?	Urban	Urban	
Junction type	Side road	No junction	
Location	<20 mins	<20 mins	A response time of less than 1 hour is expected for emergency services.
Traffic flow (AADT two way)	19,307	19,307	The highest traffic flow (AADT two way) along the whole road realignment was selected which represents a conservative approach.
% HGV	4.98	4.98	The corresponding HGV percentage value to the selected AADT value was chosen to represent the whole road realignment. This represents a conservative approach.
Spillage factor (no/10^9HGVkm/year)	1.81	0.31	This spillage factor was taken from Table D.1 as presented in LA 113 Road Drainage and the Water Environment Revision 1[4].
Risk of accidental spillage	0.0007	0.00003	This represents the total annual probability of a spillage.
Risk of pollution incident	0.00031	0.00001	This represents the total annual probability of a spillage causing a pollution incident.

	Side road	No junction	Notes
Is risk greater than 0.01?	No	No	This is the considered overall risk for the length of the realignment.
Total probability	0.0003	0.0003	
Return period (years)	3,043	3,043	

5.3.25 The evaluation of spillage risk for the A556 Shurlach Road realignment outfall 3 is presented in Table 10. The risk of a serious pollution incident occurring is identified as negligible. The highway realignment will not result in significant effects related to spillage risk and no further mitigation is required.

Table 10: Spillage risk assessment for A556 Shurlach Road realignment – outfall 3

	No junction	Notes
Water body type	Surface	
Length of road draining to outfall (km)	0.83	The length of the road was measured based on CP3.1 general arrangement drawings.
Road Type (A-road or Motorway)	A Road	
If A road, is site urban or rural?	Urban	
Junction type	No junction	
Location	<20 mins	A response time of less than 1 hour is expected for emergency services.
Traffic flow (AADT two way)	19,307	The highest traffic flow (AADT two way) along the whole road realignment was selected, which represents a conservative approach.
% HGV	4.98	The corresponding HGV percentage value to the selected AADT value was chosen to represent the whole road realignment. This represents a conservative approach.
Spillage factor (no/10^9HGVkm/year)	0.31	This spillage factor was taken from Table D.1 as presented in LA 113 Road Drainage and the Water Environment Revision 1[4].
Risk of accidental spillage	0.00009	This represents the total annual probability of a spillage.
Risk of pollution incident	0.00004	This represents the total annual probability of a spillage causing a pollution incident.
Is risk greater than 0.01?	No	This is the considered overall risk for the length of the realignment.
Total probability	0.0000	
Return period (years)	24,610	

5.3.26 An evaluation of the cumulative spillage risk for the A556 Shurlach Road realignment has been undertaken. Outfalls 2 and 3 discharge to the Wade Brook, and the combined annual probability is less than 0.01. The risk of a serious pollution incident occurring is identified as negligible. The highway realignment will not result in significant effects related to spillage risk and no further mitigation is required.