

High Speed Rail (Crewe – Manchester) Environmental Statement

Volume 5: Appendix WR-003-0MA04

Water resources and flood risk
MA04: Broomedge to Glazebrook
Water resources assessment

High Speed Rail (Crewe – Manchester) Environmental Statement

Volume 5: Appendix WR-003-0MA04

Water resources and flood risk
MA04: Broomedge to Glazebrook
Water resources assessment



Department
for Transport

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

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 | TYPESA | COSTAIN

MWJV

Mott MacDonald | WSP

High Speed Two (HS2) Limited has actively considered the needs of blind and partially sighted people in accessing this document. The text will be made available in full on the HS2 website. The text may be freely downloaded and translated by individuals or organisations for conversion into other accessible formats. If you have other needs in this regard, please contact High Speed Two (HS2) Limited.

© High Speed Two (HS2) Limited, 2022, except where otherwise stated.

Copyright in the typographical arrangement rests with High Speed Two (HS2) Limited.

This information is licensed under the Open Government Licence v3.0. To view this licence, visit www.nationalarchives.gov.uk/doc/open-government-licence/version/3 **OGL** or write to the Information Policy Team, The National Archives, Kew, London TW9 4DU, or e-mail: psi@nationalarchives.gsi.gov.uk. Where we have identified any third-party copyright information you will need to obtain permission from the copyright holders concerned.



Printed in Great Britain on paper containing at least 75% recycled fibre.

Contents

1	Introduction	3
1.1	Structure	3
1.2	Scope, assumptions and limitations	3
1.3	Study area description and key features	4
1.4	Stakeholder engagement	5
2	Site specific surface water assessments	6
2.1	Summary of assessment	6
2.2	Detailed assessment	17
3	Site specific groundwater assessments	20
3.1	Summary of assessment	20
3.2	Impact on groundwater from cuttings	32
3.3	Impacts to groundwater flow and quality from overbridge, underbridge, viaduct and embankment piling	33
3.4	Impacts to groundwater from borrow pits	35
4	Site specific water dependent habitats assessment	36
4.1	Summary of assessment	36
5	Site specific highways drainage assessments	37
5.1	Introduction	37
5.2	Methodology and assessment criteria	37
5.3	Detailed assessment	37

Tables

Table 1:	Summary of potential impacts on surface water receptors	6
Table 2:	Summary of potential impacts on groundwater receptors	20
Table 3:	Summary of the parameters for the groundwater assessment of Warburton cutting	32
Table 4:	Summary of potential water dependent habitat impacts	36
Table 5:	Spillage risk assessment for Bent Lane – outfall 1	39

Figures

Figure 1:	Current view of Manchester Ship Canal looking upstream	18
Figure 2:	Design of Manchester Ship Canal viaduct and bank improvements	19
Figure 3:	Bent Lane	38

Environmental Statement

Volume 5: Appendix WR-003-0MA04

Water resources and flood risk

MA04: Broomedge to Glazebrook

Water resources assessment

38

Figure 4: A6144 Paddock Lane realignment

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 Broomedge to Glazebrook area (MA04).
- 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 MA04, the Flood risk assessment (Volume 5: Appendix WR-005-0MA04) should also be referred to as well as the relevant Hydraulic modelling report (Volume 5: Appendix WR-006-00002).
- 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-004-0MA04)¹; and
 - WFD compliance assessment baseline data which is reported for the Proposed Scheme (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 Broomedge to Glazebrook (MA04) area covers a 7.3km 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 Rixton Clay Pits Special Area of Conservation (SAC), Site of Special Scientific Interest (SSSI), Local Nature Reserve (LNR), and Local Wildlife Site (LWS). 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, MA04 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-004-0MA04. Available online at: <https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement>.

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

Environmental Statement

Volume 5: Appendix WR-003-0MA04

Water resources and flood risk

MA04: Broomedge to Glazebrook

Water resources assessment

- 1.2.4 This assessment covers the potential impacts of the Proposed Scheme on existing surface water and groundwater resources, including consideration of:
- surface waters³;
 - 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 are presented in the Land quality report, Volume 5: Appendix LQ-001-0MA04.

1.3 Study area description and key features

- 1.3.1 The study area is predominantly rural in character, with agriculture being the main land use. There are a number of villages, hamlets and farmsteads located within proximity to the Proposed Scheme, including Hollins Green and Heatley. The urban areas of Cadishead and Partington are located along the Manchester Ship Canal to the east of the route. Lymm is located to the west of the southern section of the route of the Proposed Scheme.
- 1.3.2 Within MA04, the Proposed Scheme will be constructed as a series of cuttings, embankments and viaducts. There are no tunnelled or ground level sections.
- 1.3.3 The main environmental features of relevance to water resources include:
- River Bollin, Red Brook, Marsh Brook and Glaze Brook, and their associated tributaries;
 - the Bridgewater Canal and the Manchester Ship Canal;
 - ten licensed surface water abstractions;
 - the Sherwood Sandstone Group, which is classified as a Principal aquifer;
 - the Mercia Mudstone Group, which is classified as a Secondary B aquifer;
 - the permeable superficial deposits, which are classified as Secondary A and Secondary (Undifferentiated) aquifers;
 - two source protection zones associated with groundwater abstractions licensed for public water supply (PWS);
 - Rixton Clay Pits SAC, SSSI, LNR and LWS and Heatley Lake LWS which are groundwater dependent habitats; and
 - Fox Covert and Meadows Site of Biological Importance (SBI) and Coroners Wood ancient woodland and SBI which are surface water dependent habitats.

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 and Natural England, particularly regarding Rixton Clay Pits SAC, SSSI, LNR and LWS. Discussions held with Natural England have shown that there is no potential pathway for an impact on this site from the Proposed Scheme, as set out in Section 4.1;
- Canal & River Trust, to obtain details of surface water discharges into the canal;
- Warrington Borough Council (WBC) and Trafford Metropolitan Borough Council (TMBC) with regard to private unlicensed water supply abstractions;
- United Utilities to confirm details of public water supply abstractions (where present in the study area) and associated water resource management plans; and
- the owners of private licensed and unlicensed abstractions (where access has been available).

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-004-0MA04). Details of specific impact assessments are presented in Section 2.2. 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.
- 2.1.1 Construction compounds may have substantial water demands where they are associated with design elements, such as batching plant. 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.
- 2.1.2 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									
Agden Lane Road Drain 1	Low	<ul style="list-style-type: none"> Lymm North embankment 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)
		<ul style="list-style-type: none"> Lymm North embankment 	Watercourse will be lost during construction of the Lymm north embankment.	Magnitude of impact – Moderate Significance of effect – Minor adverse, significant	The watercourse will be incorporated into the new track drainage.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Construction (permanent)
Tributary of Agden Brook 1	Low	<ul style="list-style-type: none"> Lymm North embankment Realignment (160m) including Agden Lane culvert (70m) Utility 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. Deterioration, loss or change to the existing water environment and the ecology supported,	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)

Environmental Statement
Volume 5: Appendix WR-003-0MA04
Water resources and flood risk
MA04: Broomedge to Glazebrook
Water resources assessment

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
		<ul style="list-style-type: none"> Watercourse crossing by proposed access road Temporary works such as compounds, stockpiles and access routes 	through the disturbance of silt or direct contamination by polluting materials.						
		<ul style="list-style-type: none"> Lymm North embankment Realignment (160m) including Agden Lane culvert (70m) Watercourse crossing by proposed access road Drainage outfall from HS2 attenuation pond 	<p>Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements.</p> <p>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.</p>	<p>Magnitude of impact – Minor</p> <p>Significance of effect – Negligible, not significant</p>	<p>Mitigation measures will include realignment of watercourse to avoid embankment and appropriate watercourse crossing and drainage design.</p> <p>Culvert lengths have been reduced during the design process and invert levels set below the bed of the watercourse.</p> <p>Measures to manage water quality will be adopted during the design process.</p>	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (permanent)
Agden Lane Road Drain 2	Low	<ul style="list-style-type: none"> 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 sediments, hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.	<p>Magnitude of impact – Minor</p> <p>Significance of effect – Negligible, not significant</p>	Implementation of measures described in the draft CoCP.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (temporary)
Bridgewater Canal	Very high	<ul style="list-style-type: none"> Bridgewater Canal viaduct Lymm North embankment Heatley South embankment Utility diversion Temporary works such as compounds, stockpiles and access routes 	<p>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.</p> <p>Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.</p>	<p>Magnitude of impact – Minor</p> <p>Significance of effect – Moderate adverse, significant</p>	Implementation of measures described in the draft CoCP.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (temporary)
		<ul style="list-style-type: none"> Bridgewater Canal viaduct 	<p>Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements.</p>	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	<p>Mitigation measures include avoiding the floodplain and channel. Piers are set back to remove impacts on flows.</p>	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (permanent)
Helsdale Brook	Moderate	<ul style="list-style-type: none"> Utility diversion Watercourse crossing by proposed access road 	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include sediments, hydrocarbons	<p>Magnitude of impact – Minor</p>	Implementation of measures described in the draft CoCP.	<p>Magnitude of impact – Negligible</p>	None required.	<p>Magnitude of impact – Negligible</p>	Construction (temporary)

Environmental Statement
Volume 5: Appendix WR-003-0MA04
Water resources and flood risk
MA04: Broomedge to Glazebrook
Water resources assessment

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
		<ul style="list-style-type: none"> Temporary works such as compounds, stockpiles and access routes 	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 – Minor adverse, not significant		Significance of effect – Negligible, not significant		Significance of effect – Negligible, not significant	
		<ul style="list-style-type: none"> Watercourse crossing by proposed access road 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 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)
River Bollin	Very high	<ul style="list-style-type: none"> River Bollin West viaduct Heatley South embankment 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)
		<ul style="list-style-type: none"> River Bollin West viaduct 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 – Moderate adverse, significant	Mitigation measures include avoiding the floodplain and channel as far as reasonably practicable. Piers are set back from the existing watercourse to reduce the 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)
Wet Gate Lane Drain	Low	<ul style="list-style-type: none"> 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 sediments, 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)
Old Bollin	Low	<ul style="list-style-type: none"> River Bollin West viaduct Heatley North embankment 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,	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	The watercourse is currently in culvert where it is crossed by the viaduct, and the pier locations have been chosen to avoid the culvert. If further investigation suggested the culvert could be affected, then an appropriate watercourse realignment will be included.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (temporary)

Environmental Statement
 Volume 5: Appendix WR-003-0MA04
 Water resources and flood risk
 MA04: Broomedge to Glazebrook
 Water resources assessment

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
			through the disturbance of silt or direct contamination by polluting materials.		Measures to manage water quality will be adopted during the design process. Mitigation measures include avoiding the floodplain and channel. Piers are set back to remove impacts on flows.				
		<ul style="list-style-type: none"> River Bollin West viaduct Drainage outfall from HS2 attenuation pond 	<p>Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements.</p> <p>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.</p>	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Watercourse is in culvert at the crossing location. The pier locations chosen to avoid the culvert.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (permanent)
Tributary of Old Bollin	Low	<ul style="list-style-type: none"> Heatley North embankment Watercourse crossing by proposed access road Utility diversion Temporary works such as compounds, stockpiles and access routes 	<p>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.</p> <p>Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.</p>	<p>Magnitude of impact – Minor</p> <p>Significance of effect – Negligible, not significant</p>	Implementation of measures described in the draft CoCP.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (temporary)
		<ul style="list-style-type: none"> Heatley North embankment Watercourse crossing by proposed access road 	<p>Approximately 50m of the watercourse will be lost during construction of the Heatley North embankment.</p> <p>Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements.</p> <p>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.</p>	<p>Magnitude of impact – Moderate</p> <p>Significance of effect – Minor adverse, not significant</p>	The headwaters of this watercourse will be incorporated into the new track drainage.	<p>Magnitude of impact – Moderate</p> <p>Significance of effect – Minor adverse, not significant</p>	None required.	<p>Magnitude of impact – Moderate</p> <p>Significance of effect – Minor adverse, not significant</p>	Construction (permanent)
Carrgreen Lane Drain	Low	<ul style="list-style-type: none"> Utility diversion Temporary works such as compounds, stockpiles and access routes 	<p>Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include sediments, hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete.</p>	<p>Magnitude of impact – Minor</p> <p>Significance of effect – Negligible, not significant</p>	Implementation of measures described in the draft CoCP.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (temporary)
		<ul style="list-style-type: none"> Drainage outfall from road drainage 	<p>Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements.</p>	<p>Magnitude of impact – Minor</p>	Measures to manage water quality will be adopted during the design process.	<p>Magnitude of impact – Negligible</p>	None required.	<p>Magnitude of impact – Negligible</p>	Construction (permanent)

Environmental Statement
 Volume 5: Appendix WR-003-0MA04
 Water resources and flood risk
 MA04: Broomedge to Glazebrook
 Water resources assessment

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 – Negligible, not significant		Significance of effect – Negligible, not significant		Significance of effect – Negligible, not significant	
Tributary of Manchester Ship Canal 2 (locally known as Warburton Park Brook)	Low	<ul style="list-style-type: none"> Warburton embankment Manchester Ship Canal viaduct Realignment (140m) Watercourse crossing by proposed road and access road Utility diversion Temporary works such as compounds, stockpiles and access routes 	<p>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.</p> <p>Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.</p>	<p>Magnitude of impact – Minor</p> <p>Significance of effect – Negligible, not significant</p>	Implementation of measures described in the draft CoCP.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (temporary)
		<ul style="list-style-type: none"> Manchester Ship Canal viaduct Realignment (140m) Watercourse crossing by proposed road and access road Drainage outfalls from track and road drainage 	<p>Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements.</p> <p>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.</p>	<p>Magnitude of impact – Minor</p> <p>Significance of effect – Negligible, not significant</p>	<p>Mitigation measures will include realignment of watercourse to avoid viaduct pier and appropriate watercourse crossing and drainage design. Measures to manage water quality will be adopted during the design process.</p> <p>Mitigation measures include avoiding the floodplain and channel.</p>	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (permanent)
Field Drains A6144	Low	<ul style="list-style-type: none"> Realignment (90m) including an unnamed culvert beneath realigned A6144 Paddock Lane (70m) Watercourse crossing by proposed road and access road Utility diversion Temporary works such as compounds, stockpiles and access routes 	<p>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.</p> <p>Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.</p>	<p>Magnitude of impact – Minor</p> <p>Significance of effect – Negligible, not significant</p>	Implementation of measures described in the draft CoCP.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (temporary)
		<ul style="list-style-type: none"> Realignment (90m) including an unnamed culvert beneath realigned A6144 Paddock Lane (70m) 	<p>Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements.</p> <p>Deterioration of water quality due to contamination of surface water from both</p>	<p>Magnitude of impact – Minor</p>	<p>Mitigation measures will include realignment of watercourse to avoid proposed road and appropriate watercourse crossing and drainage design.</p>	<p>Magnitude of impact – Negligible</p>	None required.	<p>Magnitude of impact – Negligible</p>	Construction (permanent)

Environmental Statement
Volume 5: Appendix WR-003-OMA04
Water resources and flood risk
MA04: Broomedge to Glazebrook
Water resources assessment

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
		<ul style="list-style-type: none"> Watercourse crossing by proposed road and access road Drainage outfalls from highway attenuation pond, HS2 attenuation pond and track drainage 	routine discharges from the Proposed Scheme and associated infrastructure or from accidental spillages.	Significance of effect – Negligible, not significant	Measures to manage water quality will be adopted during the design process.	Significance of effect – Negligible, not significant		Significance of effect – Negligible, not significant	
Manchester Ship Canal	Very high	<ul style="list-style-type: none"> Manchester Ship Canal 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 – 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)
		<ul style="list-style-type: none"> Manchester Ship Canal viaduct Manchester Ship Canal retaining walls 	Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the viaduct piers and retaining walls (See Section 2.2).	Magnitude of impact – Minor Significance of effect – Moderate adverse, significant	See Section 2.2	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Negligible Significance of effect – Negligible, not significant	Construction (permanent)
		<ul style="list-style-type: none"> Manchester Ship Canal viaduct 	The piling for the Manchester Ship Canal viaduct will pass through the historical Hollins Green landfill site and could create a pathway for the movement of contamination into the underlying aquifer and therefore the Manchester Ship Canal. Details of the impact and effect of piling works through Hollins Green landfill site, on the aquifer, are assessed in the Land quality report, Volume 5: Appendix LQ-001-OMA04.						
Red Brook	High	<ul style="list-style-type: none"> Manchester Ship Canal 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 – 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)
		<ul style="list-style-type: none"> Manchester Ship Canal 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)
Tributary of Manchester Ship Canal 1	Moderate	None	There are no elements of the route of the Proposed Scheme likely to impact this waterbody. Impacts possible from Glazebrook embankment south and Manchester Ship Canal	Magnitude of impact – Negligible	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible	None required.	Magnitude of impact – Negligible	Construction (temporary)

Environmental Statement
Volume 5: Appendix WR-003-0MA04
Water resources and flood risk
MA04: Broomedge to Glazebrook
Water resources assessment

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
			viaduct on groundwater – surface water interactions (see Section 3.2).	Significance of effect – Negligible, not significant		Significance of effect – Negligible, not significant		Significance of effect – Negligible, not significant	
Marsh Brook	Moderate	None	There are no elements of the route of the Proposed Scheme likely to impact this waterbody. Impacts possible from Glazebrook embankment south and Manchester Ship Canal viaduct on groundwater – surface water interactions (see Section 3).	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)
Glaze Brook	High	<ul style="list-style-type: none"> 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 sediments, 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)
		<ul style="list-style-type: none"> Manchester Ship Canal viaduct 	The piling for the Manchester Ship Canal viaduct will pass through the historical Hollins Green landfill site and could create a pathway for the movement of contamination into the underlying aquifer and therefore the Glaze Brook. Details of the impact and effect of piling works through Hollins Green landfill site, on the aquifer, are assessed in the Land quality report, Volume 5: Appendix LQ-001-0MA04.						
Tributary of Glaze Brook 1 (Hollins Green Brook)	Low	<ul style="list-style-type: none"> Manchester Ship Canal viaduct Watercourse crossing by proposed road, access road and temporary road Realignment (45m) 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)
		<ul style="list-style-type: none"> Manchester Ship Canal viaduct Watercourse crossing by proposed access road Realignment (45m) Drainage outfalls from HS2 two 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 realignment of watercourse to avoid proposed road. Mitigation measures include appropriate watercourse crossing and 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)
Dam Head Lane Drains	Low	<ul style="list-style-type: none"> Glazebrook embankment north Watercourse crossing by proposed access road Utility diversion Temporary works such as compounds, 	Uncontrolled site runoff could impact the flow dynamics and water quality of the receiving watercourse. Mobilised contaminants could typically include sediments, 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)

Environmental Statement
Volume 5: Appendix WR-003-0MA04
Water resources and flood risk
MA04: Broomedge to Glazebrook
Water resources assessment

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
		stockpiles and access routes							
		<ul style="list-style-type: none"> Glazebrook embankment north Watercourse crossing by proposed access road 	<p>Watercourse will be partially lost during construction of the Glazebrook embankment north.</p> <p>Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements.</p> <p>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.</p>	<p>Magnitude of impact – Moderate</p> <p>Significance of effect – Minor adverse, not significant</p>	<p>The watercourse will be incorporated into the new track drainage.</p> <p>Mitigation measures include appropriate watercourse crossing and drainage design, and measures to manage water quality will be adopted during the design process.</p>	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (permanent)
Tributary of Glaze Brook 2	Low	<ul style="list-style-type: none"> M62 West viaduct Glazebrook embankment north Watercourse crossing by proposed access road Utility diversion Temporary works such as compounds, stockpiles and access routes 	<p>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.</p> <p>Deterioration, loss or change to the existing water environment and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.</p>	<p>Magnitude of impact – Minor</p> <p>Significance of effect – Negligible, not significant</p>	Implementation of measures described in the draft CoCP.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (temporary)
		<ul style="list-style-type: none"> M62 West viaduct Glazebrook embankment north Watercourse crossing by proposed access road 	<p>Watercourse will be partially lost during construction of the Glazebrook embankment north.</p> <p>Deterioration, loss or change to the existing water environment, flow characteristics and morphology from the presence of the design elements.</p> <p>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.</p>	<p>Magnitude of impact – Moderate</p> <p>Significance of effect – Minor adverse, not significant</p>	<p>The watercourse will be incorporated into the new track drainage, where reasonably practicable the watercourse features will be recreated, and flow will be supported by track drainage.</p> <p>Mitigation measures include appropriate watercourse crossing and drainage design, and measures to manage water quality will be adopted during the design process.</p>	<p>Magnitude of impact – Minor</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Minor</p> <p>Significance of effect – Negligible, not significant</p>	Construction (permanent)
Tributary of Glaze Brook 3	Moderate	None	No works directly adjacent to the watercourse so limited potential for surface water flow and quality effects.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Implementation of measures described in the draft CoCP.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (temporary)
Boundary Drain	Low	<ul style="list-style-type: none"> 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 sediments, hydrocarbons	<p>Magnitude of impact – Minor</p>	Implementation of measures described in the draft CoCP.	<p>Magnitude of impact – Negligible</p>	None required.	<p>Magnitude of impact – Negligible</p>	Construction (temporary)

Environmental Statement
 Volume 5: Appendix WR-003-0MA04
 Water resources and flood risk
 MA04: Broomedge to Glazebrook
 Water resources assessment

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
			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	
Birch Covert Drains	Low	<ul style="list-style-type: none"> 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 sediments, 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)
Little Woollen Moss Drain	Low	<ul style="list-style-type: none"> 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 sediments, 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)
Surface water abstractions									
Spray irrigation – direct – Bridgewater Canal 2569020060	High	<ul style="list-style-type: none"> Temporary works such as compounds, stockpiles and access routes 	Located within the land required for construction of the Proposed Scheme. There is potential for a reduction in water quality at the abstraction location due to the possible mobilisation of contaminants from the construction area upstream. Typically, these would include sediments, hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Reduction in local water quality has the potential to impact abstraction.	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)
Spray irrigation – direct – Bridgewater Canal 2569020067	High	None	Located downstream of the Proposed Scheme, however abstraction is from a watercourse considered within this assessment. Therefore, the abstraction 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)
Spray irrigation – direct – River Bollin 2569020063	High	None	Located upstream of the Proposed Scheme, however abstraction is from a watercourse considered within this assessment. Therefore, the abstraction 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)
Spray irrigation – direct – River Bollin 2569020041	High	<ul style="list-style-type: none"> 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. There is potential for a reduction in water quality at the abstraction location due to the possible mobilisation of contaminants from the	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)

Environmental Statement
Volume 5: Appendix WR-003-0MA04
Water resources and flood risk
MA04: Broomedge to Glazebrook
Water resources assessment

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
			construction area upstream. Typically, these would include sediments, hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Reduction in local water quality has the potential to impact abstraction.						
Spray irrigation – direct – River Bollin 2569020065	High	None	Located downstream of the Proposed Scheme, however abstraction is from a watercourse considered within this assessment. Therefore, the abstraction 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)
Spray irrigation – direct – River Bollin 2569020059 Spray irrigation – direct – River Bollin 2569020010 Spray irrigation – direct – Tributary of Old Bollin 1 2569020015 Fish Pass/Canoe Pass – River Bollin NW/068/0001/002 Spray irrigation– direct – Red Brook 2569017032	High	<ul style="list-style-type: none"> Temporary works such as compounds, stockpiles and access routes 	Located adjacent to or within 100m of the land required for construction of the Proposed Scheme. The areas will be used for access only and no works will be undertaken in the area immediately surrounding these abstractions. There is potential for a reduction in water quality at the abstraction locations due to the possible mobilisation of contaminants from the construction area upstream. Typically, these would include sediments, hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Reduction in local water quality has the potential to impact abstraction.	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)
Discharges to surface water									
Discharge 016892389	Low	None	Located upstream of the Proposed Scheme, however discharging into a watercourse considered within this assessment. Therefore, 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 01WAR0067	Low	None	Located downstream, of the Proposed Scheme and discharging into a watercourse considered within this assessment. Therefore, 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 016892035	Low	None	Located upstream of the Proposed Scheme, however discharging into a watercourse considered within this assessment. Therefore,	Magnitude of impact – Negligible	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible	None required.	Magnitude of impact – Negligible	Construction (temporary)

Environmental Statement
Volume 5: Appendix WR-003-0MA04
Water resources and flood risk
MA04: Broomedge to Glazebrook
Water resources assessment

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
			the discharge has been included on a precautionary basis.	Significance of effect – Negligible, not significant		Significance of effect – Negligible, not significant		Significance of effect – Negligible, not significant	
Discharge 01TRA0050	Low	None	Located downstream, of the Proposed Scheme and discharging into a watercourse considered within this assessment. Therefore, 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 016891884	Low	None	Located upstream of the Proposed Scheme, however discharging into watercourses considered within this assessment. Therefore, the discharge has been included on a precautionary basis.	Magnitude of impact – Negligible	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible	None required.	Magnitude of impact – Negligible	Construction (temporary)
Discharge 016940148				Significance of effect – Negligible, not significant		Significance of effect – Negligible, not significant			
Discharge 016982608									
Discharge 01TRA0035									
Discharge 01TRA0046									
Discharge 0174/2311									
Discharge 01TRA0047									
Discharge 01WAR0047	Low	<ul style="list-style-type: none"> 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 016992454	Low	None	Located upstream of the Proposed Scheme, however discharging into watercourses considered within this assessment. Therefore, the discharge has been included on a precautionary basis.	Magnitude of impact – Negligible	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible	None required.	Magnitude of impact – Negligible	Construction (temporary)
Discharge 016940133				Significance of effect – Negligible, not significant		Significance of effect – Negligible, not significant			
Discharge 01WAR0040									

Environmental Statement
 Volume 5: Appendix WR-003-0MA04
 Water resources and flood risk
 MA04: Broomedge to Glazebrook
 Water resources assessment

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 01WAR0037									
Discharge 01SAL0049									
Discharge 01WAR0036									

2.2 Detailed assessment

2.2.1 In support of the impact assessment presented in Table 1, further detail is provided in this section to demonstrate the more detailed assessment of any elements with potential for a significant effect on surface water receptors. The locations of these elements are shown in Volume 2, MA04 Map Series CT-05 and CT-06.

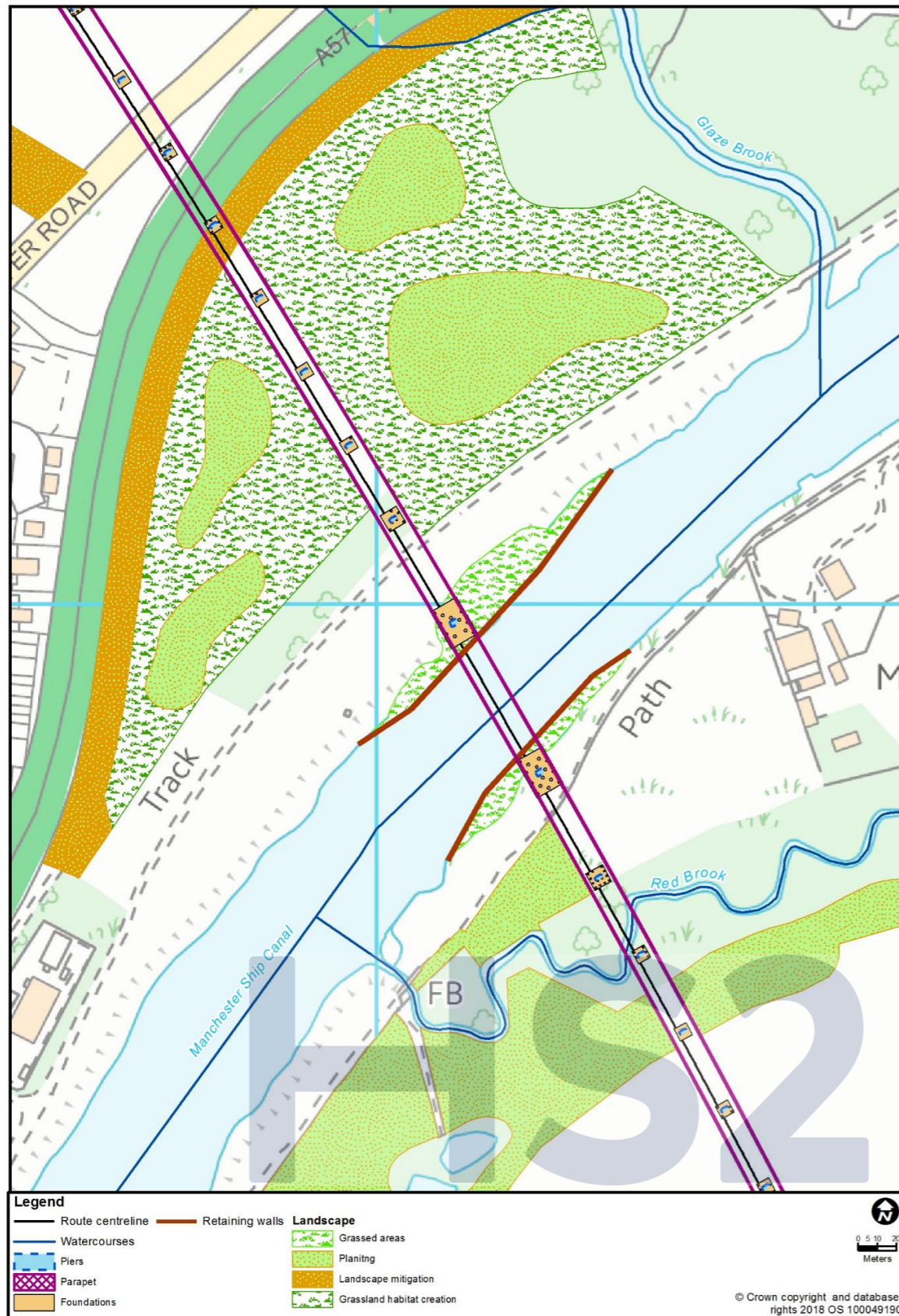
Manchester Ship Canal viaduct

- 2.2.2 The Manchester Ship Canal viaduct will have potential to impact on the Manchester Ship Canal, a very high value receptor. The Manchester Ship Canal is a canalised river, defined as a heavily modified waterbody. The watercourse is constrained by retaining walls on each bank, limiting the potential for channel migration and geomorphological changes, although these retaining walls have been breached in some areas. The viaduct will have an 85m central canal span, which requires the bank to be built out along the northern and southern bank which is currently affected by erosion, shown on Figure 1. Two piers are required on the margin of both the northern and southern banks of the watercourse (see Figure 2).
- 2.2.3 The proposed construction approach will aim to reduce impacts on the operation of the canal. The spans over or adjacent to the canal are likely to be constructed and sequenced using a 'cast-in-situ' balanced cantilever method, using moveable form travellers.
- 2.2.4 To mitigate the piers required along both the northern and southern banks of the watercourse, the banks of the Manchester Ship Canal would be built out into the canal. This would involve the construction of new permanent sheet pile canal walls along the northern and southern bank. These areas would become landscaped grass areas. Refer to the Flood risk assessment (Volume 5: Appendix WR-005-0MA04) and the Hydraulic modelling report (Volume 5: Appendix WR-006-00002) for further details.
- 2.2.5 The water quality of the Manchester Ship Canal could be affected by runoff from the construction area. Mobilised contaminants would typically include sediments, hydrocarbons related to fuel oils and high alkaline substances such as cement and concrete. Some of the piling associated with construction of Manchester Ship Canal viaduct will be installed through Hollins Green landfill site. The works could create a preferential flow path for existing contamination within the landfill to migrate into the underlying Tarpurley Siltstone Secondary B aquifer and therefore into nearby surface water courses (such as the Manchester Ship Canal and Glaze Brook. There is currently little information available on the waste material within this landfill site. The impact of construction of the Proposed Scheme on water quality in surface watercourses is set out in the Land quality report, Volume 5: Appendix LQ-001-0MA04. Mitigation measures and potential remediation options will be considered in collaboration with land quality, pending further site investigation.
- 2.2.6 These risks would be managed by implementation of measures in the draft CoCP, and therefore have a negligible impact, leading to a negligible effect, which is not significant.
- 2.2.7 The construction of a new permanent sheet pile wall along approximately 140m of the north bank, effectively reclaiming a previously eroded bank line could cause deterioration, loss or change to the existing water environment, flow characteristics and morphology of the canal bank on a permanent basis. The construction of a new permanent sheet pile wall along approximately 140m of the south bank, could also have a similar impact on the watercourse.
- 2.2.8 The watercourse would be slightly narrowed, with approximately 140m of shallow marginal aquatic habitat lost on each bank, when the currently natural banks are replaced with sheet piling. This would locally affect the bank morphology and potentially have a subsequent localised effect on aquatic ecology. This new sheet piling could, however, help to prevent the erosion of the bank immediately adjacent to the existing landfill, and potential subsequent leaching of contaminants into the canal. Overall, the impact on the Manchester Ship Canal is assessed to be negligible, leading to a negligible effect, which is not significant.
- 2.2.9 Potential additional measures could include planting and habitat niches in the sheet piling.

Figure 1: Current view of Manchester Ship Canal looking upstream



Figure 2: Design of Manchester Ship Canal viaduct and bank improvements



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 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-004-0MA04). Individual impact assessments for some design elements are presented in Section 3.2 to 3.4.
- 3.1.2 Construction compounds may have substantial water demands where they are associated with design elements, such as batching plant. 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 in Table 2.
- 3.1.5 In support of the groundwater impact assessment presented in Table 2, further detail is provided in Section 3.2 to Section 3.3 to demonstrate the methodology and assumptions used in relation to cuttings, viaducts and overbridges of the Proposed Scheme. The locations of these elements are shown in Volume 2, MA04 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)									
Peat – Unproductive strata	Low	Above ground elements and shallow excavation (<1mbgl) including: <ul style="list-style-type: none"> ground level track and roads temporary works such as stockpiles and compounds 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 – 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)
			Temporary works are above ground or shallow and of small areal extent compared to the aquifer and therefore, are likely to have a negligible impact on recharge and/or 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)
		Deeper excavation (>1mbgl) including: <ul style="list-style-type: none"> Glazebrook embankment north 	Potential alteration of shallow groundwater flow pathways may occur around piled foundations driven through the peat for the Glazebrook embankment north. Due to the location and extent of the embankment within the larger area of the peat, the impact on groundwater flow pathways will be minor (see Section 3.3).	Magnitude of impact – Minor Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	None required.	Magnitude of impact – Minor Significance of effect – Negligible, not significant	Construction (permanent)
Alluvium – Secondary A aquifer	Moderate	Above ground elements and shallow excavation (<1mbgl) including:	The temporary works have the potential to locally affect shallow groundwater quality, although this is likely to be localised and temporary.	Magnitude of impact – Moderate	Implementation of measures described in the draft CoCP.	Magnitude of impact – Negligible	None required.	Magnitude of impact – Negligible	Construction (temporary)

Environmental Statement
 Volume 5: Appendix WR-003-0MA04
 Water resources and flood risk
 MA04: Broomedge to Glazebrook
 Water resources assessment

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		
		<ul style="list-style-type: none"> ground level track and roads temporary works such as stockpiles and compounds utilities diversions Heatley North embankment 	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 localised impact on groundwater flow.	<p>Significance of effect – Moderate adverse, significant</p> <p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required though the draft CoCP will be implemented throughout construction.	<p>Significance of effect – Negligible, not significant</p> <p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Significance of effect – Negligible, not significant</p> <p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (temporary)		
		<ul style="list-style-type: none"> Deeper excavation (>1mbgl) including: <ul style="list-style-type: none"> River Bollin West viaduct Manchester Ship Canal viaduct 	<p>Potential alteration of shallow groundwater flow pathways may occur around piled foundations for new viaduct piers.</p> <p>Due to the location and minor extent of the pier foundations within the much larger area of the alluvium aquifer, the impact on groundwater flow pathways will be negligible.</p>	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (permanent)		
		None	This unit is not crossed by the Proposed Scheme in this community area. Although this unit is likely to be hydraulically connected to the alluvium and glaciofluvial deposits, it is not expected to be impacted by works.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required though the draft CoCP will be implemented throughout construction.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required		
River terrace deposits – Secondary A aquifer	Moderate	None	This unit is not crossed by the Proposed Scheme in this community area. Although this unit is likely to be hydraulically connected to the alluvium and glaciofluvial deposits, it is not expected to be impacted by works.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required though the draft CoCP will be implemented throughout construction.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required		
Shirdley Hill Sand Formation – Secondary A aquifer	Moderate	<ul style="list-style-type: none"> Above ground elements and shallow excavation (<1mbgl) including: <ul style="list-style-type: none"> ground level track and roads temporary works such as stockpiles and compounds utilities diversions Lymm north, Heatley South and Warburton embankments Spring Lane underbridge 	The temporary works have the potential to affect shallow groundwater quality, although this is likely to be localised and temporary.	<p>Magnitude of impact – Moderate</p> <p>Significance of effect – Moderate adverse, significant</p>	Implementation of measures described in the draft CoCP.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (temporary)		
		<ul style="list-style-type: none"> Deeper excavation (>1mbgl) including: <ul style="list-style-type: none"> Bridgewater Canal viaduct Warburton Footbridge 3 accommodation overbridge A6144 Paddock Lane overbridge Manchester Ship Canal viaduct 	<p>Potential alteration of groundwater flow pathways may occur around new viaduct piers.</p> <p>Due to the location and minor extent of the piers within the much larger area of alluvium,</p>	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (permanent)		
		<ul style="list-style-type: none"> Deeper excavation (>1mbgl) including: <ul style="list-style-type: none"> Bridgewater Canal viaduct Warburton Footbridge 3 accommodation overbridge A6144 Paddock Lane overbridge Manchester Ship Canal viaduct 	The temporary works have the potential to affect groundwater quality, although this is likely to be localised and temporary.	<p>Magnitude of impact – Moderate</p> <p>Significance of effect – Moderate adverse, significant</p>	Implementation of measures described in the draft CoCP.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (temporary)
		<ul style="list-style-type: none"> Above ground elements and shallow excavation (<1mbgl) including: <ul style="list-style-type: none"> ground level track and roads temporary works such as stockpiles and compounds utilities diversions Lymm north, Heatley South and Warburton embankments Spring Lane underbridge 	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 localised impacts on groundwater flow.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required though the draft CoCP will be implemented throughout construction.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (temporary)

Environmental Statement
Volume 5: Appendix WR-003-0MA04
Water resources and flood risk
MA04: Broomedge to Glazebrook
Water resources assessment

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 impact on groundwater flow pathways will be negligible.						
		Deeper excavation (>1mbgl) including: • Warburton cutting	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)
			Warburton cutting has the potential to affect groundwater flow (see Section 3.2). Due to the minor extent and depth of the cutting within the much larger area of 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)
Glaciofluvial deposits – Secondary A aquifer	Moderate	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads • temporary works such as stockpiles and compounds • utilities diversions • Heatley North embankment	The temporary works have the potential to affect shallow groundwater quality, although this is likely to be localised and largely 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)
			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/or groundwater flow.	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: • Warburton cutting	The permanent below ground features, including cuttings, may alter groundwater flow (see Section 3.2). Due to the minor extent and depth of the cutting within the much larger area of 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: • Manchester Ship Canal viaduct	Potential alteration of shallow groundwater flow pathways may occur around piled foundations for viaduct piers. Due to the location and minor extent of the viaduct piers within the much larger area of 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)
Glaciofluvial sheet deposits – Secondary A aquifer	Moderate	Above ground elements and shallow excavation (<1mbgl) including: • ground level track and roads	The temporary and permanent works have the potential to affect shallow groundwater quality, although this is likely to be localised and largely 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)

Environmental Statement
Volume 5: Appendix WR-003-0MA04
Water resources and flood risk
MA04: Broomedge to Glazebrook
Water resources assessment

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
		<ul style="list-style-type: none"> temporary works such as stockpiles and compounds utilities diversions Heatley South embankment Heatley North embankment 	Temporary 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/or groundwater flow.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (temporary and permanent)
		<p>Deeper excavation (>1mbgl) including:</p> <ul style="list-style-type: none"> River Bollin West viaduct Manchester Ship Canal viaduct 	<p>The piling for the Manchester ship canal viaduct will pass through the historical Hollins Green landfill site and could create a pathway for the movement of contamination into this aquifer. Details of the impact and effect of piling works through Hollins Green landfill site, on the aquifer, are assessed in the Land quality report, Volume 5: Appendix LQ-001-0MA04.</p> <p>Potential alteration of shallow groundwater flow pathways may occur around piled foundations for viaduct piers. Due to the location and minor extent of the viaduct piers within the much larger area of aquifer, the impact on groundwater flow pathways will be negligible.</p>	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (permanent)
		<p>Deeper excavation (>1mbgl) including:</p> <ul style="list-style-type: none"> Glazebrook embankment north 	<p>Potential alteration of shallow groundwater flow pathways may occur around piled foundations for the Glazebrook embankment north. The impact on groundwater flow pathways will be minor (see Section 3.2).</p>	<p>Magnitude of impact – Minor</p> <p>Significance of effect – Minor adverse, not significant</p>	None required.	<p>Magnitude of impact – Minor</p> <p>Significance of effect – Minor adverse, not significant</p>	None required.	<p>Magnitude of impact – Minor</p> <p>Significance of effect – Minor adverse, not significant</p>	Construction (permanent)
		<p>Deeper excavation (>1mbgl) including:</p> <ul style="list-style-type: none"> Warburton cutting 	<p>The permanent below ground features, including cuttings, may alter groundwater flow (see Section 3.2). Due to the minor extent and depth of the cutting within the much larger area of aquifer, the impact on groundwater flow pathways will be negligible.</p>	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (permanent)
Glacial till – Secondary (Undifferentiated) aquifer	Moderate	<p>Above ground elements and shallow excavation (<1mbgl) including:</p> <ul style="list-style-type: none"> ground level track and roads temporary works such as stockpiles and compounds utilities diversions Warburton embankment 	<p>The temporary works have the potential to affect shallow groundwater quality, although this is likely to be localised and temporary.</p> <p>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/or groundwater flow.</p>	<p>Magnitude of impact – Moderate</p> <p>Significance of effect – Moderate adverse, significant</p> <p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Implementation of measures described in the draft CoCP.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p> <p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p> <p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	Construction (temporary)
		<p>Deeper excavation (>1mbgl) including:</p> <ul style="list-style-type: none"> Bridgewater Canal viaduct 	<p>Potential alteration of shallow groundwater flow pathways may occur around piled foundations for viaduct piers. Due to the location and minor extent of the viaduct piers within the much larger area of</p>	<p>Magnitude of impact – Negligible</p>	None required.	<p>Magnitude of impact – Negligible</p>	None required.	<p>Magnitude of impact – Negligible</p>	Construction (permanent)

Environmental Statement
Volume 5: Appendix WR-003-0MA04
Water resources and flood risk
MA04: Broomedge to Glazebrook
Water resources assessment

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
		<ul style="list-style-type: none"> River Bollin West viaduct Manchester Ship Canal viaduct 	aquifer, the impact on groundwater flow pathways will be negligible.	Significance of effect – Negligible, not significant		Significance of effect – Negligible, not significant		Significance of effect – Negligible, not significant	
		Deeper excavation (>1mbgl) including: <ul style="list-style-type: none"> Glazebrook embankment north 	Potential alteration of shallow groundwater flow pathways may occur around piled foundations for the Glazebrook embankment north The impact on groundwater flow pathways will be minor (see Section 3.3).	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)
		Deeper excavation (>1mbgl) including: <ul style="list-style-type: none"> Warburton cutting 	The permanent below ground features, including cuttings, may alter groundwater flow (see Section 3.2). Due to the minor extent and depth of the cutting within the much larger area of 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: <ul style="list-style-type: none"> ground level track and roads temporary works such as stockpiles and compounds Lymm north embankment Heatley 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 – 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)
			Temporary 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 groundwater flow.	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 (temporary)
		Deeper excavation (>1mbgl) including: <ul style="list-style-type: none"> Bridgewater Canal viaduct Spring Lane underbridge River Bollin West viaduct 	Piling is not expected to occur in the Northwich Halite Member During installation, there is a slight risk of causing temporary mobility of poor water quality in the Northwich Halite Member however, the impact on groundwater flow pathways and water quality 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)
Mercia Mudstone Group – Sidmouth Mudstone Formation – Bollin Mudstone Member – Secondary B aquifer	Moderate	Above ground elements and shallow excavation (<1mbgl) including: <ul style="list-style-type: none"> ground level track and roads temporary works such as stockpiles and compounds 	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)
			Temporary and permanent works are above ground or shallow and of small areal extent	Magnitude of impact – Negligible	None required.	Magnitude of impact – Negligible	None required.	Magnitude of impact – Negligible	Construction (temporary)

Environmental Statement
Volume 5: Appendix WR-003-0MA04
Water resources and flood risk
MA04: Broomedge to Glazebrook
Water resources assessment

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
		<ul style="list-style-type: none"> Heatley North embankment Warburton embankment 	compared to the aquifer therefore are likely to have a negligible impact on groundwater flow.	Significance of effect – Negligible, not significant		Significance of effect – Negligible, not significant		Significance of effect – Negligible, not significant	and permanent)
		Deeper excavation (>1mbgl) including: <ul style="list-style-type: none"> River Bollin West viaduct Warburton cutting Warburton Footbridge 3 accommodation overbridge A6144 Paddock Lane overbridge Manchester Ship Canal viaduct 	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)
		<ul style="list-style-type: none"> A6144 Paddock Lane overbridge Manchester Ship Canal viaduct 	The Warburton cutting is not expected to extend below the superficial deposits and into the Bollin Mudstone Member and should not, therefore, have any impact on groundwater flow in the bedrock. Due to the location and minor extent of the viaduct piers within the much larger area of the Bollin Mudstone Member, 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 (temporary and permanent)
Mercia Mudstone Group – Tarporley Siltstone Formation – Secondary B aquifer	Moderate	Above ground elements and shallow excavation (<1mbgl) including: <ul style="list-style-type: none"> ground level track and roads temporary works such as stockpiles and compounds utilities diversions Glazebrook embankment south 	The temporary works have the potential to affect shallow 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)
		<ul style="list-style-type: none"> utilities diversions Glazebrook embankment south 	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/or groundwater flow.	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 (temporary)
		Deeper excavation (>1mbgl) including: <ul style="list-style-type: none"> Manchester Ship Canal viaduct Glazebrook (railway) viaduct 	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)
		The piling for the Manchester ship canal viaduct will pass through the historical Hollins Green landfill site and could create a pathway for the movement of contamination into this aquifer. Details of the impact and effect of piling works through Hollins Green landfill site, on the aquifer, are assessed in the Land quality report, Volume 5: Appendix LQ-001-0MA04.			Potential alteration of groundwater flow pathways may occur as a result of piling in the bedrock beneath viaduct piers. Due to the location and minor extent of the piling within the much larger area of the Tarporley Siltstone Formation, the impact on groundwater flow pathways will be localised and 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.

Environmental Statement
 Volume 5: Appendix WR-003-0MA04
 Water resources and flood risk
 MA04: Broomedge to Glazebrook
 Water resources assessment

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
		Deeper excavation (>1mbgl) including: <ul style="list-style-type: none"> Glazebrook embankment north 	Piling for the Glazebrook embankment north will not extend into the mudstone and therefore 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)
Sherwood Sandstone Group – Helsby Sandstone Formation – Principal aquifer	High	Above ground elements and shallow excavation (<1mbgl) including: <ul style="list-style-type: none"> ground level track and roads temporary works such as stockpiles and compounds utilities diversions 	The temporary works have the potential to affect groundwater flow and 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: <ul style="list-style-type: none"> approximately 325m of the Glazebrook embankment north M62 West viaduct 	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)
			Piling for the Glazebrook embankment north is not expected to extend into the bedrock. Piling for the M62 west viaduct will extend into the sandstone and there is the potential for a localised alteration to groundwater flow pathways in the top of the Helsby Sandstone Formation (see Section 3.3).	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)
Sherwood Sandstone Group – Wilmslow Sandstone Formation – Principal aquifer	High	None	This formation may be hydraulically connected to the adjacent deposits so could potentially be impacted. At the closest point, the Wilmslow Sandstone Formation is located 90m from the consolidated construction boundary. The temporary works have the potential to affect groundwater flow and 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)
Abstractions									
SPZ3 for PWS sources	Very high	Deeper excavation (>1mbgl) including: <ul style="list-style-type: none"> Glazebrook embankment north M62 West viaduct 	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: <ul style="list-style-type: none"> Glazebrook embankment north 	The piles for Glazebrook embankment north will not extend into the sandstone aquifer (from which the PWS abstractions are assumed to draw water) therefore the impact	Magnitude of impact – Negligible	None required.	Magnitude of impact – Negligible	None required.	Magnitude of impact – Negligible	Construction (permanent)

Environmental Statement
 Volume 5: Appendix WR-003-0MA04
 Water resources and flood risk
 MA04: Broomedge to Glazebrook
 Water resources assessment

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
		<ul style="list-style-type: none"> M62 West viaduct 	<p>on groundwater flow pathways and quality will be negligible.</p> <p>Potential alteration of groundwater flow pathways may occur as a result of piling for the M62 west viaduct. Due to the location and minor extent of the piling within the much larger area of the SPZ3, the impact on groundwater flow pathways will be negligible (see Section 3.3).</p>	<p>Magnitude of impact – Negligible, not significant</p> <p>Significance of effect – Negligible, not significant</p>		<p>Magnitude of impact – Negligible, not significant</p> <p>Significance of effect – Negligible, not significant</p>		<p>Magnitude of impact – Negligible, not significant</p> <p>Significance of effect – Negligible, not significant</p>	
Discharges to groundwater									
Discharge EPRCB3592AS	Low	<p>Above ground elements and shallow excavation (<1mbgl) including:</p> <ul style="list-style-type: none"> ground level track and roads temporary works such as stockpiles and compounds <p>Deeper excavation (>1mbgl) including:</p> <ul style="list-style-type: none"> Bridgewater Canal viaduct 	<p>The discharge is within an area of Shirdley Hill Sand Formation. It is not within the footprint of the Proposed Scheme or in proximity to any below ground works and therefore the impact on this discharge will be negligible.</p>	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	<p>None required though the draft CoCP will be implemented throughout construction.</p>	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	<p>None required.</p>	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	<p>Construction (temporary and permanent)</p>
Groundwater – surface water interactions									
Spring at Agdenlane Farm west, Agden Lane	Low	<p>Construction of above ground elements and shallow excavation (<1mbgl) including:</p> <ul style="list-style-type: none"> ground level track and roads temporary works such as stockpiles and compounds <p>Deeper excavation (>1mbgl) including:</p> <ul style="list-style-type: none"> A56 Lymm Road viaduct (in MA03) 	<p>The spring is located approximately 150m west of any construction works. The spring is also located up hydraulic gradient of the Proposed Scheme, therefore, impacts on groundwater flow and quality should be negligible.</p>	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	<p>None required though the draft CoCP will be implemented throughout construction.</p>	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	<p>None required.</p>	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	<p>Construction (temporary and permanent)</p>
Potential spring at Glazebrook Trail and railway intercept	Moderate	<p>Deeper excavation (>1mbgl) including:</p> <ul style="list-style-type: none"> Glazebrook embankment north M62 West viaduct 	<p>This feature is located on the opposite side of the valley of Glaze Brook to the Proposed Scheme and is unlikely to be hydraulically connected to the area of the Proposed Scheme.</p>	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	<p>None required.</p>	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	<p>None required.</p>	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	<p>Construction (permanent)</p>
Tributary of Agden Brook 1	Low	<p>Above ground elements and shallow excavation (<1mbgl) including:</p> <ul style="list-style-type: none"> ground level track and roads 	<p>The temporary construction works have the potential to affect the quality of baseflow to this watercourse.</p>	<p>Magnitude of impact – Minor</p> <p>Significance of effect – Negligible, not significant</p>	<p>None required though the draft CoCP will be implemented throughout construction.</p>	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	<p>None required.</p>	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	<p>Construction (temporary)</p>

Environmental Statement
Volume 5: Appendix WR-003-0MA04
Water resources and flood risk
MA04: Broomedge to Glazebrook
Water resources assessment

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
		<ul style="list-style-type: none"> temporary works such as stockpiles and compounds Lymm north embankment Deeper excavation (>1mbgl) including: <ul style="list-style-type: none"> Bridgewater Canal viaduct 							
		Deeper excavation (>1mbgl) including: <ul style="list-style-type: none"> A56 Lymm Road viaduct (in MA03) 	Potential alteration of shallow groundwater flow pathways may occur around new viaduct piers. Due to the location and very limited extent of the piers within the superficial Shirdley Hill Sand Formation in the area, the impact on any groundwater flow pathways towards the watercourse 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)
Helsdale Brook	Moderate	Above ground elements and shallow excavation (<1mbgl) including: <ul style="list-style-type: none"> ground level track and roads temporary works such as stockpiles and compounds utilities diversions Heatley South embankment 	Watercourse is located upgradient of construction works and therefore no impact is expected.	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)
River Bollin	Very high	Above ground elements and shallow excavation (<1mbgl) including: <ul style="list-style-type: none"> ground level track and roads temporary works such as stockpiles and compounds Heatley South embankment Heatley North embankment 	The temporary construction works have the potential to affect the quality of baseflow to this watercourse.	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: <ul style="list-style-type: none"> River Bollin West viaduct 	Potential alteration of shallow groundwater flow pathways may occur around new viaduct piers. Due to the location and minor extent of the viaduct piers within the much larger area of the alluvium and glaciofluvial sheet deposits the impact on groundwater flow pathways will be negligible in the context of baseflow to the river.	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)

Environmental Statement
Volume 5: Appendix WR-003-0MA04
Water resources and flood risk
MA04: Broomedge to Glazebrook
Water resources assessment

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
Old Bollin	Low	Above ground elements and shallow excavation (<1mbgl) including: <ul style="list-style-type: none"> ground level track and roads temporary works such as stockpiles and compounds utilities diversions Heatley South embankment Heatley North embankment 	The temporary construction works have the potential to affect the quality of baseflow to this watercourse.	Magnitude of impact – Minor 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 excavation (>1mbgl) including: <ul style="list-style-type: none"> River Bollin West viaduct 	Potential alteration of shallow groundwater flow pathways may occur around new viaduct piers. Due to the location and minor extent of the viaduct piers within the much larger area of the alluvium and glaciofluvial sheet deposits the impact on groundwater flow pathways will be negligible in the context of baseflow to the river.	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 Old Bollin	Low	Above ground elements and shallow excavation (<1mbgl) including: <ul style="list-style-type: none"> ground level track and roads temporary works such as stockpiles and compounds 	The temporary construction works have the potential to affect the quality of baseflow to this watercourse.	Magnitude of impact – Minor 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 excavation (>1mbgl) including: <ul style="list-style-type: none"> Warburton cutting 	The cuttings assessment (Section 3.2) shows that this feature is just within the potential dewatering zone of influence and a small proportion of groundwater may be intercepted that would otherwise flow to this watercourse.	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 – Moderate Significance of effect – Minor, not significant	None required.	Magnitude of impact – Moderate Significance of effect – Minor, not significant	Construction (temporary and permanent)
Tributary of the Manchester Ship Canal 2	Low	Above ground elements and shallow excavation (<1mbgl) including: <ul style="list-style-type: none"> ground level track and roads temporary works such as stockpiles and compounds utilities diversions Warburton embankment 	The temporary construction works have the potential to affect the quality of baseflow to this watercourse.	Magnitude of impact – Minor 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)

Environmental Statement
 Volume 5: Appendix WR-003-0MA04
 Water resources and flood risk
 MA04: Broomedge to Glazebrook
 Water resources assessment

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
		Deeper excavation (>1mbgl) including: <ul style="list-style-type: none"> Manchester Ship Canal viaduct 	Potential alteration of shallow groundwater flow pathways may occur around new viaduct piers. Due to the location and minor extent of the viaduct piers within the much larger area of the Shirdley Hill Sand Formation the impact on groundwater flow pathways will be negligible in the context of baseflow to the watercourse.	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: <ul style="list-style-type: none"> Warburton cutting 	The cuttings assessment (see Section 3.2 shows that this feature is outside of the potential dewatering zone of influence therefore the watercourse will not be affected by any permanent dewatering.	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)
Manchester Ship Canal	Very high	Above ground elements and shallow excavation (<1mbgl) including: <ul style="list-style-type: none"> ground level track and roads temporary works such as stockpiles and compounds 	The temporary construction works have the potential to affect the quality of baseflow to these watercourses.	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)
Red Brook	High	Deeper excavation (>1mbgl) including: <ul style="list-style-type: none"> Manchester Ship Canal viaduct 	Potential alteration of shallow groundwater flow pathways may occur around new viaduct piers. Due to the location and minor extent of the viaduct piers within the much larger area of alluvium and glaciofluvial deposits the impact on groundwater flow pathways will be negligible in the context of baseflow to these watercourses.	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)
Marsh Brook	Moderate	Above ground elements and shallow excavation (<1mbgl) including: <ul style="list-style-type: none"> ground level track and roads temporary works such as stockpiles and compounds Glazebrook embankment south 	Marsh Brook and Tributary of the Manchester Ship Canal 1 are separated from the Proposed Scheme by the shallow valley of Tributary of Glaze Brook 1 over much of their course and are unlikely to be hydraulically connected to 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 and permanent)
Tributary of the Manchester Ship Canal 1		Deeper excavation (>1mbgl) including: <ul style="list-style-type: none"> Manchester Ship Canal viaduct 							
Glaze Brook	High	Above ground elements and shallow excavation (<1mbgl) including: <ul style="list-style-type: none"> ground level track and roads 	The temporary construction works have the potential to affect the quality of baseflow to this watercourse.	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)

Environmental Statement
Volume 5: Appendix WR-003-0MA04
Water resources and flood risk
MA04: Broomedge to Glazebrook
Water resources assessment

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
		<ul style="list-style-type: none"> temporary works such as stockpiles and compounds Deeper excavation (>1mbgl) including: <ul style="list-style-type: none"> Manchester Ship Canal viaduct Glazebrook embankment north M62 West viaduct 	Potential alteration of shallow groundwater flow pathways may occur around the new viaduct piers. Due to the location and minor extent of the viaduct piers within the much larger area of superficial deposits, the impact on groundwater flow pathways will be negligible in the context of baseflow to these watercourses.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	Magnitude of impact – Negligible	Construction (permanent)
Tributary of Glaze Brook 1	Low	<p>Above ground elements and shallow excavation (<1mbgl) including:</p> <ul style="list-style-type: none"> ground level track and roads temporary works such as stockpiles and compounds utilities diversions 	The temporary construction works have the potential to affect the quality of baseflow to this watercourse.	<p>Magnitude of impact – Moderate</p> <p>Significance of effect – Minor adverse, not significant</p>	None required though the draft CoCP will be implemented throughout construction.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	Magnitude of impact – Negligible	Construction (temporary)
		<p>Deeper excavation (>1mbgl) including:</p> <ul style="list-style-type: none"> Manchester Ship Canal viaduct Glazebrook embankment north M62 West viaduct 	Potential alteration of shallow groundwater flow pathways may occur around new viaduct piers. Piling for the Glazebrook embankment north and the viaducts has the potential to disrupt groundwater baseflow to this watercourse (see Section 3.3).	<p>Magnitude of impact – Minor</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Minor</p> <p>Significance of effect – Negligible, not significant</p>	None required.	Magnitude of impact – Minor	Construction (permanent)
Tributary of Glaze Brook 2	Low	<p>Above ground elements and shallow excavation (<1mbgl) including:</p> <ul style="list-style-type: none"> ground level track and roads temporary works such as stockpiles and compounds utilities diversions 	The temporary construction works have the potential to affect the quality of baseflow to this watercourse.	<p>Magnitude of impact – Moderate</p> <p>Significance of effect – Minor adverse, not significant</p>	None required though the draft CoCP will be implemented throughout construction.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	Magnitude of impact – Negligible	Construction (temporary)
		<p>Deeper excavation (>1mbgl) including:</p> <ul style="list-style-type: none"> Glazebrook embankment north M62 West viaduct 	Piling for the Glazebrook embankment north and M62 West viaduct has the potential to disrupt groundwater baseflow into this watercourse (see Section 3.3).	<p>Magnitude of impact – Minor</p> <p>Significance of effect – Negligible, not significant</p>	None required.	<p>Magnitude of impact – Minor</p> <p>Significance of effect – Negligible, not significant</p>	None required.	Magnitude of impact – Minor	Construction (permanent)
Tributary of Glaze Brook 3	Moderate	None	Watercourse is upgradient of the Proposed Scheme and on the opposite bank of Glaze Brook to the proposed Scheme. There are no works near to the watercourse.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required though the draft CoCP will be implemented throughout construction.	<p>Magnitude of impact – Negligible</p> <p>Significance of effect – Negligible, not significant</p>	None required.	Magnitude of impact – Negligible	Construction (temporary and permanent)

3.2 Impact on groundwater from cuttings

- 3.2.1 Summary parameters for the Warburton cutting are presented below in Table 3.
- 3.2.2 Where the groundwater elevation lies above the base of the cutting the likely maximum zone of influence from dewatering of the cutting has been undertaken. In the case that the groundwater level is not known, the groundwater level is assumed to be at surface and a detailed assessment is undertaken accordingly.
- 3.2.3 Assessment of the likely maximum zone of influence from dewatering of the cuttings has been made using Sichardt’s formula as set out in the SMR Technical Note: Groundwater assessment.
- 3.2.4 Hydraulic conductivity values from the high end of the range, presented in literature, have been used in the assessment, to provide a conservative estimate of the dewatering zone of influence. Where groundwater levels are not known, the worst-case assumption, that groundwater is at ground level, has been used.
- 3.2.5 Cuttings are assumed to be open and any permanent works such as retaining walls or drainage measures do not form part of the quantitative assessment. Maximum drainage invert below track level is estimated at 3.15m.
- 3.2.6 Based on these precautionary assumptions, the zone of influence is likely to be overestimated. However, for the purpose of this preliminary assessment, this precautionary approach is considered to be appropriate.

Warburton cutting

Table 3: Summary of the parameters for the groundwater assessment of Warburton cutting

Cutting parameters	Parameter details
Length (km)	1.0
Maximum depth (m)	4.1 to top of rail (7.3 to drainage invert)
Strata intercepted	Glaciofluvial deposits (Secondary A aquifer) Shirdley Hill Sand Formation (Secondary A aquifer) Glacial till (Secondary (Undifferentiated) aquifer)
Lowest level of drainage invert along track (metres above ordnance datum: mAOD)	14.9
Groundwater level(s) (mAOD)	Assumed to be at ground level
Principal receptors	Glaciofluvial deposits (Secondary A aquifer) Glaciofluvial sheet deposits (Secondary A aquifer) Shirdley Hill Sand Formation (Secondary A aquifer) Glacial till (Secondary (Undifferentiated) aquifer) Tributary of the Manchester Ship Canal 2 Tributary of Old Bollin Fox Covert and Meadow SBI

- 3.2.7 There is no currently available information on groundwater elevations or depth to groundwater in this area. It has therefore been conservatively assumed that groundwater levels within the glacial till, glaciofluvial deposits and Shirdley Hill Sand Formation are at ground level and that groundwater flow within the glacial till, glaciofluvial deposits and Shirdley Hill Sand Formation may be affected by the cutting. Application of the draft CoCP will ensure that materials and fluids used during construction are managed so that there is no significant adverse effect on groundwater quality.
- 3.2.8 Assuming a hydraulic conductivity value of $3 \times 10^{-4} \text{m/s}$ for the glaciofluvial deposits, glaciofluvial sheet deposits, Shirdley Hill Sand Formation and glacial till⁵ (where present), the lateral extent of drawdown (also referred to as the zone of influence) is estimated to extend a maximum distance of 220m (in the glaciofluvial sheet deposits). This is based on a maximum depth of 7.3m from ground level to the track drainage

⁵ On a precautionary basis, high-end sand and gravel conductivity values are assumed for glacial till 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.

invert. The glaciofluvial deposits, glaciofluvial sheet deposits, Shirdley Hill Sand Formation and glacial till extend over a total depth of more than 20m below the cutting depth and are laterally extensive. Therefore, potential local changes in groundwater level to the maximum cutting depth are assessed as negligible, not significant in terms of impact on the Secondary A and Secondary (Undifferentiated) aquifers.

- 3.2.9 Tributary of Old Bollin may receive reduced baseflow due to the interception of groundwater by the Warburton cutting. The watercourse is only just within the potential dewatering zone of influence but a large proportion of the catchment for this watercourse is located within this zone of influence. This impact is assessed to be moderate on this low value receptor, leading to a minor effect which is not significant. Scheme drainage will be discharged into Tributary of the Old Bollin just downstream of the crossing with the Proposed Scheme, which will help to support flow. Impact after embedded mitigation is assessed to be minor, leading to a negligible effect which is not significant.
- 3.2.10 Tributary of Old Bollin also runs through the potentially surface water dependent habitat Fox Covert and Meadows is located within the calculated zone of influence, downgradient of the Proposed Scheme. The scheme drainage will enter Tributary of Old Bollin upstream of the site so the impact on surface water flow through the site is assessed to be negligible, leading to a negligible effect which is not significant.
- 3.2.11 Tributary of Manchester Ship Canal 2 is located outside of the calculated radius of influence of this cutting. Any reduction to baseflow due to the interception of groundwater by the Warburton cutting will be negligible.

3.3 Impacts to groundwater flow and quality from overbridge, underbridge, viaduct and embankment piling

- 3.3.1 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 potable use. Catchments for groundwater abstraction are indicated by the SPZ1, SPZ2 and SPZ3 areas and are defined by the Environment Agency around all licenced abstraction sites.
- 3.3.2 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 and underbridges

- 3.3.3 The following overbridges are located within MA04:
- Spring Lane underbridge;
 - Footpath Warburton 3 accommodation overbridge; and
 - A6144 Paddock Lane overbridge.
- 3.3.4 There is a possibility that groundwater quality in the superficial deposits may be impacted by the constructions of underbridge and overbridge piles, although the piles are not expected to extend any deeper than 20m below ground level. The potential impacts from construction piling can be mitigated by using bentonite in the process to reduce fluid loss. Many methods of piling can also be facilitated by the use of temporary casing, which is generally more effective in preventing losses to immediately adjacent watercourses. The impact from the construction of overbridges and underbridges is expected to be localised and temporary and of minor extent in comparison to the areal extent of the superficial and bedrock aquifers. Therefore, the impact of the piling is assessed as negligible leading to a negligible effect, which is not significant.

Bridgewater Canal viaduct

- 3.3.5 The Bridgewater Canal viaduct will include drilled concrete piles with pile caps. The piles are designed with a depth of 32m and would be constructed within the Shirdley Hill Sand Formation and glacial till. The piles will not penetrate into the underlying bedrock as the superficial deposits are over 50m deep at the location. The piles may obstruct the flow of groundwater in the superficial deposits in the immediate vicinity of the foundations for the viaduct. However, any impacts are likely to be localised. Taking into account the extent and depth of the superficial aquifers, the impact will be negligible leading to a negligible effect, which is not significant.

River Bollin West viaduct

- 3.3.6 The River Bollin West viaduct will comprise drilled concrete piles with pile caps. The piles are designed with a depth of 36m. They are expected to penetrate through the alluvium, glaciofluvial sheet deposits, glacial till and into the underlying Sidmouth Mudstone Formation (Bollin Mudstone Member) of the Mercia Mudstone Group. Piling is not expected to occur in the Sidmouth Mudstone Formation (Northwich Halite Member). Therefore, these piles may obstruct the flow of groundwater in the superficial deposits and an upper section of the Bollin Mudstone Member in the immediate vicinity of the foundations for the viaduct, although any impacts are likely to be localised. Taking into account the extent and depth of the superficial and bedrock aquifers, the impact will be negligible, leading to a negligible effect which is not significant.
- 3.3.7 The Old Bollin and River Bollin are both crossed by the Proposed Scheme at the River Bollin West viaduct. However, the impact on local groundwater contributions to the watercourses, resulting from the obstruction of groundwater flow by permanent below ground structures, is considered to be negligible.

Manchester Ship Canal viaduct

- 3.3.8 The Manchester Ship Canal viaduct will include drilled concrete piles with pile caps. The piles are designed with a depth of 29m. They and are expected to penetrate through the Shirdley Hill Sand Formation, glaciofluvial deposits, glaciofluvial sheet deposits and glacial till into the underlying Sidmouth Mudstone Formation (Bollin Mudstone Member) and Tarporley Siltstone Formation of the Mercia Mudstone Group. Therefore, 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, although any impacts are likely to be localised. Taking into account the extent and depth of the superficial and bedrock aquifers, the impact will be negligible, leading to a negligible effect which is not significant.
- 3.3.9 Below ground structures have the potential to obstruct groundwater flow towards watercourses in proximity to the Manchester Ship Canal viaduct. Tributary of the Manchester Ship Canal 2 and Tributary of Glaze Brook 1 are predominantly upgradient of, and crossed by, the Proposed Scheme. The impact on local groundwater contributions to the watercourses, resulting from the obstruction of groundwater flow by permanent below ground structures, is considered to be negligible, leading to a negligible effect which is not significant.
- 3.3.10 Some of the piling associated with construction of Manchester Ship Canal viaduct will be installed through Hollins Green landfill site. The works could create a preferential flow path for existing contamination within the landfill to migrate into the underlying Tarporley Siltstone Secondary B aquifer. There is currently little information available on the waste material within this landfill site. The impact of construction of the Proposed Scheme on water quality in the underlying aquifer is set out in the Land quality report, Volume 5: Appendix LQ-001-0MA04. Mitigation measures and potential remediation options will be considered in collaboration with land quality, pending further site investigation.
- 3.3.11 Red Brook and Manchester Ship Canal are also crossed by the Manchester Ship Canal viaduct. Taking into account the extent of these watercourses, the impact on baseflow resulting from the obstruction of groundwater flow by permanent below ground structures will be negligible.

Glazebrook (railway) viaduct

- 3.3.12 The Glazebrook (railway) viaduct will comprise drilled concrete piles with pile caps. The piles are designed with a depth of 21m. There are no superficial deposits overlying the bedrock and the piles would penetrate into the Tarporley Siltstone Group of the Mercia Mudstone Group. The piles may obstruct the flow of groundwater in the bedrock in the immediate vicinity of the foundations of the viaduct. However, taking into account the extent of the bedrock aquifer, the impact will be negligible, leading to a negligible effect which is not significant.

Glazebrook embankment north

- 3.3.13 The Glazebrook embankment north will require piled foundations where it is located on peat and ground conditions are poor. It is currently envisaged that the embankment would most likely be constructed with closely spaced, precast, concrete piles driven through the peat and into the underlying superficial deposits. A geotextile 'mattress' and longitudinal anchor blocks would be installed to support the toe of the embankment. These piles and anchors may obstruct the flow of groundwater in the superficial deposits in the immediate vicinity of the embankment, although the impact is likely to be localised. Taking into account the extent of the peat and the location of the embankment close to an existing cutting within the peat, the impact is expected to be minor, leading to a negligible effect which is not significant. The impact on the other superficial deposits is also assessed to be minor leading to a minor adverse effect which is not significant.
- 3.3.14 The Glazebrook embankment north sits within SPZ3 for public water supplies (map WR-02-304 – F5, F6, G5 and G6, SPZ3 location) in the Sherwood Sandstone aquifer. Potential alteration of groundwater flow pathways may occur as a result of piling beneath the section of Glazebrook embankment north. However, as the piles are not expected to extend into the Sherwood Sandstone, which underlies the superficial deposits over a part of the embankment, the impact on groundwater flow pathways in the Sherwood Sandstone aquifer will be negligible, leading to a negligible effect which is not significant.

Environmental Statement

Volume 5: Appendix WR-003-0MA04

Water resources and flood risk

MA04: Broomedge to Glazebrook

Water resources assessment

- 3.3.15 There is the potential for adverse impacts on baseflow in two branches of Tributary of Glaze Brook 1 which originate as land drains located about 20m to the west of the embankment. The land drains are listed in the water resources assessment baseline data (BID, WR-004-0MA04) as 'potential spring 170m south of Church Farm, Glazebrook Moss' and 'potential spring south of Church Farm, Glazebrook Moss'. However, surveys have shown that these are land drainage features, which may drain groundwater and are assessed to be low value receptors. Groundwater flow is generally expected to be to the north-east, however local groundwater maybe towards the two branches of Tributary of Glaze Brook 1. The piling associated with the Glazebrook embankment north could reduce local groundwater flow into the two land drains and this is assessed to be a moderate impact, leading to a minor adverse effect, which is not significant. The loss of flow from the land drains would also lead to a reduction in baseflow in Tributary of Glaze Brook 1 and this is assessed to be a minor impact, leading to a negligible effect, which is not significant.
- 3.3.16 Tributary of Glaze Brook 2, also a low value receptor, is crossed by Glazebrook embankment north but only a 30m section of the watercourse is upstream of the Proposed Scheme. The below-ground structures of the embankment may affect the baseflow to the watercourse, assessed as a minor adverse impact, leading to a negligible effect which is not significant.

M62 West viaduct

- 3.3.17 The majority of the M62 West viaduct is located in the Risley to Bamfurlong area. The impact assessment for this viaduct is presented in the Water resources assessment, Volume 5: Appendix WR-003-0MA05.

3.4 Impacts to groundwater from borrow pits

- 3.4.1 There are no borrow pits within the Broomedge to Glazebrook area (MA04).

4 Site specific water dependent habitats assessment

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 Ecological register of local level effects, Volume 5: Appendix EC-015-0MA04. Where there are significant effects, the ecological effects and associated mitigation are reported in Volume 2, Community Area report: Broomedge to Glazebrook (MA04), 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		
Fox Covert and Meadows SBI	Above ground elements and shallow excavation (<1mbgl) including: <ul style="list-style-type: none"> • ground level track and roads • temporary works such as stockpiles and compounds • utilities diversions Deeper excavation (>1mbgl) including: <ul style="list-style-type: none"> • Warburton cutting 	Tributary of Old Bollin flows through the habitat, which is located adjacent to the Proposed Scheme and is within land required for construction of the Proposed Scheme and adjacent to utilities diversions which may temporarily impact surface water quality. However, any potential impacts on water resources will be mitigated by implementation of the draft CoCP. Therefore, the impact on the water dependent habitat from temporary construction will be negligible. The scheme drainage will enter the Tributary of Old Bollin upstream of the site so the impact on surface water flow through the site is assessed to be negligible.
Coroners Wood ancient woodland and SBI	Above ground elements and shallow excavation (<1mbgl) including: <ul style="list-style-type: none"> • ground level track and roads • temporary works such as stockpiles and compounds Deeper excavation (>1mbgl) including: <ul style="list-style-type: none"> • Manchester Ship Canal viaduct 	Red Brook flows through the habitat, which is crossed by the Proposed Scheme and is adjacent to land required for construction of the Proposed Scheme and utilities diversions which may temporarily impact surface water quality. However, any potential impacts on water resources will be mitigated by implementation of the draft CoCP. Surface water mitigation measures also include avoiding the floodplain and channel, with piers set back to remove impacts on flows. Therefore, the impact on the water dependent habitat from temporary construction will be negligible. Permanent structures from the viaduct are unlikely to cause significant impact to the habitat as the majority of Coroners Wood is up-gradient of the Proposed Scheme. The scale of the piles is unlikely to impact groundwater flow within the habitat, resulting in a negligible impact.
Groundwater dependent habitats		
Rixton Clay Pits SAC, SSSI, LNR and LWS (Rixton Brickworks)	Above ground elements and shallow excavation (<1mbgl) including: <ul style="list-style-type: none"> • ground level track and roads • temporary works such as stockpiles and compounds Deeper excavation (>1mbgl) including: <ul style="list-style-type: none"> • Manchester Ship Canal viaduct 	This site is on the opposite side of Marsh Brook to the Proposed Scheme, and 961m west of the closest area required for construction. The Proposed Scheme is on embankment and viaduct in the vicinity of Rixton Clay Pits, with no extensive below ground works proposed in the area. As a result, there are no potential pathways by which contaminated groundwater could migrate to the area around Rixton Clay Pits. Therefore, the impact on groundwater flow and quality to the water dependent habitat will be negligible.
Heatley Lake (Heatley Flash) LWS	Above ground elements and shallow excavation (<1mbgl) including: <ul style="list-style-type: none"> • ground level track and roads; and • temporary works such as stockpiles and compounds. Deeper excavation (>1mbgl) including: <ul style="list-style-type: none"> • River Bollin west viaduct 	Land required for the construction of the Proposed Scheme is located 120m from this site at its closest point. The site is not within the footprint of the Proposed Scheme, or in proximity to any below ground works. Therefore, the impact on the water dependent habitat will be negligible.

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 runoff 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 MA04.

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 HEWRAT⁴. 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 not identified the need for a routine runoff and pollution risk assessment in MA04 during the construction phase. The screening exercise identified the need for a spillage pollution risk assessment in MA04 during the construction phase, associated with Bent Lane, shown in Figure 3.
- 5.3.2 A screening exercise identified the need for a routine runoff and pollution risk assessment in MA04 during the operational phase. This is related to the modifications to A6144 Paddock Lane, shown in Figure 4. The screening exercise has not identified the need for a spillage pollution risk assessment in MA04 during the operational phase.

Figure 3: Bent Lane

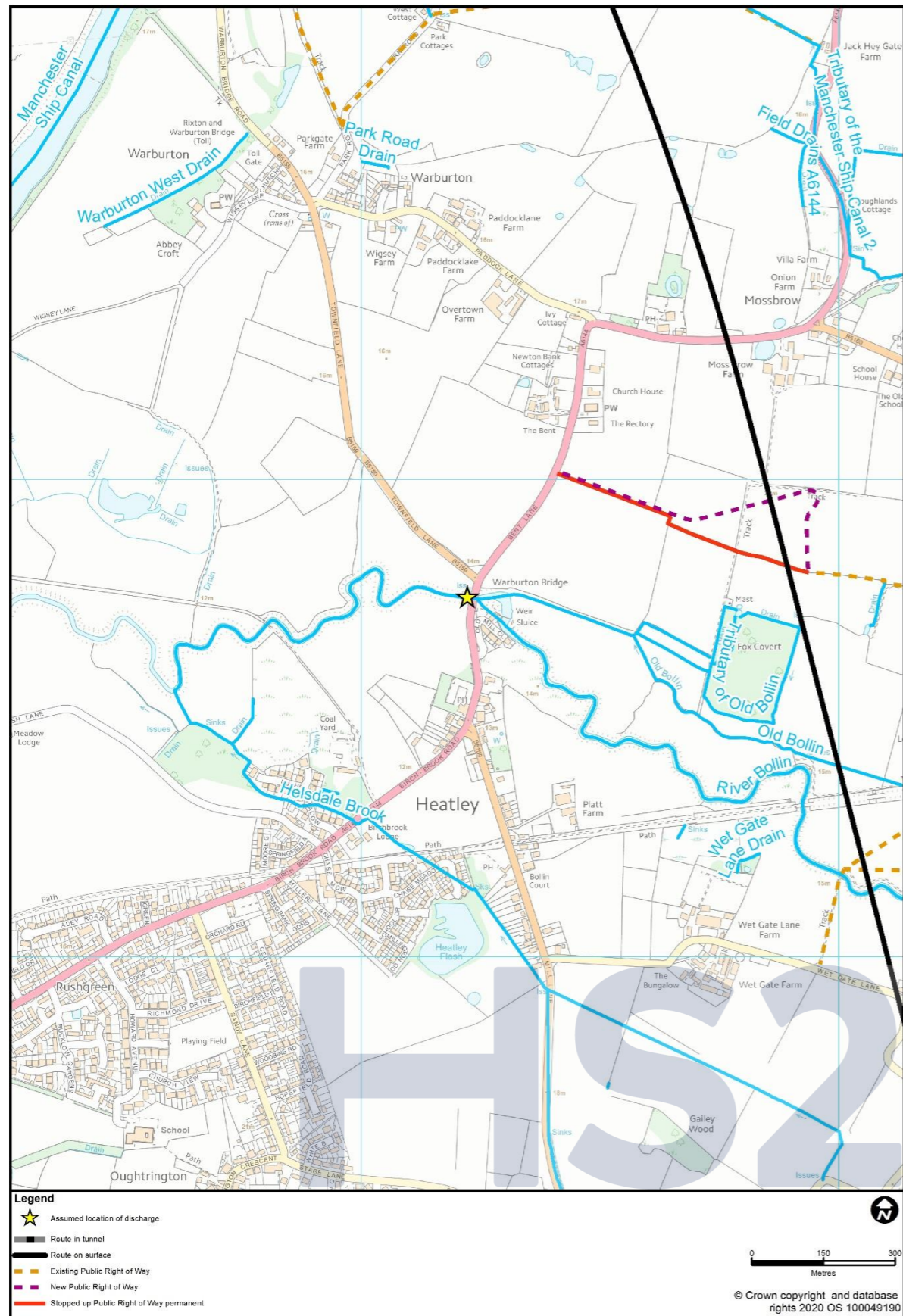
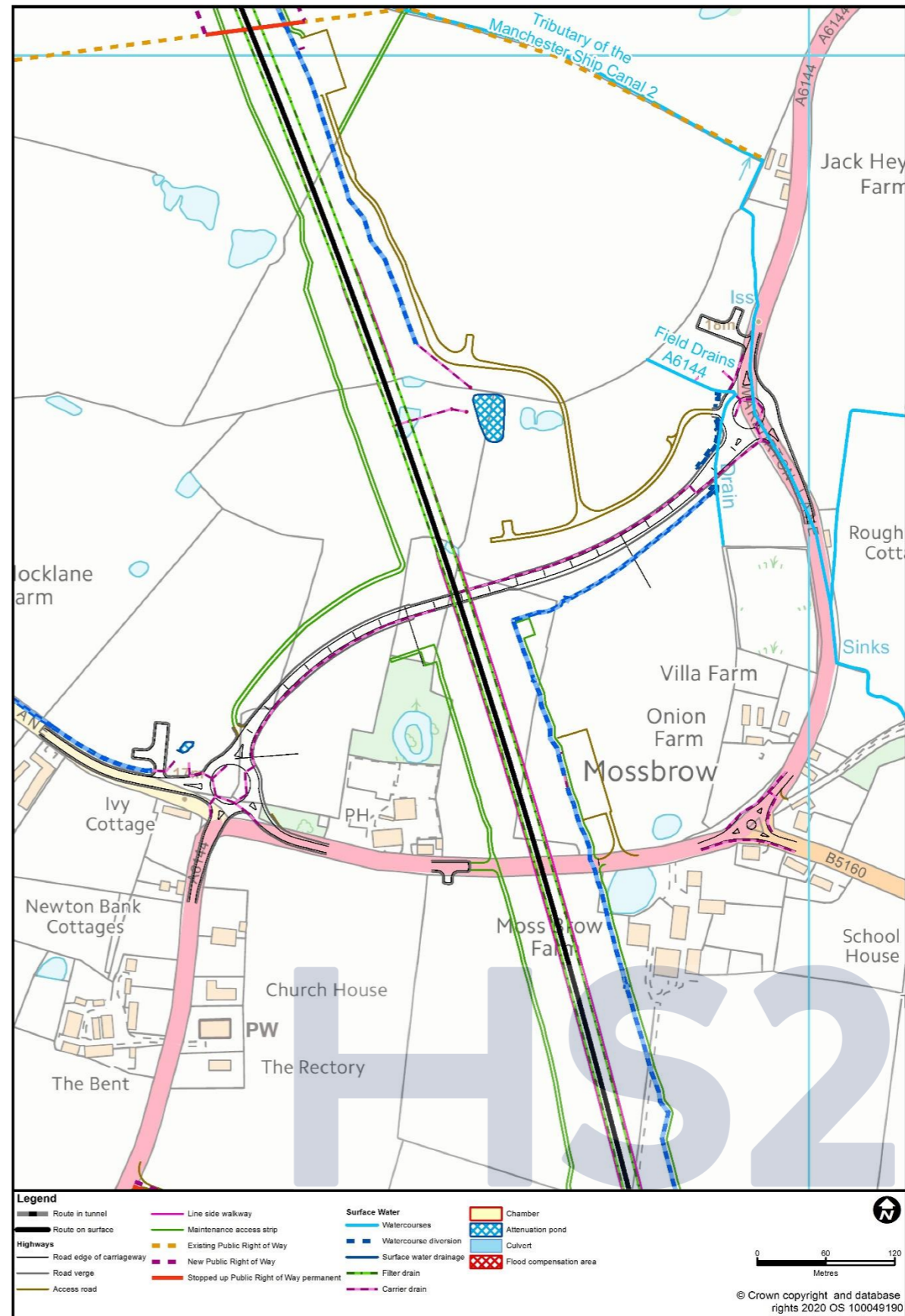


Figure 4: A6144 Paddock Lane realignment



Routine runoff pollution risk

A6144 Paddock Lane

- 5.3.3 The modification to the A6144 Paddock Lane between Warburton and Mossbrow involves the realignment of the carriageway along a total length of approximately 540m via embankments and an overbridge over the route of the Proposed Scheme at grade. The existing highway drainage comprises of kerbside linear gully drains, which is also proposed for the road realignment. Highway runoff will be attenuated in two attenuation ponds on either side of the overbridge; the pond to the west of the bridge is proposed to outfall to the existing drainage network, and the pond to the east is proposed to outfall to a drainage ditch, named Field Drains A6144. Since flow in Field Drains A6144 is expected to be low, a groundwater assessment has been carried out.
- 5.3.4 The groundwater 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 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.

Highways spillage risk assessment

- 5.3.5 The evaluation of spillage risk for Bent Lane outfall 1 is presented in Table 5⁶. 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 Bent Lane – outfall 1

	No junction	Notes
Water body type	Surface	
Length of road draining to outfall (km)	0.58	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)	3,313	The highest traffic flow (AADT two way) along the whole road was selected which represents a conservative approach.
% HGV	3	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	0.00001	This represents the total annual probability of a spillage.
Risk of pollution incident	0.00000	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)	340,692	

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>.