Haweswater Aqueduct Resilience Programme

Proposed Marl Hill Section - EIA Scoping Report

October 2019

United Utilities

Haweswater Aqueduct Resilience Programme

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1. Introduction

1.1 Background

1) Jacobs has been commissioned by United Utilities plc to prepare an Environmental Impact Assessment (EIA) Scoping Report to inform the scope and content of an EIA for the proposed replacement of a tunnel section of the Haweswater Aqueduct in Lancashire. The proposed development is known as the *Proposed Marl Hill Section* and comprises the replacement of approximately 3.8 km of existing aqueduct.

2) The Proposed Marl Hill Section is a single development which forms part of the broader Haweswater Aqueduct Resilience Programme (*the Proposed Programme of Works).* The Proposed Marl Hill Section is necessary to enhance the resilience of the Haweswater Aqueduct, an essential part of United Utilities' water supply network in the North West region. Over two million United Utilities customers will benefit from the Proposed Marl Hill Section through a more resilient supply of clean drinking water.

3) The existing 110 km Haweswater Aqueduct was designed in the 1930s and construction was completed in 1955. It takes raw water from Haweswater Reservoir in the Lake District National Park along a 16 km section of the aqueduct to Watchgate Water Treatment Works (WTW) for treatment. From Watchgate WTW the aqueduct conveys treated water to customers in Greater Manchester, Cumbria and Lancashire through service reservoirs and water mains which branch off the main aqueduct.

4) The aqueduct comprises five unpressurised single line tunnels and conduit sections (generally 2.6 m internal diameter) in addition to multi-line sections.[1] The flow of water along the entire length of the aqueduct is achieved under the influence of gravity; there are no energy-consuming pumps involved in supplying the water from north to south. Out of the total 110 km length of the aqueduct, the Proposed Programme of Works on the single line sections accounts for just under half this distance, about 53 km.

5) The proposed baseline solution is to provide a full replacement of the five single line tunnel sections as illustrated in Figure 1.1. The existing single line tunnel sections are connected via transition well structures to multi-line siphons crossing several major valleys along the route. It is the intention to retain the existing multi-line siphons and, where possible, the associated well structures which are housed within valve house buildings.

6) The preliminary routing for the replacement sections is offset from but follows the existing Haweswater Aqueduct corridor to minimise the length of new tunnel and associated hydraulic losses, thereby enabling the continued transfer of flow by gravity.

1.2 Purpose of the Report

7) This document is an EIA Scoping Report prepared in support of a formal Scoping Request made by United Utilities plc to Ribble Valley Borough Council. The Scoping Request is made under Regulation 15 of the 2017 EIA Regulations[2] and relates to a specific section of the Proposed Programme of Works (*the Proposed Marl Hill Section*) within Ribble Valley Borough Council's administrative area.

8) The Scoping Report aims to provide the information necessary to accompany such a request, and to inform Ribble Valley Borough Council when considering its Scoping Opinion in consultation with statutory and non-statutory stakeholders.

9) In total five Scoping Reports (corresponding with the five sections of replacement single line tunnelled structures) are being submitted as part of Scoping Requests to the seven local planning authorities in whose areas the Proposed Programme of Works is located, as follows:

- *The Proposed Docker Section*: South Lakeland District Council
- *The Proposed Swarther Section*: South Lakeland District Council and Yorkshire Dales National Park Authority
- *The Proposed Bowland Section*: Lancaster City Council and Ribble Valley Borough Council
- *The Proposed Marl Hill Section*: Ribble Valley Borough Council

[1] The multi-line sections of the existing Haweswater Aqueduct comprise four parallel pressurised pipes referred to as 'siphons', each of which is around 1.6 m internal diameter.
[2] Statutory Instrument 2017 No. 571 The Town and Country Planning (Environmental Impact Assessment) Regulations 2017

- *The Proposed Haslingden and Walmersley Section*: Hyndburn Borough Council, Rossendale Borough Council and Bury Metropolitan Borough Council.

10) These sections will predominately consist of tunnelled structures of a minimum three metres (m) external diameter to be constructed below ground level. (At present a maximum internal diameter of approximately 3.6 m is anticipated.) On the Proposed Docker and Swarther sections the design proposals comprise alternative options to build up to four pipes of approximately 1.6 m internal diameter constructed using open-cut methods at ground level along either all (Proposed Docker Section) or some (Proposed Swarther Section) of the new aqueduct sections.

11) The approach to the EIA scoping for the Proposed Marl Hill Section is described further in Chapter 5.

1.3 United Utilities

12) United Utilities' is a FTSE 100 company whose activities span the north-west region of England as shown in Figure 1.2. The company abstracts water from a range of different sources, but predominantly from reservoirs in the Lake District and the Pennines, and also from Lake Vyrnwy in Wales. The remainder of customers' supplies are taken from rivers, boreholes and streams across the region. Of the 1,700 million litres that are supplied to customers every day, well over half is from Cumbria and Wales. The two biggest reservoirs are Thirlmere and Haweswater in Cumbria. Haweswater typically holds more than 84,800 million litres of water - equivalent to around 33,900 Olympic swimming pools.

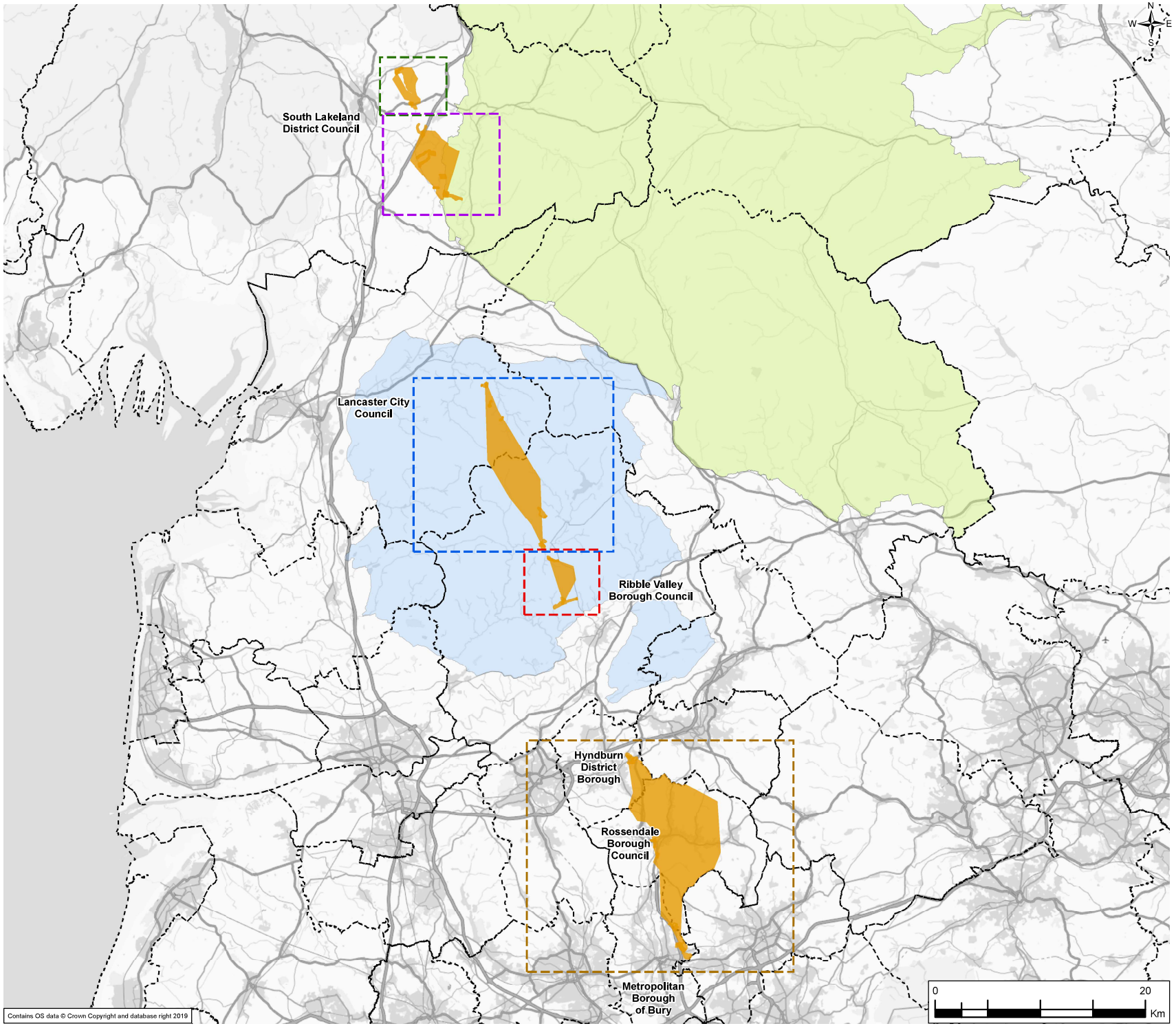
Figure 1.2: United Utilities provides water and wastewater services across the north-west region

1.4 Structure of the Scoping Report

13) This report is divided into eighteen chapters. Following this introduction, the report is structured as follows:

- Chapter 2 describes the Haweswater Aqueduct Resilience Programme, including the need for the Proposed Programme of Works, the regulatory framework governing EIA applications, and a description of alternative schemes to the proposed replacement of single line sections on the aqueduct
- Chapter 3 describes the general approached to the design of the Proposed Programme of Works, summarises the scope of the Proposed Marl Hill Section, and presents a provisional construction programme
- Chapter 4 explains the proposed approach to the EIA and planning applications, reflecting the fact that the Proposed Programme of Works comprises five distinct engineering components extending across seven planning authorities
- Chapter 5 summarises the approach to EIA scoping of the Proposed Marl Hill Section
- Chapters 6-18 address each of the environmental topics within the proposed ES, describing the nature and scope of proposed EIA activities, and highlighting some of the key environmental assets, resources and constraints that will be considered during the environmental assessment. There is a scoping overview of each of the EIA topic areas, summarising baseline conditions, the regulatory and policy framework, the potential significant effects of the Proposed Marl Hill Section, EIA methodology and how the outcome of the EIA will be presented in the ES.

FIGURE 1.1



Legend

- Indicative Development Envelope Boundary
- Proposed Docker Section
- Proposed Swarther Section
- Proposed Bowland Section
- Proposed Marl Hill Section
- Proposed Haslingden and Walmersley Section
- Planning Authority Boundary

Constraints

- Yorkshire Dales National Park Boundary
- Forest of Bowland Area of Outstanding Natural Beauty

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2. The Proposed Programme of Works

2.1 Introduction

14) The following chapter summarises the need for the Proposed Programme of Works, and explains the regulatory framework within which the Proposed Programme of Works is being delivered. There is a summary of the alternative options considered prior to adoption of the replacement line sections as the preferred solution.

2.2 Need for the Proposed Programme of Works

15) In the early 2000s United Utilities began planning major investment, which spanned over ten years, to ultimately enable the Haweswater Aqueduct to be taken out of service for the first time in over 60 years. The aim was to identify any future service risk to customers supplied by this ageing asset.

16) To carry out a detailed inspection on the Haweswater Aqueduct, several major steps had to be taken including the £250 million construction of the West East Link Main (WELM), completed in 2011. The WELM, along with other activities such as upgrading Lostock Water Treatment Works to increase flow capacity, made it possible to take the Haweswater Aqueduct out of service (referred to as an *outage*) in 2013. A subsequent outage in 2016 allowed for more detailed investigations and some minor, targeted repairs.

17) Arranging and implementing outages on the aqueduct requires many months of planning, and the outages are very limited in terms of allowable duration (only a month or so) and the time of year they can be delivered (normally October). These tight constraints limit how much work can be undertaken during each aqueduct outage. It is not possible to deliver the Proposed Programme of Works during an outage because the available timescales are too short.

18) The data collected from the inspections in 2013 and 2016 uncovered areas of concern in the single line sections of aqueduct relating to both future water supply and water quality risks. It is anticipated that the condition of these single line sections will continue to deteriorate, and a solution is required to address the risks to water supply and water quality. The company has therefore been looking at different solutions to mitigate these risks, including repairs to the existing asset, and concluded that replacement of the single line sections was the best option.

2.3 Need for the Marl Hill Section

19) The need for the Marl Hill Section is driven by the same need as the overall Proposed Programme of Works i.e. there is a requirement to replace part of an ageing strategic asset to secure a major water supply serving over two million people, and to mitigate potential risks to drinking water quality.

2.4 Regulatory Framework

20) As a statutory water services undertaker, United Utilities serves its customers, operates and maintains its assets, and invests in new infrastructure within a strict regulatory framework. The Office of Water Services, or Ofwat, is the statutory body responsible for economic regulation of the privatised water and sewerage industry in England and Wales. The Drinking Water Inspectorate (DWI) is the independent drinking water regulator serving England and Wales. The DWI is responsible for ensuring that water companies supply safe drinking water that is acceptable to consumers and meets the relevant legal standards. The Environment Agency, Natural England and other statutory bodies monitor the environmental performance of the company, for example, in relation to discharges of treated wastewater to watercourses, abstraction of water and the management of designated wildlife habitats and species across its substantial landholdings in the North West. Additionally, United Utilities, as one of the biggest landowners in the North West, has representation on or reports into many local non-statutory bodies with interests in the protection and enhancement of natural assets and community amenity.

21) The proposed replacement sections of the Haweswater Aqueduct Resilience Programme comprise one of the company's largest ever programme of works. The selection of the Proposed Programme of Works as the preferred solution for improving the resilience of the aqueduct has been subject to detailed financial modelling, customer surveys and engineering optioneering over the last several years.

2.5 Consideration of Alternatives

22) The EIA process provides an opportunity to describe the design evolution of a proposed development as well as consideration of any alternative development options, including specifically considering the different potential environmental impacts of those options, before a final decision is taken on the design. In accordance with the EIA Regulations, the ES will describe alternatives that were considered by the applicant.

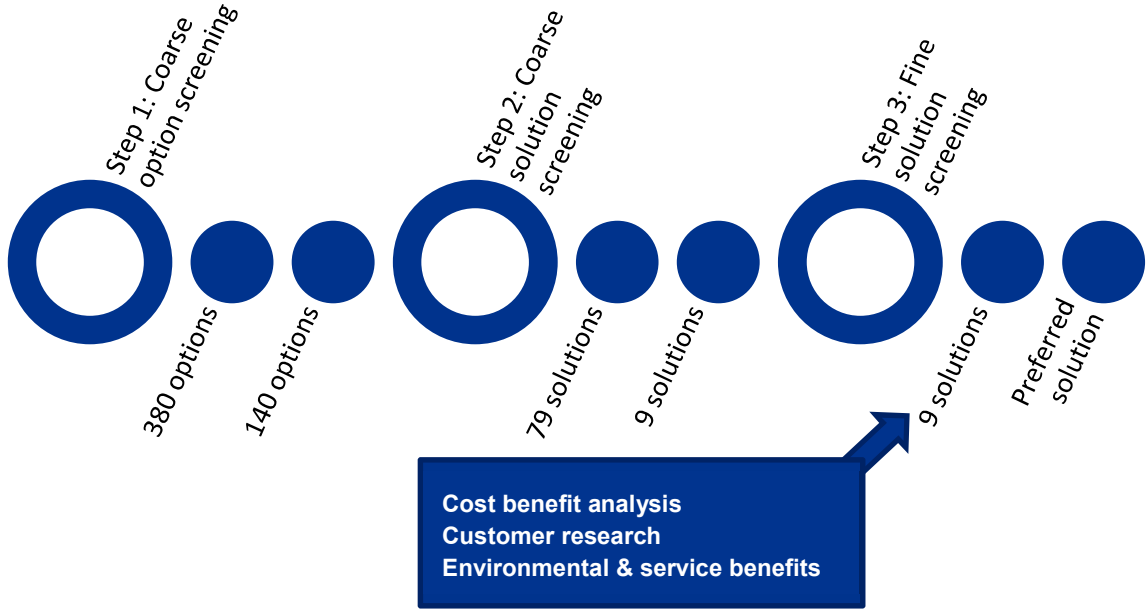
23) During 2017 United Utilities undertook an extensive process to identify and assess a full range of options to provide a reduction in the risk to customer supplies. These options were appraised against cost, environmental and technical considerations, and additionally a range of options were tested through extensive customer and stakeholder engagement. This section summarises the approach to how alternative options were considered.

24) The Proposed Programme of Works was chosen as the preferred baseline solution following an exhaustive three stage optioneering exercise which considered many potential combinations of engineering and operational solutions. The optioneering process followed three steps:

- Coarse option screening
- Coarse solution screening
- Fine solution screening.

25) This process involved taking approximately 380 unconstrained options to the preferred solution, as illustrated in Figure 2.1.

Figure 2.1: Three step optioneering process to develop a preferred solution



26) *Coarse option screening* looked to remove unviable options through the following three criteria:

- Technical feasibility – Options were reviewed in respect of whether the option will be technically possible and buildable in AMP7/8[3]
- Statutory/ environmental feasibility – Options were reviewed to evaluate the likelihood of permission being granted for the works to be constructed. United Utilities considered whether each proposed option had the potential to impact on important designated sites such as Special Areas of Conservation (SAC)

[3] Asset Management Plans (AMPs) are regulated business and investment plans produced by all water utility companies on a five yearly cycle. AMP 7 and AMP8 are United Utilities' next regulated business cycle scheduled for 2020 through to 2024 and 2025 to 2030 respectively.

- Addressing the need - An assessment was made of the impact that the option could have in supporting the need for improving the resilience of the Haweswater Aqueduct's supply through Cumbria and Lancashire and into Greater Manchester.

27) *Coarse solution filtering* grouped options into solutions, calculated simplified bill impacts, assessed risk reduction and screened out solutions using a dominance criterion (i.e. solutions with lower risk reduction for higher bill impact were removed).

28) *Fine solution filtering* of the options considered Ofwat's resilience principles, most notably: 'resilience in the round' (Principle 1); 'Naturally resilient' (Principle 2); 'Customer engagement' (Principle 3); 'Broad option set' (Principle 4); 'Best value solution' (Principle 5).

29) The approach to Robust Decision Making (RDM) was to consider three main areas to inform the selection of a preferred solution that provides best value for customers. The three areas were as follows:

- Customer engagement: focused customer research to understand customer preferences for risk reduction and associated costs via the impact on their bills
- Cost benefit assessment (CBA): a detailed CBA using specific and standard economic metrics
- Multi-criteria Decision Analysis: a wider analysis looking at resilience in the round covering metrics beyond those provided by customers and included within the CBA. The five 'Decision Metrics' used in the multi-criteria analysis were:
  - Bill Impact
  - Economic Impact
  - Resilience Risk
  - Environmental Impact
  - Willingness to pay benefit.

30) The five solutions presented to customers as part of the fine filtering process are presented in Table 2.1. An additional four solutions, informed by customer preference and forming the nine referred to above, were tested in the CBA and multi-criteria analysis. When applying RDM techniques of sensitivity and weighting to the decision-making criteria, Solution D emerged as the most beneficial across the wide range of sensitivity tests.

Table 2.1: Outcome of the Robust Decision Making approach

Solution	Description	Evaluation/Reasoning
A	Volumetric (new and / or modified alternative supply) and targeted repairs of the Haslingden and Walmersley Section (with a new and / or modified treatment installation).	Unrepaired sections of Haslingden and Walmersley and all upstream sections continue to deteriorate with associated risk to quality and supply. Insufficient risk reduction to water quality and risk of supply interruptions.
B	Replacement of the Haslingden and Walmersley Section and UV/Metals Treatment (new and / or modified treatment installations).	Unrepaired upstream sections continue to deteriorate with associated risks to supply. Insufficient risk reduction to water quality and risk of supply interruptions.
C	Turn Haweswater Aqueduct to raw water and provide three new and / or modified treatment installations at strategic supply points. Solution included new and / or modified	Solution included new and / or modified alternative supplies and new and / or modified service reservoirs – Addresses quality issues however all sections continue to deteriorate with associated risk to supply.

Solution	Description	Evaluation/Reasoning
	alternative supplies and new and / or modified service reservoirs.	
D (Preferred Solution)	**Replacement of all single line Haweswater Aqueduct sections.**	**Addresses the risk to water quality and of supply interruptions.**
E	Volumetric (new and / or modified alternative supplies and new and / or modified treatment installations) and replacement of all single line HA aqueduct sections.	Addresses the risk to water quality and of supply interruptions but significant increase in bill impact to achieve nominal increase in risk reduction compared to preferred Solution D.
F	Replacement of the Haslingden and Walmersley Section, conversion to raw water aqueduct and provide 3 new and / or modified treatment installations at strategic supply points.	Addresses quality issues however, sections not replaced continue to deteriorate with associated risk to supply. Greater cost and less risk reduction than the preferred Solution D.
G	Haweswater Aqueduct volumetric (new and / or modified alternative supply) and lining of all single line aqueduct sections.	Addresses quality and supply issues. Significant increase in bill impact and lesser risk reduction compared to preferred Solution D. Thickness of lining reduces diameter and capacity of Haweswater Aqueduct.
H	Haweswater Aqueduct volumetric (new and / or modified alternative supply), targeted repair of all single line aqueduct sections and conversion to raw water aqueduct	Addresses quality issues however unrepaired sections continue to deteriorate with associated risk to supply which is largely mitigated by the new sources. Greater cost and less risk reduction than the preferred Solution D.
I	Over-pumping and Lining of all single line Haweswater Aqueduct sections.	Addresses quality and supply issues. Significant increase in bill impact and lesser risk reduction compared to preferred Solution D. Thickness of lining reduces diameter and capacity of the Haweswater Aqueduct. Insufficient risk reduction as preferred by customers.

31) Solution D, the preferred solution, comprises a full replacement of each single line section of the existing aqueduct conveying drinking water from Watchgate WTW (Cumbria) downstream to Woodgate Hill WTW (Bury).

32) The ES will summarise the design evolution of the Proposed Marl Hill Section and the way in which any comments received during consultation on the Proposed Marl Hill Section have influenced the decision-making.

3. The Proposed Marl Hill Section

3.1 Introduction

33) The following chapter describes how the Proposed Marl Hill Section could be constructed and operated based on current design options, and provides a general description of construction techniques. An indicative construction and commissioning programme is also provided.

3.2 Indicative Development Envelope

34) Figure 3.1 and Figure 3.2 show the land that presently falls within the indicative 'worst case' (using a Rochdale Envelope approach)[4] development envelope for the Proposed Marl Hill Section. It is important to note that Figures 3.1 and 3.2 are not intended to imply that this is the total development area. Instead it shows indicative areas of land within which construction- and operation-phase activities might take place.

35) These indicative areas are based on reasonable worst-case assumptions (based on professional judgment and experience of other similar projects) concerning the nature and scope of both construction phase and operation activities for the Proposed Marl Hill Section. At this early stage of the design process it encourages a robust worst case which will be assessed as part of the EIA, including in the siting of construction activities in response to potential environmental constraints which may be identified in later stages of the EIA, and in response to feedback from statutory bodies, non-governmental organisations (NGOs) and local communities.

36) As the design for the Proposed Marl Hill Section progresses, and the outcomes of the EIA process start to emerge, it is anticipated that the current indicative worst-case development envelopes will be refined and reduced in size. It is important to note that the indicative tunnel alignment shown in Figure 3.1 represents where the replacement single line tunnels for the Proposed Marl Hill Section could be constructed *below ground level*. In these locations, there would generally be no construction activities or development at the surface.

3.3 The Existing Asset

37) The total length of the existing Marl Hill Section is 4.3 km, comprising:

- Marl Hill Conduit (0.5 km)
- Marl Hill Tunnel (3.8 km).

38) The Hodder multi-line siphon is located to the north of the Marl Hill Section, and the Ribblesdale multi-line siphon to the south. At its deepest point (the Marl Hill Tunnel) the single line aqueduct is 127 m below ground level.

3.4 General Approach to Design

39) United Utilities started the initial design in 2018 and commenced ground investigation (GI) and environmental surveys in 2019. It is currently proposed that the first planning applications to local planning authorities will be submitted in late 2020. Construction of the Proposed Marl Hill Section could start in 2024 and extend over a period of approximately 18 months with completion in 2025, followed by reinstatement. Completion of the overall Proposed Programme of Works is anticipated in 2028, with testing and reinstatement extending into the following year. There are various technical requirements that will influence its design, including:

- A need for the replacement aqueduct sections to be connected to retained sections of pipework
- To maintain a gravity flow along its entire length and, ultimately, along the full length of the Haweswater Aqueduct
- A need for the Proposed Marl Hill Section to be designed, built and operated safely
- A requirement for an aqueduct outage to enable connection of the newly-built infrastructure. This is a considerable undertaking and one that could only be delivered over a short timescale, potentially four weeks during the month of October

[4] The Rochdale Envelope approach is a method [of providing] flexibility in design options where details of the whole project are not available…while ensuring the impacts of the final development are fully assessed during the EIA. https://transform.iema.net/article/using-rochdale-envelope (accessed 9 October 2019)

- The replacement sections being delivered over five distinct sections.

40) Extensive site investigations will be undertaken along the route of the Proposed Programme of Works in 2019 and 2020 to characterise the underlying geology and ground conditions. Some boreholes may be drilled to considerable depths below ground level, reflecting the depth at which tunnel sections of the aqueduct would be constructed. To supplement intrusive investigations, geophysical surveys will be carried out and geotechnical models will be constructed to describe the ground conditions. Areas where there is believed to be high ground water pressure will also be identified.

3.5 Proposed Marl Hill Section

41) The Proposed Marl Hill Section would be constructed in tunnel below ground level over approximately 4.1 km, with a small additional distance (approximately 200 m) of open-cut trenching at the surface to transition from the new tunnel to the retained multi-line sections. Once the new section of aqueduct has been constructed, the replaced section of aqueduct would be decommissioned. Current thinking on approaches to decommissioning are presented below. The new asset would be tested and commissioned before the existing sections of aqueduct are decommissioned.

42) It should be noted that the engineering design and construction techniques for the Proposed Marl Hill Section are under development. All scheme descriptions and dimensions should therefore be viewed as 'work in progress', and may well change in response to ongoing design development, consultations with external stakeholders, including local people, and outcomes from the EIA process.

43) The indicative development envelope for surface-based activities associated with the Proposed Marl Hill Section encompasses some 53 ha of predominantly agricultural land. The purpose of the indicative development envelope at the scoping stage is to provide design flexibility until further environmental assessment, consultation and engineering design activities have been undertaken.

3.5.1 Enabling Works

44) Enabling works would include fencing off working areas. This may consist of stock-proof post and wire fencing along the short open-cut working widths and higher 'heras' type fencing around compound areas. Access points as agreed with the landowner would be provided for crossing working widths using gates. Working areas would be topsoil and subsoil stripped, and drainage installed where required. Where unavoidable, trees would be felled and vegetation would be cleared. Compounds and laydown areas would be constructed and safe access and egress to and from the sites would be provided via the local road network.

3.5.2 Haulage Routes on the Public Highway

45) Significant amounts of construction materials would need to be transported by road to the compounds and laydown areas from the public highway. Accesses onto and off the public highway would be designed to highway authority engineering and safety standards. Where practicable, access points would make use of existing field gates, which would be improved or enlarged where necessary to meet appropriate highway safety requirements.

46) Vehicles would travel along the working width of any open-cut pipeline sections after leaving the local road network and entering construction areas. This would serve to minimise the number of vehicle movements on the local road network.

47) Surplus excavated material from open-cut / tunnelling operations (depending on the selected option on the Proposed Marl Hill Section) may need to be transported by road to final licensed destinations which can accept material of this nature.

48) Traffic management plans and potential highway improvements (e.g. temporary haul roads, passing places, etc.) would be developed in conjunction with highways authorities and local communities to minimise potential conflicts with other road users and enable the safe and timely movement of HGVs and other construction vehicles along local roads, prior to joining the strategic road network.

49) The decommissioning phase of the existing asset and the commissioning and operational phases of the new aqueduct would give rise to very low volumes of traffic. Further details surrounding approaches to the transport planning study are presented in Chapter 16.

3.5.3 Public Rights of Way

50) Access along public rights of way (PRoW) may need to be temporarily suspended and, where practicable, diverted to enable users to continue safely accessing footpaths, bridleways etc. Alternatively, and only when safe to do so, a banksman would be present to assist PRoW users in crossing the construction easement.

3.5.4 Temporary Access Tracks

51) Access tracks would be constructed from the public highway to laydown areas and construction compounds. Access tracks would normally be in the order of 3 m wide and would be constructed along a soil-stripped and vegetation-cleared easement comprising a layer of crushed stone. Temporary drainage may need to be installed alongside or across the access tracks to maintain existing drainage lines, and the tracks would be aligned to minimise flood risk within the development envelopes or local watercourses.

52) Proposed points of access to and from the public highway are subject to further design development and would need to be agreed with the relevant highways authority. Accesses where the compound area is adjacent to the highway are not indicated on the plans but these too would need to be developed with the agreement of the highways authority.

3.5.5 Tunnel Boring Construction Option

Launch and Reception Tunnel Facilities

53) Tunnel sections would be constructed using tunnel boring machines (TBM); the type of TBM and the method of conveying material from the tunnel face to the surface would be varied to suit the expected ground conditions of the drives.

54) Tunnels would be driven from launch locations with above-ground temporary works to support the operation and maintenance of the TBMs. The above-ground activities may require 24 hours per day working. The temporary construction works areas would provide an area for plant, machinery, equipment, welfare, offices and vehicle movements. Surplus excavated material from the tunnelling works would be removed and treated as required at the launch location, while tunnel segments and consumables would enter the tunnel at this location. Surplus material would be stored on site prior to removal off-site to a licenced facility.

55) Tunnels would be driven to a reception location where the TBM would be removed from the tunnel and dismantled prior to removal from site. Temporary construction works areas would be required to support this operation, but these would be of a smaller scale and reduced duration compared with the launch locations.

56) Launch and reception facilities would be required to access the tunnel for the launch and reception of the TBMs. The size of these facilities would be determined as part of the ongoing design process.

57) If these facilities take the form of shafts, current indications are that these could be of 15 m to 20 m diameter with depths ranging from 15 m to 65 m. Launch and reception facilities can be constructed using a range of techniques and these will be confirmed as the design is developed.

58) Launch and reception access points would have a cover slab fitted on completion of construction and would be backfilled and covered for reinstatement. Surface features in these locations would be limited to access covers.

Surface Management of Tunnel Arisings

59) Arisings from tunnel construction would be brought to the surface and, according to the tunnelling technique, may require some form of processing such as dewatering within the construction areas. While tunnel arisings may be brought to the surface on a 24 hours-per-day basis, surplus materials would be taken off site within agreed hours to minimise effects on local communities. This approach is likely to require the temporary storage of material on-site. Additionally, processing of rock from the tunnel may take place within the indicative development envelopes.

60) Material may require disposal at a suitably licensed destination, such as a quarry undergoing restoration or an operational landfill. Work is presently underway to review options for the destinations of surplus material associated with tunnel construction. A surplus materials management strategy will be developed for the Proposed Marl Hill Section. The surplus materials strategy will need to strike a balance between technical,

highways, commercial, environmental and community constraints; the weighting of these factors may differ between different proposed sections of replacement aqueduct.

3.5.6 Construction Compounds and Laydown Areas

61) Construction compounds are locations within which construction activities would be undertaken. The construction compounds would contain tunnel launch or reception facilities (e.g. vertical tunnel shafts), surplus materials storage areas and de-watering operations. Compounds would also contain generator sets, vehicle parking, site cabins and welfare facilities.

62) Laydown areas are temporary features where pipes and other construction materials are temporarily stored, allowing safe and efficient access to pipework prior to its installation. The locations of proposed indicative construction compounds and laydown areas are shown in Figure 3.1.

63) Temporary site cabins would be brought to site for offices, workshops and stores. The remainder of the compound would be used for construction related activities such as car parking, plant and commercial vehicle storage, material storage areas and traffic circulation routes connecting and servicing these areas.

64) Power supply for the compounds would be via connection with the local electricity network where appropriate or the use of on-site generators. Where required, generators would need to operate 24 hours a day. A water connection would be provided from the nearest suitable connection point or where necessary water bowsers would be provided.

65) Lighting would be required for safety reasons, and where 24-hour working is required. Lights would be located so as to minimise light spill towards adjacent properties and other sensitive locations.

3.5.7 Decommissioning of the Existing Asset

66) Following completion and commissioning of the new aqueduct, sections of the existing aqueduct would be taken out of service. A future maintenance and usage strategy for the redundant sections of aqueduct is being prepared. This strategy would include protection of existing structures above the redundant sections and dealing with any flows arising from the decommissioned aqueduct. To deal with such flows, proposed existing discharge pipework would, where necessary, be supplemented / provided within locations identified within the development envelope boundary.

3.5.8 Above-Ground Installations and Permanent Infrastructure

67) This section describes the key elements of infrastructure which would be constructed to serve the operational aqueduct.

68) For much of the length of the replacement aqueduct there would be no permanent above-ground structures with much of the new sections of aqueduct being located deep below ground level. Stiles or access gates would be provided through field boundaries to enable personnel to undertake future inspections of the aqueduct route.

Valve House Buildings

69) At the end of each replacement section there is a transition from the existing single line sections to the multiple pipes for the siphon sections. These transition points are referred to as well structures. In most cases the existing valve house buildings (which house the well structures) would be reused, however in some locations this would not be possible and a new well structure would be required. The valve house buildings would be single storey and approximately 11 m wide and 12 m long. New valve house buildings would be similar in size and appearance to the existing structures. Photographs of existing valve house buildings in suburban and rural locations are shown in Figures 3.3 and 3.4 below:

Figure 3.3: Typical valve house building – suburban setting

Figure 3.4: Typical valve house building – rural setting

3.5.9 Land reinstatement

70) Land used for temporary compounds and open-cut pipeline construction would be reinstated after completion of construction works with temporary access roads being removed. Where launch and reception facilities (e.g. shafts) are constructed these would be covered and reinstated at ground level.

3.5.10 Easements

71) Operational access along the line of the new Haweswater Aqueduct would be similar to existing. Stiles or access gates would be provided at field boundaries to enable a walk over survey along the route of the aqueduct to take place.

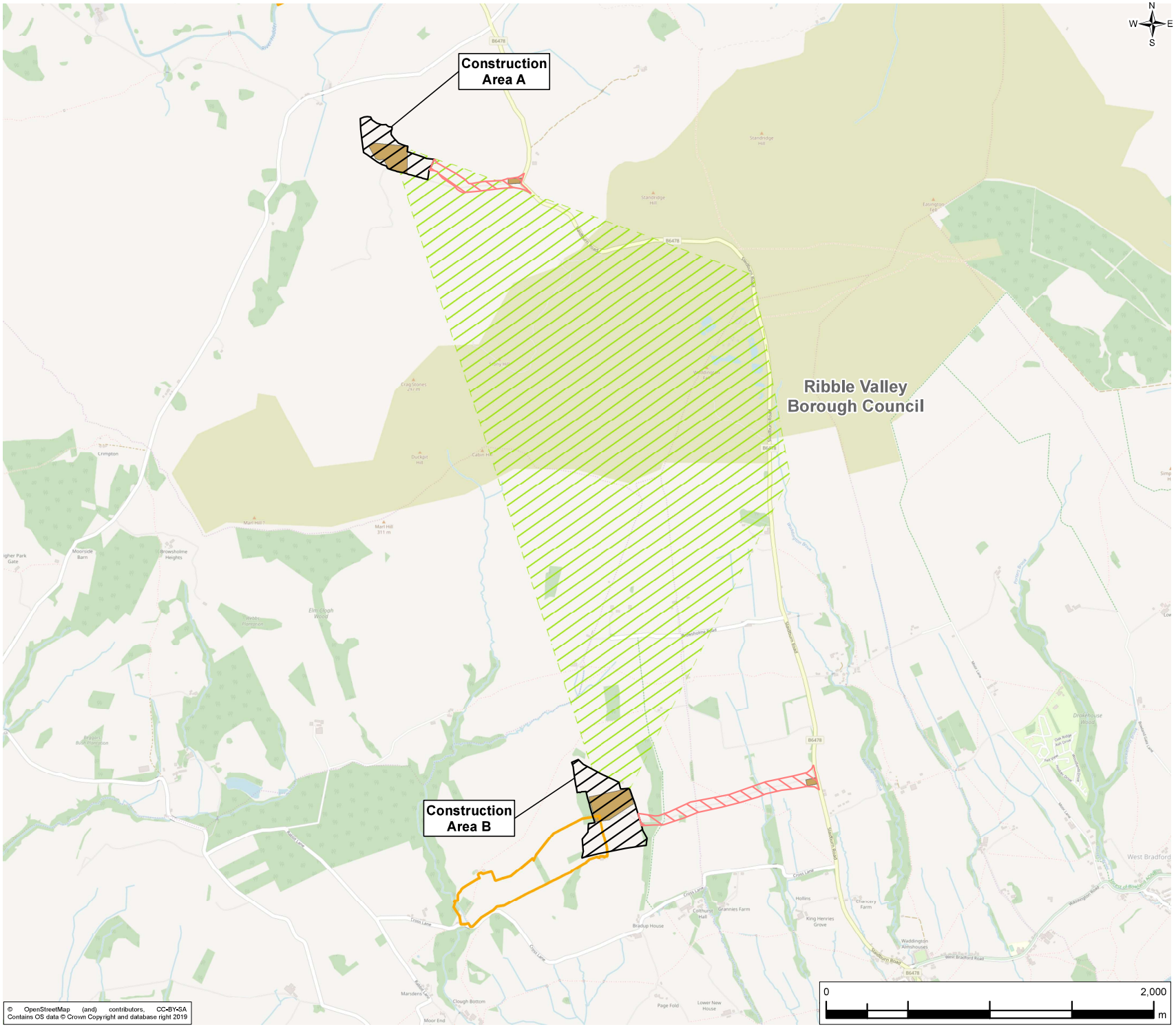
3.6 Construction and Commissioning Programme

72) An indicative construction programme is shown in Figure 3.5 below and presents a high level overview of when proposed construction works might be undertaken, subject to planning permission. Figure 3.5 shows that the Proposed Programme of Works could start in 2023 with enabling works, ultimately reaching completion and commissioning in 2029. The indicative programme provided does not include reinstatement works, which may continue for several years beyond the completion of construction. The dates and durations are indicative and will be developed further as the design progresses.

73) The construction programme would be phased so that some of the proposed new sections of aqueduct could start later and / or be completed earlier than others. Some could be completed prior to the overall indicative construction programme end date in 2028 (noting that decommissioning could extend into 2029).

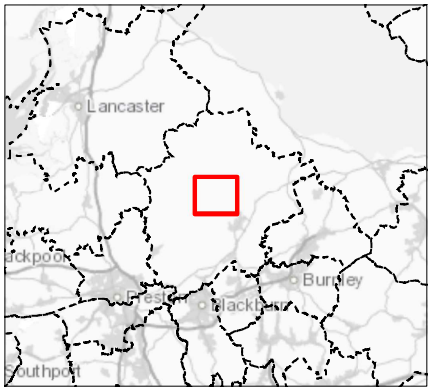
Figure 3.5: Indicative construction programme

FIGURE 3.1



Legend

- Proposed Tunnel Route - Indicative
- Proposed Construction Access - Indicative
- Proposed Construction Compound / Laydown Area - Indicative Development Envelope
- Proposed Indicative Construction Compound / Laydown Area
- Proposed Discharge Pipe - Indicative
- Planning Authority Boundary



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
0	OCT 19	Initial Issue	LT	JM	TA	SH

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Drawing Title: PROPOSED MARL HILL SECTION RIBBLE VALLEY BOROUGH COUNCIL SHEET 1 OF 1

Drawing Status: FINAL

Scale @ A3	1:22,500	DO NOT SCALE
Jacobs No.	B27070CG	
Client No.		
Drawing No.	B27070CG_ESR_03_01	

FIGURE 3.2

Legend

Proposed Marl Hill Section Area Extent

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Project: HAWESWATER AQUEDUCT RESILIENCE PROGRAMME

Drawing Title: INDICATIVE DEVELOPMENT ENVELOPE SHEET LAYOUT PROPOSED MARL HILL SECTION

Drawing Status: FINAL

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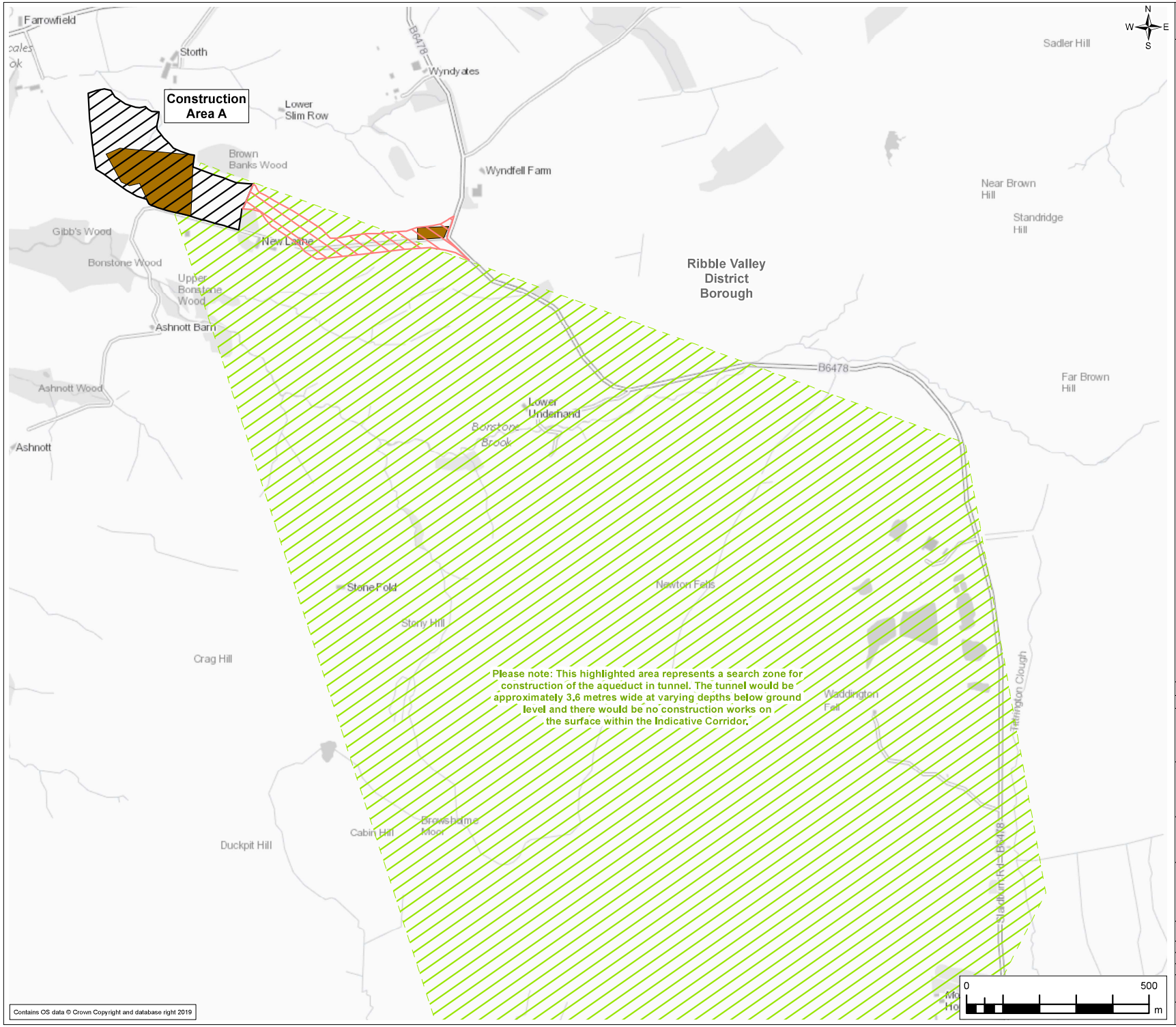
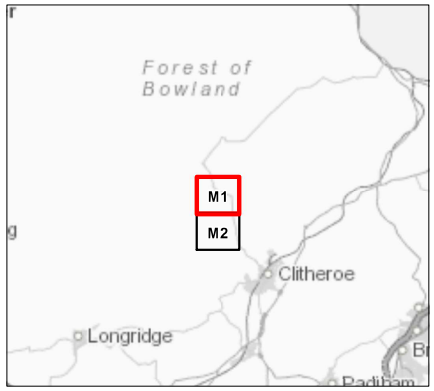


M1

Legend

- Proposed Tunnel Route - Indicative
- Proposed Construction Access - Indicative
- Proposed Construction Compound / Laydown Area - Indicative Development Envelope
- Proposed Indicative Construction Compound / Laydown Area
- Planning Authority Boundary



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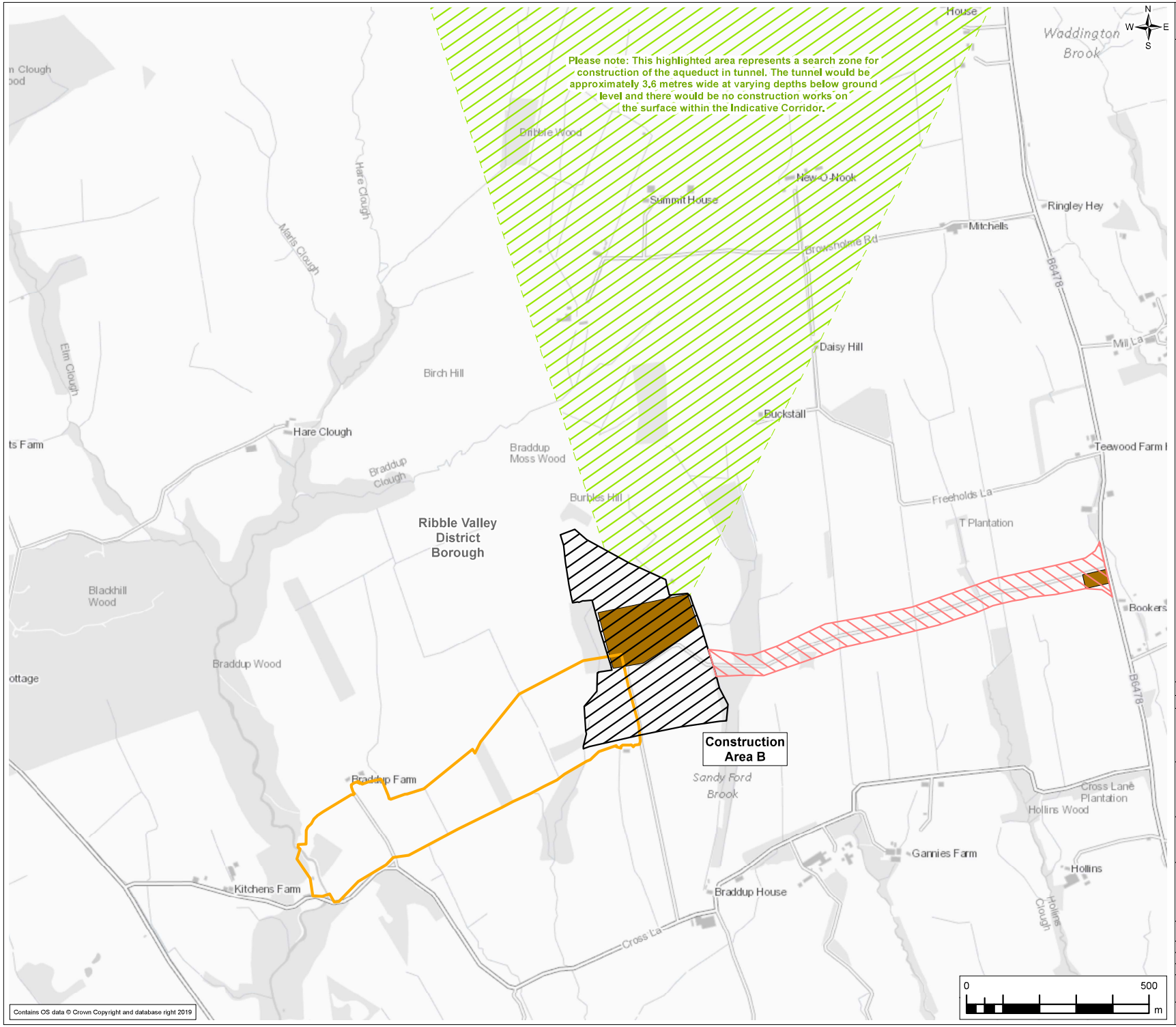
Project: HAWESWATER AQUEDUCT RESILIENCE PROGRAMME

Drawing Title: INDICATIVE DEVELOPMENT ENVELOPE PROPOSED MARL HILL SECTION SHEET 1 OF 2

Drawing Status: FINAL

Scale @ A3	1:10,000	DO NOT SCALE
Jacobs No.	B27070CG	
Client No.		

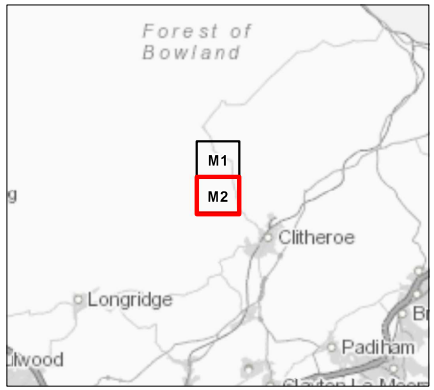
Drawing No. B27070CG_ESR_03_02



M2

Legend

- Proposed Tunnel Route - Indicative
- Proposed Construction Access - Indicative
- Proposed Construction Compound / Laydown Area - Indicative Development Envelope
- Proposed Indicative Construction Compound / Laydown Area
- Proposed Discharge Pipe - Indicative
- Planning Authority Boundary



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Project: HAWESWATER AQUEDUCT RESILIENCE PROGRAMME

Drawing Title: INDICATIVE DEVELOPMENT ENVELOPE PROPOSED MARL HILL SECTION SHEET 2 OF 2

Drawing Status: FINAL

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Client No.		

Drawing No. B27070CG_ESR_03_02

4. Approach to Planning and the Environmental Statement

4.1 Planning Application Approach

74) Through legal advice and consultation with the planning authorities it has been determined that planning consents for the Proposed Programme of Works should be sought under the Town and Country Planning Act 1990 (*TCPA*). It has also been concluded that a single planning application for the Proposed Programme of Works covering all five sections is not appropriate because the five new sections straddle local planning authority boundaries and:

- Can be constructed and operated independently of each other. (Each of the replacement lines within the Programme of Works is intended to deliver an additional level of resilience to the Haweswater Aqueduct, meaning that United Utilities would propose to implement a consented section irrespective of whether planning permission was granted for any of the remaining sections related to the Proposed Programme of Works)
- Do not physically connect with each other, although their combined purpose and effect will be an improvement to the operation and resilience of the existing Haweswater Aqueduct.

75) This approach requires separate planning applications in support of each of the five replacement sections of aqueduct. A planning application for the Proposed Marl Hill Section will therefore be submitted to Ribble Valley Borough Council independently of the planning applications for the other replacement sections of aqueduct.

76) It is intended that each application will be for planning permission in full, including above and below-ground elements of infrastructure and temporary accesses, construction compounds and ancillary working areas.

4.2 Environmental Statement Approach

4.2.1 EIA Screening

77) United Utilities acknowledges that the Proposed Marl Hill Section constitutes EIA Development as defined in Schedule 2 of the EIA Regulations. United Utilities has therefore chosen not to submit an EIA Screening Request to Ribble Valley Borough Council. In turn, therefore, there is no EIA Screening Request associated with the Proposed Marl Hill Section. United Utilities has discussed and agreed this approach with Ribble Valley Borough Council during EIA scoping consultations.

4.2.2 Robust Approach to EIA

78) Whilst the individual sections comprising the Proposed Programme of Works are considered by United Utilities to be standalone 'projects', for the purposes of the EIA Regulations and the assessment of likely significant environmental effects, a robust approach to assessment has been adopted. This approach is as follows:

- Assessment of each individual section alone (so in this case, the Proposed Marl Hill Section)
- Assessment of the Proposed Programme of Works combined (so in this case, the Proposed Marl Hill Section with the other four sections of replacement aqueduct)
- The cumulative effects of the individual section (so in this case, the Proposed Marl Hill Section), with the Proposed Programme of Works combined and other committed developments, as agreed with the determining local planning authority).

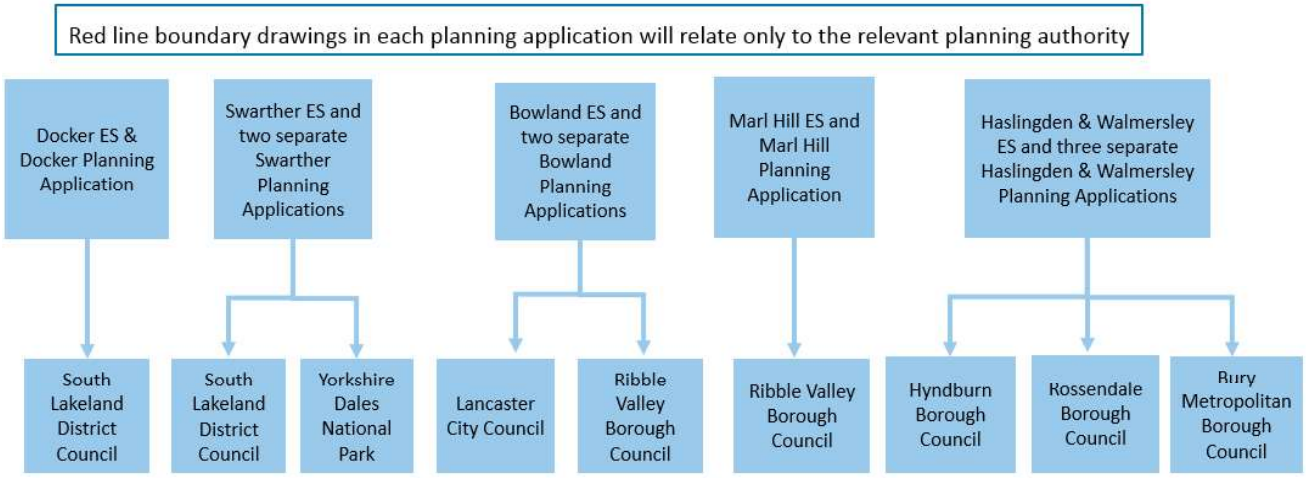
79) As such, an ES will be produced for each of the five replacement aqueduct sections (so five ESs in total). Figure 4.1 summarises the distribution of ESs and planning applications for the five replacement aqueduct sections.

80) This approach to EIA has been adopted to ensure that each section as it relates to the Proposed Programme of Works combined has been assessed.

81) Each ES will also include a cumulative assessment of the other sections along the route of the Proposed Programme of Works. This would mean that the cumulative assessment within each ES would follow the approach described above and set out in more detail below.

82) This approach not only ensures that a robust EIA is undertaken but will also allow the LPAs as the individual decision-makers on the nine planning applications in their respective areas to understand the likely significant effects of the proposals - not only at a local level, but also the cumulative effects of the overall Proposed Programme of Works. It will also assist and inform proposed consultation arrangements and support local engagement. Figure 4.1 illustrates the proposed approach to production of ESs and planning application submissions to the seven planning authorities.

Figure 4.1: Approach to ES and planning application submissions



4.3 Consultation and Engagement Strategy

4.3.1 Local Planning Authorities and Statutory Consultees

83) United Utilities met the seven local planning authorities individually in early 2018, with follow-up meetings in 2019. These meetings outlined the intended planning and ES approach, and there are ongoing discussions with the planning authorities concerning the adoption of the proposed planning approach.

84) It is intended to enter into planning performance agreements (PPA) with the determining authorities to cover the pre-application and determination stages but this arrangement may also extend through to the post-application stage. PPAs are useful in setting out an efficient and transparent process for determining large and / or complex planning applications. They help to secure required resources, encourage joint working between the applicant and the relevant planning authorities, and help to bring together other parties such as statutory consultees. A PPA is agreed voluntarily between the applicant and the local planning authority prior to the application being submitted, and can be a useful focus of pre-application discussions about the issues that will need to be addressed.

85) At a programme level, pre-application advice agreements are in place with Cumbria County Council, Lancashire County Council, Natural England and the Environment Agency in connection with matters relating to their respective statutory functions, such as highways, flood risk and water resources.

86) Working group meetings to include representatives of all the main statutory consultees will be established at appropriate key points during the pre-application and determination phases. This will help to encourage cross-boundary consistency and will support knowledge sharing between officers dealing with the five separate sections of replacement.

4.3.2 Non-Statutory Consultees

87) The planning applications for each of the five sections of replacement aqueduct will be supported by a programme of community and stakeholder consultation. Consultations with local communities and non-statutory bodies will aim to:

- Enable early and effective opportunities to participate in the decision-making process
- Provide an opportunity to express views about the EIA for the Proposed Marl Hill Section and the contents of the ES
- Provide a platform for commenting on the engineering design and construction proposals
- Report back on how their views have been taken into account in design development.

5. Approach to Scoping

5.1 Purpose of Scoping

88) This Scoping Report has been prepared to accompany a request for a Scoping Opinion from Ribble Valley Borough Council in connection with the Proposed Marl Hill Section. It aims to provide the information necessary to accompany such a request and inform Ribble Valley Borough Council in its formal consultations with statutory environmental bodies.

89) Scoping is an important initial stage of the EIA process. The EIA Regulations (Regulation 15 (2)) state that a Scoping Report should provide the following information:

- A plan sufficient to identify the land (refer to Figure 3.1)
- A brief description of the nature and purpose of the development, including its location and technical capacity (Chapters 2 and 3)
- An explanation of the likely significant effects of the development on the environment (provided in each of the technical chapters of the Scoping Report (Chapters 6-18)).
- Such other information or representations as the person making the request may wish to provide or make (provided at points through the Scoping Report).

90) This Scoping Report identifies existing features along the Proposed Marl Hill Section, including important watercourses, residential areas and landscape features. Such features are referred to as the *baseline environment* or *baseline conditions*. Where baseline conditions may alter prior to construction or operation of the Proposed Marl Hill Section, for example where land use trends are affecting the status of a designated ecological site, this is highlighted within the relevant chapter. This Scoping Report then provides information on how the Proposed Marl Hill Section may interact with the baseline environment, and in particular identifies where the proposals may give rise to *likely significant environmental effects*.

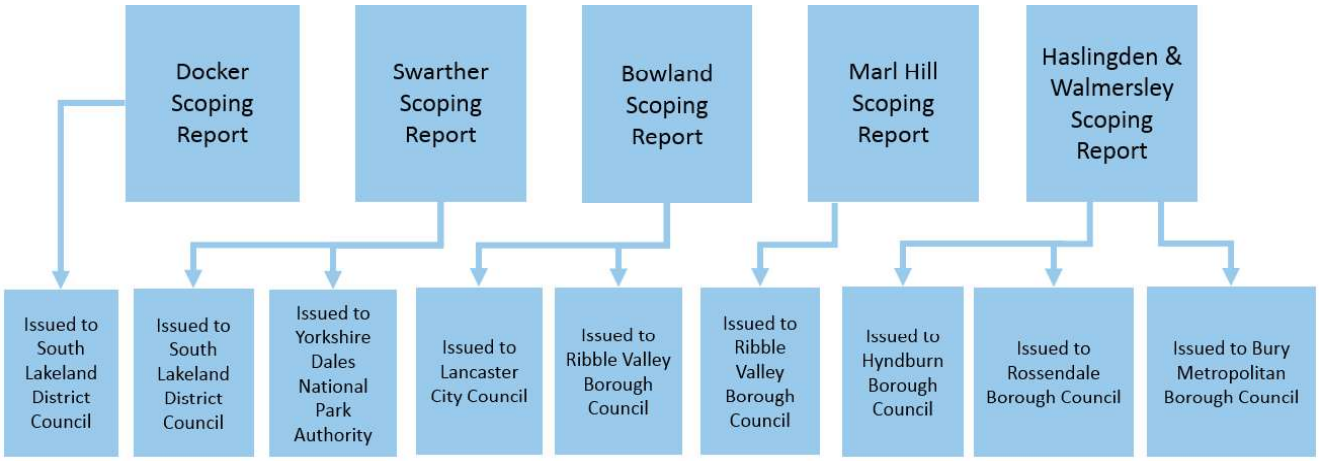
91) Where potential environmental effects are not considered to be significant, perhaps falling below an established threshold, they are generally discounted from the EIA process. This assists in promoting the principles of proportionate EIA, which aims to maintain a focus on likely significant effects only; this keeps the scope of EIA and the size of the subsequent ES to reasonable levels, with an emphasis on issues that are directly relevant to the decision-making process.

5.2 Approach to Scoping

92) The Proposed Programme of Works requires a bespoke approach to the scoping process. This is because of the complexity of dealing with a Proposed Programme of Works which comprises independent civil engineering projects delivered across seven planning authority areas. In addition, however, the ESs for each of the proposed sections will need to be linked with each other because, collectively, they represent the Proposed Programme of Works along the aqueduct. The proposed approach to cumulative effects is described in Section 5.6.

93) Figure 5.1 below illustrates the proposed approach to the structure of the scoping reports across each of the five sections (the Proposed Docker Section, the Proposed Swarther Section, the Proposed Bowland Section, the Proposed Marl Hill Section and the Proposed Haslingden and Walmersley Section) comprising the Proposed Programme of Works together, and the distribution of the five Scoping Reports to each of the seven local planning authorities.

Figure 5.1: Approach to scoping report submissions to planning authorities



5.3 Topic-Specific Scoping

94) Topic-specific scoping has been undertaken by suitably qualified and experienced United Utilities and Jacobs personnel. This Scoping Report for the Proposed Marl Hill Section presents the outcomes of topic-specific scoping activities and confirms the nature and scope of assessment that will be undertaken in the EIA. Each technical section in this Scoping Report summarises the baseline conditions, methodology and deliverables relating to a particular topic.

5.4 Scoping Consultations

5.4.1 Planning Authorities and Statutory Consultees

95) Preliminary meetings with the determining local planning authorities have already taken place to introduce each of the proposed sections and how they relate to the Proposed Programme of Works, explain the need for each of the five sections, and to explore options for how best to manage and co-ordinate pre-application activities for each of the planning applications. Further details are provided in Chapter 4.

5.4.2 Community and Non-statutory Stakeholder Engagement

96) The planning application for the Proposed Marl Hill Section will be supported by a programme of community and stakeholder consultation. Consultation will aim to ensure that the statutory consultation bodies, non-statutory stakeholder organisations and the public are given timely and effective opportunities to participate in the decision-making process.

97) The timing of public consultation events, exhibitions and design freezes will be communicated after Ribble Valley Borough Council has published its Scoping Opinion. The consultation exercise will consult on the preferred option for the Proposed Marl Hill Section and particularly the likely significant effects at a local level. The consultation exercises will also provide clear justification for discounting alternatives and seek views on the preferred option for the Proposed Marl Hill Section and potential mitigation. The consultation programme will allow for time to review and respond to issues raised during consultation, allowing for changes to be incorporated into the design and mitigation process for the Proposed Marl Hill Section, where practicable.

5.5 Assessment Criteria

98) As stated previously, the EIA process is directed towards the assessment of *likely significant effects*. This enables both the scoping process and the subsequent environmental assessment to focus on issues which will be relevant and material to the determination of the planning application for the Proposed Marl Hill Section. It also supports the principles of proportionate EIA, which aim to reduce the volume of unnecessary scope or technical content in an ES; in doing so this assists in making the ES and planning application documents more accessible and legible to interested parties.

99) When considering whether likely environmental effects may be significant or not, assessment criteria are employed to assist in determining whether effects could be above or below defined thresholds. In some

cases, these thresholds are quantitative and are based on recognised numerical standards, for example, noise effects, while others are qualitative and subject to professional opinion, such as landscape effects. In addition, some professional bodies have developed their own guidelines which their members are broadly expected to work to.

100) Within this scoping report, each topic confirms the assessment criteria that have been applied in determining whether potential environmental effects are significant or not. In support of this exercise, some topics have also considered the magnitude of an environmental effect against the value or sensitivity of each asset or resource that is being affected. The outcome of this exercise will be carried forward into the ES.

101) The sensitivity of a receptor is determined by, among other things, its level of designation or protection, its susceptibility to or ability to accommodate change, the availability and efficacy of mitigation measures, and professional judgement. Table 5.1 provides an illustration of how the significance of effects can be assessed by forecasting the magnitude of change and a receptor's sensitivity to that change.

Table 5.1: Forecasting the Significance of Effects

		Value / Sensitivity of Asset / Resource		
		Low	Medium	High
Magnitude of Effect	Very Low	Negligible	Negligible	Minor
	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

102) The threshold between insignificant and significant environmental effects is normally taken to be a 'moderate' effect. The combination of magnitude of effect and value / sensitivity combinations resulting in a potential significant effect are shaded in the table above.

103) Where possible, assessment criteria and the determination of 'significance' in the Scoping Report (and the ES to follow) will reflect nationally-accepted EIA procedures and methods including, but not limited to:

- *Guidance for Ecological Impact Assessment* (CIEEM 2018 as amended)
- *Guidelines for Landscape and Visual Impact Assessment* 3rd Edition (2013)
- ICOMOS guidelines for the assessment of cultural heritage assets
- *Design Manual for Roads and Bridges* (HA 208/07) (2013)
- British Standards relating to noise assessment, such as BS 5228-1:2009 *Code of practice for noise and vibration control on construction and open sites*.

104) Once likely significant adverse effects – both adverse and positive – have been identified in the EIA process, mitigation proposals are developed in the ES to avoid, reduce or offset these likely significant effects. In selected cases adverse environmental effects falling below the 'significant' threshold may also be proposed. Approaches to mitigation are described in Section 5.7.

5.6 Cumulative Effects and Interaction of Effects

105) The EIA Regulations require an applicant to consider the cumulative effects of a proposed scheme with other, reasonably foreseeable, proposals whose environmental effects could act in combination with those described in the ES. For example, two separate developments could both give rise to increased flood risk in a river catchment which, when considered in combination, are more significant than when assessed as individual schemes.

106) The interaction of effects considers different environmental effects associated with a proposed scheme (e.g. traffic, noise, air quality and community severance) acting at the same location or upon the same environmental resource. For example, a local community may experience increased noise levels, severance and traffic congestion during the construction phase of a project.

107) Therefore, and in consultation with stakeholders, the cumulative effects and the interaction of effects of the Proposed Marl Hill Section in conjunction with the other four sections relevant to the Proposed Programme of Works, as well as other committed schemes to be agreed with both planning authorities, will be addressed in the ES.

108) In consultation with the determining local planning authorities and other stakeholders, United Utilities has developed an agreed approach to assessing cumulative effects and the interaction of effects arising from the Proposed Marl Hill Section in conjunction with the other sections comprised within the Proposed Programme of Works, which reflects the local and regional aspects of the proposals.

109) As explained elsewhere in this Scoping Report, the cumulative assessment will consider the likely significant effects of the Proposed Marl Hill Section with the Proposed Programme of Works combined, and then further in combination with other committed developments confirmed to United Utilities by the local planning authorities.

5.7 Mitigation and Environmental Monitoring

110) The EIA Regulations allow for the consideration of available mitigation techniques during the scoping phase to discount likely significant effects which can be mitigated with proven techniques. Due to the early stage of engineering design development, including in relation to the construction, surplus material and road haulage strategies for the Proposed Marl Hill Section, it has not been possible (at this stage in the scoping process) to discount many potential likely significant effects from the EIA scope. As the design of the Proposed Marl Hill Section progresses, it may be possible to de-scope certain areas of work. Any deviation from the proposals in the Scoping Report would only take place in consultation with and with the agreement of Ribble Valley Borough Council and the relevant statutory stakeholders.

111) The ES for the Proposed Marl Hill Section will consider the likely significant adverse and beneficial environmental effects. Mitigation measures to avoid, reduce or eliminate any likely significant adverse effects will be presented in each technical chapter of the ES. Steps taken to avoid or reduce significant adverse effects through design revisions to the Proposed Marl Hill Section – known as embedded mitigation – will be recorded in the ES. The EIA Regulations require authorities to determine procedures for the monitoring of significant adverse effects on the environment, as identified in the ES.

112) The Environmental Statement will present an outline Environmental Management Plan (EMP). The EMP will present initial approaches to protecting the environment, respecting the amenity of local communities, and compliance with environmental legislation. It will also capture mitigation and monitoring commitments which have been presented in the ES. The EMP will comprise a series of volumes as illustrated in Figure 5.2.

Figure 5.2: ES Environmental Management Plan

113) The Environmental Masterplan will collate and map environmental commitments and mitigation proposals for some of the ES topics, such as ecology, landscape and visual, cultural heritage and water environment. The proposals will be mapped onto large scale base plans to indicate where and when (e.g. enabling works, construction phase, operation phase) mitigation proposals should be implemented.

114) The Construction Code of Practice will incorporate a series of documents. It will outline the general construction methodologies to be adopted by the contractor. Environmental control measures and other mitigation measures will be identified to avoid, reduce or offset likely significant effects. The documents making up the Construction Code of Practice will include outline methodologies and strategies along with some preliminary site-specific method statements. Examples could include construction strategies for:

- Pipe laying (open out, directional drill, and slip lining)
- Watercourse crossings using open cut
- Water quality monitoring methodology
- Tunnelling
- Sustainable soil stripping, storage and reinstatement
- Working in floodplain
- Biosecurity management plan
- Traffic management and diversions.

115) The purpose of the Code of Practice will be to provide detailed guidance to enable the planning authority, regulators and the contractor to develop an appropriate system of work that would be employed for construction activities and documented in detailed Method Statements.

116) The information contained within these documents and the subsequent detailed Method Statements would be conveyed to all relevant third party stakeholders for consent/approval as required.

117) In tandem with the Construction Code of Practice and the Environmental Masterplan, the ES would present a schedule of mitigation detailing all the mitigation proposals arising in each chapter. The schedule could act as a basis for forming planning conditions should the Proposed Marl Hill Section received planning consent.

118) Finally, a schedule of environmental monitoring would be developed to indicate the nature and scope of monitoring requirements that would be required to complement and support the mitigation programme. These monitoring requirements could be short-term (for example, water quality monitoring during construction adjacent to a watercourse), or extend well beyond the construction and reinstatement phase, for example in relation to the establishment of landscape planting schemes.

5.8 Programme

119) While it is currently too early to provide a detailed timeline for the Proposed Marl Hill Section and the other proposed sections, a provisional schedule has been prepared for inclusion in the Scoping Report (refer to Figure 3.5). If the Proposed Marl Hill Section receives planning consent from Ribble Valley Borough Council construction works could start on site in 2024 and take place over an 18 month period, although reinstatement would extend beyond this date. Commissioning of the Proposed Marl Hill Section in conjunction with other sections of the Proposed Programme of Works would then follow, with the entire Haweswater Aqueduct Resilience Programme being fully operational by 2029 (indicatively).

5.9 Scope of the Environmental Statement

120) There is no statutory provision surrounding the structure and presentation of an ES. However, it must contain the information specified in Part 2 of Schedule 4 of the EIA Regulations, and '*such of the relevant information* in Part 1 of Schedule 4 *as is reasonably required to assess the effects of the project and which the applicant can reasonably be required to compile*'. Schedule 4 of the EIA Regulations require that an ES should contain the following information:

- A description of the development, including in particular:
  a. A description of the location of the development
  b. A description of the physical characteristics of the whole development, including, where relevant, requisite demolition works, and the land-use requirements during the construction and operational phases
  c. A description of the main characteristics of the operational phase of the development
  d. An estimate, by type and quantity, of expected residues and emissions
- A description of the reasonable alternatives, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects
- A description of the baseline, and potential changes in the future baseline
- A description of the likely significant effects of the development on:
  a. Population
  b. Human health
  c. Biodiversity[5]
  d. Land
  e. Soil resources and conservation
  f. Water environment
  g. Air quality
  h. Climate[6]
  i. Material assets
  j. Cultural heritage
  k. Landscape
- A description of the likely significant effects of the development on the environment resulting from the:
  a. Construction and operation phases of the development, including, where relevant, demolition and decommissioning works

[5] The term 'biodiversity' is used in the EIA Regulations. Chapter 9 of the Scoping Report has adopted the more commonly-used and recognised term 'ecology'.
[6] Climate change and climate resilience have been addressed in Chapter 18 – Air Quality – of the Scoping Report.

b. Use of natural resources, in particular land, soil, water and biodiversity, considering as far as possible the sustainable availability of these resources

c. Emission of pollutants, noise, vibration, light, heat and radiation, the creation of nuisances, and the disposal and recovery of waste

d. Risks to human health, cultural heritage or the environment (for example due to accidents or disasters)

e. Cumulation of effects with other existing and / or approved projects

f. Impact of the project on climate and the vulnerability of the project to climate change

g. Technologies and the substances used.

121) Schedule 4 of the EIA Regulations further explains that the ES should contain information on:

- Both direct significant effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development. (It is not envisaged that the Proposed Programme of Works would give rise to any transboundary effects and so this requirement of Schedule 4 will be descoped from the ES.)
- Additionally, the Regulations require a description of methodologies and technical assumptions, and a consideration of mitigation measures to avoid, reduce or offset any of the significant adverse effects identified during the EIA process. Mitigation measures should consider both the construction and operation phases of the proposed development
- A description of the expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks of relevant major accidents and / or disasters. Where appropriate, this description should address measures to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for and proposed response to such emergencies.

122) Finally, the Regulations require a non-technical summary of the information provided in the ES, and a reference list detailing the sources used for the baseline descriptions and assessments.

123) The ES for the Proposed Marl Hill Section will include the above-mentioned requirements and technical scope where appropriate. The subsequent sections of this Scoping Report consider in more detail how each of the technical topics listed earlier in this section will be addressed in the ES.

6. Landscape and Arboriculture

6.1 Overview

124) This chapter presents the outcome of the scoping exercise in relation to the likely significant landscape and visual amenity effects of the Proposed Marl Hill Section. It also describes the proposed approach to surveying arboricultural resources – individual trees, tree groups, woodlands and hedgerows – within the indicative development envelopes.

125) The Landscape and Visual Impact Assessment (LVIA) will identify and assess the potential effects of the Proposed Marl Hill Section during the construction and operational stages on the landscape and visual resource within a defined assessment area.

126) The assessment of landscape effects will address the effects of change and development on the landscape as a resource (i.e. landscape receptors such as landscape character units and designated landscapes). The assessment will be primarily concerned with the extent to which the Proposed Marl Hill Section will affect the elements that make up the landscape, the aesthetic and perceptual aspects of the landscape and its distinctive character. Landscapes vary considerably in character and quality and constitute a key component of the distinctiveness of any local area.

127) The assessment of visual effects will address the effects of change and development on the views available to people and their visual amenity (i.e. visual receptors). It will be primarily concerned with how the surroundings of individuals or groups of people may be specifically affected by changes in the content and character of views as a result of the change or loss of existing elements in the landscape and / or the introduction of new elements.

128) The Guidelines for Landscape and Visual Impact Assessment (GLVIA)[7] promote landscape and visual impact assessment that is proportional to the scale and nature of the proposals and the likely landscape and visual effects.

6.2 Proposed LVIA Methodology

129) The assessment will be undertaken in accordance with GLVIA. It will also draw on previous experience of similar projects, professional judgement and knowledge of the local landscape within which the Proposed Marl Hill Section will be delivered.

130) Guidance is provided by GLVIA on the area of landscape that should be covered in assessing landscape effects i.e. the 'assessment area'. Paragraph 5.2 of GLVIA states that '*the assessment area should include the site itself and the full extent of the wider landscape around it which the proposed development may influence in a significant manner. This will usually be based on the extent of Landscape Character Areas likely to be significantly affected either directly or indirectly. However, it may also be based on the extent of the area from which the development is potentially visible, defined as the Zone of Theoretical Visibility, or a combination of the two.*'

131) The following activities will be undertaken in the assessment:

- Establish the assessment area
- Review and take account of relevant guidance and policy
- Establish baseline conditions within the assessment area
- Identify viewpoint locations
- Identify the potential effects
- Identify mitigation measures (including reinstatement measures) to reduce and minimise potential impacts on both landscape and visual receptors. Design and development of appropriate landscape mitigation proposals and contributions to a project-wide Environmental Masterplan
- Undertake an assessment of likely significant effects on landscape receptors

[7] Guidelines for Landscape and Visual Impact Assessment 3rd edition (GLVIA) produced by the Landscape Institute and the Institute of Environmental Management and Assessment.

- Undertake an assessment of likely significant effects on the visual amenity of receptors.

132) Further detail of these aspects of the assessment are discussed below.

6.2.1 Planning Policy and Guidance

133) The assessment, design proposals and mitigation measures will be guided by relevant National Planning Policy Framework policy and local planning policy. Planning policies and designations of relevance to the Proposed Marl Hill Section will be taken into consideration, for example in terms of assessing the value of receptors and identifying mitigation measures. The compliance of the proposed development in terms of planning policy will be dealt with under a separate planning statement supporting the planning application.

6.2.2 Baseline Conditions

134) In establishing the existing baseline conditions, the assessment will include a description and analysis of the existing landscape character and visual quality of the assessment area. This will draw on available information considered during scoping and supplemented with field study to account for any environmental trends or new features.

135) Landscape character assessments will be based on published information from local landscape character assessments and Natural England's National Character Assessments (NCA).[8]

136) A winter baseline survey will be undertaken within the assessment area to verify landscape character areas and important viewpoints. Field notes and photographs will record the existing landscape and visual environment during the most visually exposed period. The winter survey findings will be recorded, against which comparisons can be drawn from a summer survey. Views of the Proposed Marl Hill Section from properties and communities within the assessment area will form the focus of the visual impact assessment. Visual receptors will also include locations associated with outdoor pursuits and activities, where a viewer's attention or interest is related to views and the landscape, and views which are incidental to a visitor's or user's day-to-day routine. These may include: residential properties; guests at hotels, hostels, camp sites; visitors to heritage or tourist attractions; and travellers through the landscape (e.g. motorists, cyclists, tourists, ramblers and outdoor workers).

137) The assessment of likely significant effects will take account of mitigation proposals developed as an integral part of the overall scheme design.

6.2.3 Viewpoints and Visualisations

138) The identification of impacts and effects will draw on information depicted in a series of representative photomontages and / or visualisations, which will be developed to assist in understanding how the Proposed Marl Hill Section interacts with the receiving landscape and affects visual amenity. The location of viewpoints will be identified and agreed with local authority officers and other key stakeholders as part of an agreed consultation process. This will consider the phase of work to be represented and the proposed locations.

139) All photography and visualisations will be prepared in accordance with the Landscape Institute's Photography and Photomontage Technical Guidance Note update – Interim Statement (November 2018) [9] with consideration of Technical Guidance Note 02/17 Visual Representation of Development Proposals (31 March 2017).[10]

6.3 Proposed LVIA Assessment Criteria

140) In accordance with GLVIA the assessment of sensitivity for both landscape and visual assessments will combine judgements on the value attributed to that receptor and the susceptibility of the receptor to the specific type of development proposed. Sensitivity will be assessed on a three-point scale of High, Medium or Low.

[8] Natural England National Character Area profiles 2014 [Accessed August 2019] https://www.gov.uk/government/publications/national-character-area-profiles-data-for-local-decision-making/national-character-area-profiles
[9] Landscape Institute Photography and Photomontage Technical Guidance Note update – Interim Statement (November 2018) [Accessed August 2019] https://www.landscapeinstitute.org/visualisation/photography-and-photomontage/
[10] Landscape Institute Technical Guidance Note 02/17 Visual Representation of Development Proposals [Accessed August 2017] https://www.landscapeinstitute.org/visualisation/

6.3.1 Landscape Sensitivity Evaluation

141) Susceptibility is defined as the ability of the landscape to accommodate the proposed development without undue negative consequences. Susceptibility of landscape receptors to change will be assessed using the criteria detailed in Table 6.1 below.

Table 6.1: Landscape Susceptibility Criteria

Susceptibility	Criteria
High	Little ability to accommodate the proposed development without undue harm.
Medium	Some ability to accommodate the proposed development without undue harm.
Low	Substantial ability to accommodate the proposed development without undue harm.

142) GLVIA defines landscape value as '*the relative value that is attached to different landscapes by society*'. A review of existing designations (e.g. National Park, AONB, etc.) is usually the starting point in understanding value. Table 6.2 below sets out the relative importance of generic landscape designations and descriptions.

Table 6.2: Criteria for Assessing Value of Landscape Designations

Typical Designation	Description	Importance (Value)
World Heritage Site	Unique sites, features or areas of international importance with settings of very high quality.	International (High)
National Parks, AONBs, Registered Parks and Gardens of Special Historic Interest, Ancient Woodland, Scheduled Monuments, curtilage of Grade I, II and II* Listed Buildings	Sites, features or areas of national importance with settings of high quality.	National (High)
Conservation Areas	Sites, features or areas of regional importance with intact character.	Regional/County (High/ Medium)
Local Landscape Designations e.g. Green Belt, protecting setting of higher value landscape designations, Tree Preservation Orders (TPO)	Sites, features or areas of district importance.	District (Medium/Low)
Probably no designation, e.g. Public - Space or local footpath	General countryside area valued at the local level.	Local (Medium/ Low)

143) Table 6.3 outlines the criteria incorporating the above assessment of 'value' along with professional judgement that will be used in the evaluation of overall landscape sensitivity.

Table 6.3: Landscape Sensitivity Criteria

Sensitivity	Criteria
High	Landscape elements of particularly distinctive character, which are highly valued and considered susceptible to relatively small changes.
Medium	Landscape of moderately valued characteristics considered reasonably tolerant of change. Some ability to accommodate the proposed development without undue harm.
Low	Landscape of generally low valued characteristics considered potentially tolerant of substantial change.

6.3.2 Visual Sensitivity Evaluation

144) The susceptibility of different visual receptors to changes in views and visual amenity is mainly a function of:

- The occupation or activity of people experiencing the view at particular locations
- The extent to which their attention or interest may therefore be focused on the views and the visual amenity they experience at particular locations.

145) Table 6.4 below (based on generic guidance in GLVIA) will be used to help evaluate the susceptibility of different types of receptors.

Table 6.4: Visual Receptor Susceptibility to Change

Susceptibility	Receptor Type
High	• Residents • People engaged in outdoor recreation, including users of public rights of way, whose attention is likely to be focused on the landscape and on particular views • Visitors to heritage assets or other attractions where views of the surroundings are an important part of the experience • Communities where views contribute to the landscape setting and are enjoyed by residents • Transient users of scenic routes where awareness of views is likely to be particularly high.
Medium	• Transient users of road, rail or other transport routes where the appreciation of visual amenity is not the primary concern • Outdoor workers.
Low	• People engaged in outdoor sport or recreation, which does not involve appreciation of views • People at their place of work, education and worship whose attention may be focused on their activities and where the setting is not important.

146) The criteria in Table 6.5 below will be used, along with professional judgement, to help determine the value of the views in relation to designations and helps to equate sensitivity to other factors, for example, residential views.

Table 6.5: Value of Views

Value	Views from:
High	Viewpoints of national importance, or highly popular visitor attractions where the view forms an important part of the experience, or with important cultural associations. A view that may be identified in character area appraisals.
Medium	Viewpoints of regional / district importance or moderately popular visitor attractions where the view forms part of the experience, or with local cultural associations. A typical and / or representative view.
Low	Viewpoints with no designations, not particularly popular/ important as a viewpoint and with minimal or no cultural associations.

147) The sensitivity of visual receptors to changes in their views will be evaluated in accordance with the criteria provided in Table 6.6, based on the receptor susceptibility to change and the value of views.

Table 6.6: Visual Sensitivity Criteria

Sensitivity	Criteria
High	Receptors where the changed view is of high value and importance and / or where the receptor will notice any change to visual amenity by reason of the nature of use and their expectations. Receptors where the view is important to users will be of high sensitivity such as residential properties or PRoW.
Medium	Receptors where the changed view is incidental, but not critical to amenity and / or the nature of the view, is not a primary consideration of the users (receptors where users are likely to spend time outside or participation in an activity looking at the view and industrial receptors that have offices with windows that take advantage of views).
Low	Receptors where the changed view is unimportant and / or users are not sensitive to change (outdoor receptors where users are unlikely to consider the views an important element of their usage of the site will generally be assessed to be of low sensitivity).

6.3.3 Evaluation of Magnitude of Effects

Magnitude of Landscape Effects

148) The magnitude of landscape effect will be assessed in terms of its size or scale, the geographical extent of the area that would be influenced, its duration and reversibility.

149) This judgement on magnitude of change in the landscape takes into consideration the following factors:

- The extent / proportion of landscape elements lost or added
- The contribution of that element to landscape character and the degree to which aesthetic / perceptual aspects are altered
- Whether the change is likely to alter the key characteristics of the landscape, which are critical to its distinctive character.

150) The criteria used to assess the size, scale and geographic extents of landscape effects will be based upon the amount of change that would occur as a result of the scheme, as described in Table 6.7 below.

Table 6.7: Magnitude of Landscape Effects

Magnitude	Criteria
Major	Substantial adverse or beneficial impact where the scheme would cause a significant change in the landscape character e.g. notable change in landscape characteristics over an extensive area or very intensive change over a more limited area.
Moderate	Moderate adverse or beneficial impact where the scheme would cause a noticeable change in the landscape character e.g. minor changes in landscape characteristics over a wide area or notable changes in a more limited area.
Minor	Minor adverse or beneficial impact in landscape characteristics over a wide area ranging to notable changes in a more limited area.
Negligible	Barely discernible change in the existing landscape character e.g. minor imperceptible change in area or landscape components.
No Change	No noticeable change or alteration of character or features or elements.

151) In accordance with GLVIA, consideration will also be given to the duration and reversibility of landscape effects in the evaluation of magnitude.

Magnitude of Visual Effects

152) Evaluation of the magnitude of visual change affecting receptors will be carried out by considering the following:

- The scale of the change in the view with respect to the loss or addition of features and changes in its composition, including the proportion of the receptor's available view affected by the development
- The degree of contrast or integration of any new features or changes in the landscape with the existing landscape elements and characteristics
- The nature of the view of the proposed development, in terms of the relative amount of time over which it will be experienced and whether views will be full, partial or glimpsed
- The angle of view relative to the main activity of the receptor
- The distance of the viewpoint from the Proposed Marl Hill Section
- The extent of the area over which changes would be visible
- The duration and reversibility of changes.

153) The criteria used to help determine the magnitude of visual effects are shown in Table 6.8 below.

Table 6.8: Magnitude of Visual Effects

Magnitude	Criteria
Major	Substantial adverse or beneficial impact where the scheme would cause a significant change in the view e.g. the proposals dominate the view and fundamentally change its character and components.
Moderate	Moderate adverse or beneficial impact where the scheme would cause a noticeable change in the view e.g. the proposals are noticeable in the view, affecting its character and altering some of its components and features.
Minor	Minor adverse or beneficial impact where the scheme would be perceptible but not alter the overall balance of features and elements that comprise the existing view e.g. the proposals are noticeable in the view, but not affecting its character or altering its components and features.

Magnitude	Criteria
Negligible	Adverse or beneficial impact where the scheme would cause a small or virtually imperceptible change in the view e.g. the changes are only a minor element of the overall view that are likely to be missed by the casual observer.
No Change	Barely or no discernible change in the existing view e.g. the changes are scarcely appreciated.

154) Mitigation measures and standard construction and operational management practices will be incorporated into the design and will be considered in the determination of the magnitude of change.

6.3.4 Significance of Effects

155) The resulting determinations of sensitivity and magnitude will be applied together to assess the significance of effect through use of the matrix set out in Table 6.9. Effects will be qualified as 'adverse' or 'beneficial'. The significance of landscape and visual effects will be assessed on a five-point scale of very large, large, moderate, slight and neutral as set out below in Table 6.9, based on professional judgement and informed by GLVIA.

Table 6.9: Criteria to Assess the Significance of Effect for Landscape and Visual Resources

Category	Landscape	Visual
Very Large Beneficial Effect - Significant	The project would greatly enhance the character (including quality and value) of the landscape; create a high quality feature and / or series of elements; enable a sense of place to be created or greatly enhanced.	The project would create a new feature that would greatly enhance the view.
Large Beneficial Effect - Significant	The project would enhance the character (including quality and value) of the landscape; enable the restoration of characteristic features and elements lost as a result of changes from inappropriate management or development; enable a sense of place to be enhanced.	The project would lead to a major improvement in a view from a highly sensitive receptor.
Moderate Beneficial Effect - Significant	The project would improve the character (including quality and value) of the landscape; enable the restoration of characteristic features and elements partially lost or diminished as a result of changes from inappropriate management or development; enable a sense of place to be restored.	The proposals would cause obvious improvement to a view from a receptor of medium sensitivity or a perceptible improvement to a view from a more sensitive receptor.
Slight Beneficial Effect	The project would complement the character (including quality and value) of the landscape; maintain or enhance characteristic features and elements; enable some sense of place to be restored.	The project would cause limited improvement to a view from a receptor of medium sensitivity, or would cause greater improvement to a view from a receptor of low sensitivity.
Neutral Effect	The project would maintain the character (including quality and value) of the landscape; blend in with characteristic features and elements; enable a sense of place to be retained.	No perceptible change in the view.
Slight Adverse Effect	The project would not quite fit the character (including quality and value) of the landscape;	The project would cause limited deterioration to a view from a

Category	Landscape	Visual
	be at variance with characteristic features and elements; detract from a sense of place.	receptor of medium sensitivity or cause greater deterioration to a view from a receptor of low sensitivity.
Moderate Adverse Effect - Significant	The project would conflict with the character (including quality and value) of the landscape; have an adverse impact on characteristic features or elements; diminish a sense of place.	The project would cause obvious deterioration to a view from a receptor of medium sensitivity or perceptible damage to a view from a more sensitive receptor.
Large Adverse Effect - Significant	The project would be at considerable variance with the character (including quality and value) of the landscape; degrade or diminish the integrity of a range of characteristic features and elements; damage a sense of place.	The project would cause major deterioration to a view from a highly sensitive receptor, and would constitute a major discordant element in the view.
Very Large Adverse Effect - Significant	The project would be at complete variance with the character (including quality and value) of the landscape; cause the integrity of characteristic features, elements and sense of place to be lost.	The project would cause the loss of view from a highly sensitive receptor, and would constitute a dominant discordant feature in the view.

6.4 Proposed Arboricultural Assessment Methodology

6.4.1 Preamble

156) The landscape associated with the Proposed Marl Hill Section takes its character from a combination of elements. Landscape elements can vary considerably in character and quality, with trees – defined as individual trees, groups of trees and woodlands – contributing to the distinctiveness of a local area.

157) The following section describes the proposed approach to surveying and assessing arboricultural interests potentially affected by the Proposed Marl Hill Section. To date there have been no site-specific appraisals undertaken and so this section considers only the broad principles of how arboricultural assets will be addressed within the EIA process. In addition to desk study and fieldwork, consultations with key stakeholders will form an important element of work.

158) Trees and woodlands play a crucial role in improving and maintaining the environment by protecting against flooding, improving water quality and providing habitats for wildlife. Woodlands also provide the backdrop for recreation and tourism facilities that attract people to the countryside and urban areas, whilst also contributing to the mental and physical wellbeing of residents and visitors.

159) A preliminary assessment area focused on the Proposed Marl Hill Section was adopted to inform the scoping of potential effects on trees. The assessment area falls within Lancashire, parts of which are recognised for their scenic beauty and high quality landscapes. The tree populations of these areas have evolved over a long period of time, and have been influenced by geology, climate and, to a large extent, human intervention.

6.4.2 Potential Effects

160) Trees are complex organisms that can be affected by direct or indirect damage during construction; scoping therefore identified potential short- and long-term effects which could occur on trees as a result of construction activities. These construction effects would potentially occur because of both tree removal and direct damage to branches and roots, with minor damage potentially affecting tree growth and their ability to take up water, oxygen and nutrients.

161) Additional effects can include ground compaction, altered drainage and the potential effects of wind-throw on retained trees which, depending on the magnitude of the change, can affect a tree's ability to recover and increase its susceptibility to disease and decay.

162) Short-term effects could be associated with tree felling within the indicative development envelopes (but not along the indicative tunnel sections where no above-ground working would take place). Tree felling or disturbance could also take place along access routes from the public highway, while loss of or disturbance to hedgerows and hedgerow trees is also a potential risk. It should be noted that much of the Proposed Marl Hill Section comprises tunnelling at varying depths below ground level and, at locations where this construction technique is employed, there would be no direct or indirect effects on trees, hedgerows or woodlands at ground level. While construction activities at ground level (for example, construction compound/laydown areas and soil storage) could potentially impact tree resources, the indicative development envelopes are generally sufficiently sized to enable a high degree of avoidance through embedded design.

163) Long-term effects would principally be associated with the unavoidable loss of any trees required in connection with enabling works and site preparation, and the prevention of replanting along easements where, for operational reasons, it is not permissible to introduce tree root zones above pipework.

6.4.3 Proposed Scope, Methodology and Criteria

164) A tree assessment for the Proposed Marl Hill Section will be undertaken in accordance with British Standard 5837:2012 '*Trees in relation to design, demolition and construction – Recommendations*', and in line with nationally-accepted guidelines for the visual assessment of trees from ground level.

165) An assessment will be undertaken along the route of the Proposed Marl Hill Section, concentrating on those indicative development envelopes where activities would take place at ground level, such as proposed access routes, compounds and laydown areas, and discharge pipes. Where construction activities are proposed below ground level, specifically tunnel boring, surveys and assessment will be discounted. Where appropriate, the survey area may extend a short distance beyond indicative development envelopes to account for indirect effects, for example, compaction of root zones, or in cases where there are particularly sensitive arboricultural assets. Potential wind-throw resulting from the removal of existing trees will also be considered where appropriate.

166) Information will be obtained from stakeholders and published sources including: aerial photography; local authorities (protected trees); Natural England (ancient woodland); landowners and the Forestry Commission (woodland management and grant status).

167) The survey will generally encompass trees with a stem diameter of 75 mm or greater measured at a height of 1.5 m). Individual trees, groups of trees and woodlands will be assessed for their quality and benefits, with each tree or tree group recorded by allocating it to one of four categories:

- A) Trees of high quality with an estimated remaining life expectancy of at least 40 years
- B) Trees of moderate quality with an estimated remaining life expectancy of at least 20 years
- C) Trees of low quality with an estimated remaining life expectancy of at least ten years, or young trees with a stem diameter below 150 mm
- U) Trees in such a condition that they cannot realistically be retained as living trees in the context of the current land use for longer than ten years.

168) Trees growing as groups or woodland will be identified and assessed as such, where appropriate. An assessment of individuals within any group will still be undertaken in order to highlight significant variation in attributes (including physiological or structural condition).

169) The significance of tree loss will be expressed in the ES in relation to the number of trees affected. Mitigation measures will be developed in consultation with statutory and non-statutory bodies. The effects of tree removal, tree loss and tree decline are factors that will also be considered in the ecological and landscape assessments. Additionally, opportunities to avoid the loss of trees through embedded mitigation and avoidance will be described.

6.5 Existing Conditions

170) This report will summarise the landscape and visual amenity baseline for the assessment area and identify receptors where there is potential for significant effects to arise. A brief description of the existing conditions is also included.

171) The process of scoping commenced with the definition of a preliminary assessment area within which both existing landscape character and visual amenity could be evaluated to assist in the identification of potential effects.

6.5.1 Assessment Area

172) The assessment area includes the tunnelling compounds (Construction Areas A and B) and the surrounding local landscape. The two tunnelling compounds would be operational for a period of approximately 18 months. Soils would be stripped, and the site would be laid with a temporary surface. The compounds would be located on the rising valley sides from which the soil strip would be highly visible within the surrounding elevated land and valleys. Gantry cranes would be used at the shaft locations and these would be highly visible in the local area.

173) Plant and machinery movements along haul roads (which would be constructed to provide access from the local road network) would cause visual disturbance. Haulage routes would use defined routes within the minor road network passing through local settlements and past local properties and would be visually intrusive.

174) The assessment area is located within the south-east of the Forest of Bowland Area of Outstanding Natural Beauty (AONB). The AONB '*is a nationally protected landscape and internationally important for its heather moorland, blanket bog and rare birds. It is designated as a landscape of national significance due to the grandeur and isolation of the upland core; the steep escarpments of the Moorland Hills; the undulating lowlands; the visual contrasts between each element of the overall landscape; the serenity and tranquillity of the area; the distinctive pattern of settlements; and the landscape's historic and cultural associations*'[11].

175) The landscape of the assessment area is characteristic by undulating lowland, moorland and rolling upland with occasional rocky outcrops. Topography ranges from approximately 150 m AOD to elevations of 300 m AOD at the tops of the nearby fells. The undulating lowland comprises a rich patchwork of farmland pastures, mixed farm woodlands, copses and winding lanes lined with hedgerows. At a higher level within the moorland fringe, dry stone walls and scattered farmsteads with stone out-barns are typical. The moorlands encircle the moorland fringe and rolling upland at lower elevations and are characterised by distinct hill profiles. Distinctive features include large enclosures, mostly delineated by gritstone walls, and small, isolated stone hamlets and farmsteads.

176) The upland farmland comprises gentle landscape of soft rolling hills, cloaked with moorland grasses in the higher parts, and lush green pastures and herb rich meadows on the lower slopes. Stands of beech trees are a distinctive feature, growing on rocky slopes and outcrops, and often enclosed by circular walls. Small clustered stone villages occur on south facing slopes and there are also some small linear settlements.

177) Drystone walls form the majority of field boundaries at higher elevations, creating strong patterns in the landscape, and reflecting the underlying geology. From elevated locations there is a feeling of openness and remoteness with dramatic, unimpeded long-distance views across wide valleys and surrounding lowlands.

178) Settlements are few within the assessment area. The settlements of Newton-in-Bowland, Waddington consist of stone houses and cottages, and churches which provide landmarks in the landscape. Bashall Eaves is a small hamlet of dispersed properties. Farmsteads are located throughout the area, often along tracks following the contour of the hills. The network of PRoWs and Open Access Land provide opportunities for recreation. The local road network provides links between villages and isolated properties.

179) There is a strong sense of tranquillity across the assessment area with the most tranquil areas within the higher areas. The remoteness, vast skies, extensive panoramic views give a strong sense of wildness and isolation. Within the high fells, there is little sign of human activity and night skies are almost completely

[11] Lancashire County Council, Forest of Bowland AONB Landscape Character Assessment (2009) [Accessed August 2019] https://www.forestofbowland.com/landscape-character-assessment

dark. Dark sky events occur throughout the year and there are five designated Dark Sky Discovery Sites[12] within the AONB.

6.5.2 Information Sources

180) The following desk-based sources have been used to inform this scoping chapter:

- Adopted Local Plans:
  - Ribble Valley Borough Council
    - Adopted Core Strategy[13]
    - District Wide Plan Maps[14].
- Natural England's National Character Areas[15]
- Local Landscape Character Assessments
  - Lancashire County Council[16]
  - Forest of Bowland AONB Landscape Character Assessment[17]
- The Forest of Bowland AONB Management Plan[18]
- MAGIC website[19].

6.5.3 Landscape Designations

181) Both Construction Areas A and B fall within the Forest of Bowland Area of Outstanding Natural Beauty (AONB) designated for its distinctive character and natural beauty, unspoiled and richly diverse landscapes wildlife and heritage. The Forest of Bowland Joint Advisory Committee have produced the AONB Management Plan which is a statutory plan. It provides a framework for ensuring delivery of the statutory purpose for AONBs, that of conserving and enhancing the natural beauty of the landscape.

182) There is one Scheduled Monument, Ashcott lead mine and lime kiln (ref: 1016550) that is located 0.6 km south west of Construction Area A. There are many Listed Buildings within the assessment area, the closest of these is 0.2 km north of Construction Area A, named Farm Building. The majority of these buildings are associated with the settlements of Newton-in-Bowland and Waddington.

183) The nearest National Park, the Yorkshire Dales National Park, is located to the north east of the assessment area, approximately 16 km from the Proposed Marl Hill Section at its closest point. There are no Country Parks or Registered Parks and Gardens within the assessment area. However, there are blocks of ancient woodland throughout the assessment area, the closest of which is located 0.5 km from Construction Area A. Refer to Chapter 10 Cultural Heritage for further information.

184) There are several areas of Open Access Land and Registered Common Land, designated under the CRoW Act and there are several PRoWs providing access within the surrounding area. There are no national trails within the assessment area. National Cycle Network route 90 (Lancashire Cycle Way)[20] passes through

[12] Forest of Bowland Area of Outstanding Natural Beauty, Star Gazing https://forestofbowland.com/star-gazing
[13] Ribble Valley Borough Council Core Strategy 2008-2028 A Local Plan for Ribble Valley Adopted Version [Accessed August 2019] https://www.ribblevalley.gov.uk/download/downloads/id/10010/adopted_core_strategy.pdf
[14] Ribble Valley Borough Council district wide local maps [Accessed August 2019] https://www.ribblevalley.gov.uk/info/200364/planning_policies/432/districtwide_local_plan
[15] Natural England National Character Area Profiles (2014) [Accessed August 2019] https://www.gov.uk/government/publications/national-character-area-profiles-data-for-local-decision-making/national-character-area-profiles#ncas-in-north-west-england
[16] Lancashire County Council (2000) A Landscape Strategy for Lancashire. Preston [Accessed August 2019] https://www.lancashire.gov.uk/media/152746/characterassesment.pdf
[17] Forest of Bowland AONB Landscape Character Assessment (2009) [Accessed August 2019] https://www.forestofbowland.com/landscape-character-assessment
[18] Joint Advisory Committee Forest Of Bowland AONB Management Plan (20191-20240 [Accesses August 2019] https://www.forestofbowland.com/Management-Plan
[19] Magic Maps [Accessed August 2019] https://magic.defra.gov.uk/MagicMap.aspx
[20] National Cycle Network and Open Road Open Skies https://www.openroadopenskies.co.uk/self-guided-cycling-holidays/route-90-north-lancashire-loop

Waddington, approximately 2.1 km south east of Construction Area B. Further information on these can be found in Chapter 13 Public Access.

6.5.4 Landscape Character

185) The assessment area falls within two National Character Areas (NCA)[21] 33 Bowland Fringe and Pendle Hill and 34 Bowland Fells with the border between these NCAs bisecting the assessment area.

186) At the local scale, the Landscape Strategy for Lancashire [22] undertaken by Lancashire County Council provides a more specific description of the landscape character areas (LCA). LCAs that fall within the assessment area include:

- LCA Undulating Lowland Farmland 5a Upper Hodder Valley
- LCA Moorland Fringe 4d Bowland Gritstone Fringe
- LCA Rolling Upland Farmland 14a Slaidburn and Giggleswick
- LCA Undulating Lowland Farmland 5g
- LCA South Bowland Fringe; LCA Moorland Hills 2d Waddington Fell
- LCA Moorland Fringe 4d Bowland Gritstone Fringe.

187) Forest of Bowland AONB has also carried out a landscape character assessment[23] which provides greater detail for the AONB. LCAs that fall within the assessment area include:

- LCA Undulating Lowland Farmland with Parkland G3 Upper Hodder
- LCA Undulating Lowland Farmland with Parkland G7 Browsholme
- LCA Moorland Fringe D7 Moorcock
- LCA Enclosed Moorland Hills C3 Easington
- LCA Enclosed Moorland Hills C9 Newton and Birket
- LCA Rolling Upland Farmland L1 Harrop Fold.

188) The Landscape Institute's Technical Information Note (TIN) 01/2017[24] identifies tranquillity as a perceptual aspect of landscape and will be considered as part of the landscape character assessment, which will form the baseline against which the landscape effects of the Proposed Marl Hill Section will be assessed.

6.5.5 Key Visual Receptors

189) Key visual receptors include:

- Residents of the villages of Newton-in-Bowland and Waddington, the hamlet of Bashall Eaves, and the various farmsteads and individual properties throughout the assessment area (refer to Figure 6.1).
- Users of the PRoW network and Open Access land, and the NCN route 90, particularly those near to the area of works, and the surrounding hills
- Users of roads throughout the area including the B6478 Slaidburn Road and minor roads.

6.6 Potential Effects

190) Effects on landscape character are likely to derive from modifications to the physical landscape and how this is experienced, whereas effects on visual amenity are likely to arise from modification to the composition of existing views and how people perceive and respond to this.

[21] Repeated Refer to citation 43
[22] Repeated Refer to citation 44
[23] Repeated Refer to citation 45
[24] Landscape Institute, Tranquillity, an Overview. Technical Information Note 1/2017 (2017) [Accessed August 2017] Technical https://www.landscapeinstitute.org/technical-resource/tranquillity/

191) Potential likely significant temporary construction effects of the Proposed Marl Hill Section to be considered in the assessment are as follows:

- Effects on landscape components and character - associated with construction work including vegetation clearance or disturbance along working corridors; topsoil stripping and the temporary stockpiling of materials (including soils); areas of excavation and tunnelling
- Effects on visual amenity - associated with focused construction activities and vehicle movements along working corridors, vehicle movements along the local road network, visual awareness of compounds, particularly when lit, vegetation removal, excavation of areas for the new aqueduct and tunnel, and with changes in the outlook from temporarily diverted rights of way if required.

192) Potential permanent changes to the landscape character as a result of construction will also be considered as a result of the removal of hedgerows and trees/woodland.

193) Potential operational effects of the Proposed Marl Hill Section to be considered in the assessment are as follows:

- Effects on landscape components and character - associated with the loss of vegetation and agricultural land, the introduction of new valve house buildings at the location directly above the tunnel junctions, and modifications to existing highways from the creation of temporary/permanent access arrangements
- Effects on visual amenity - associated with working corridor, compound areas for tunnel access facilities (e.g. shafts), access tracks from a range of visual receptor types including public rights of way users.

194) The scoping exercise highlighted that there may also be changes to the landscape setting of heritage assets within the assessment area, and from potential changes in landscape resulting from the new tunnel and associated aqueduct. Effects on heritage assets are described in Chapter 10.

6.7 Summary Scope for the EIA

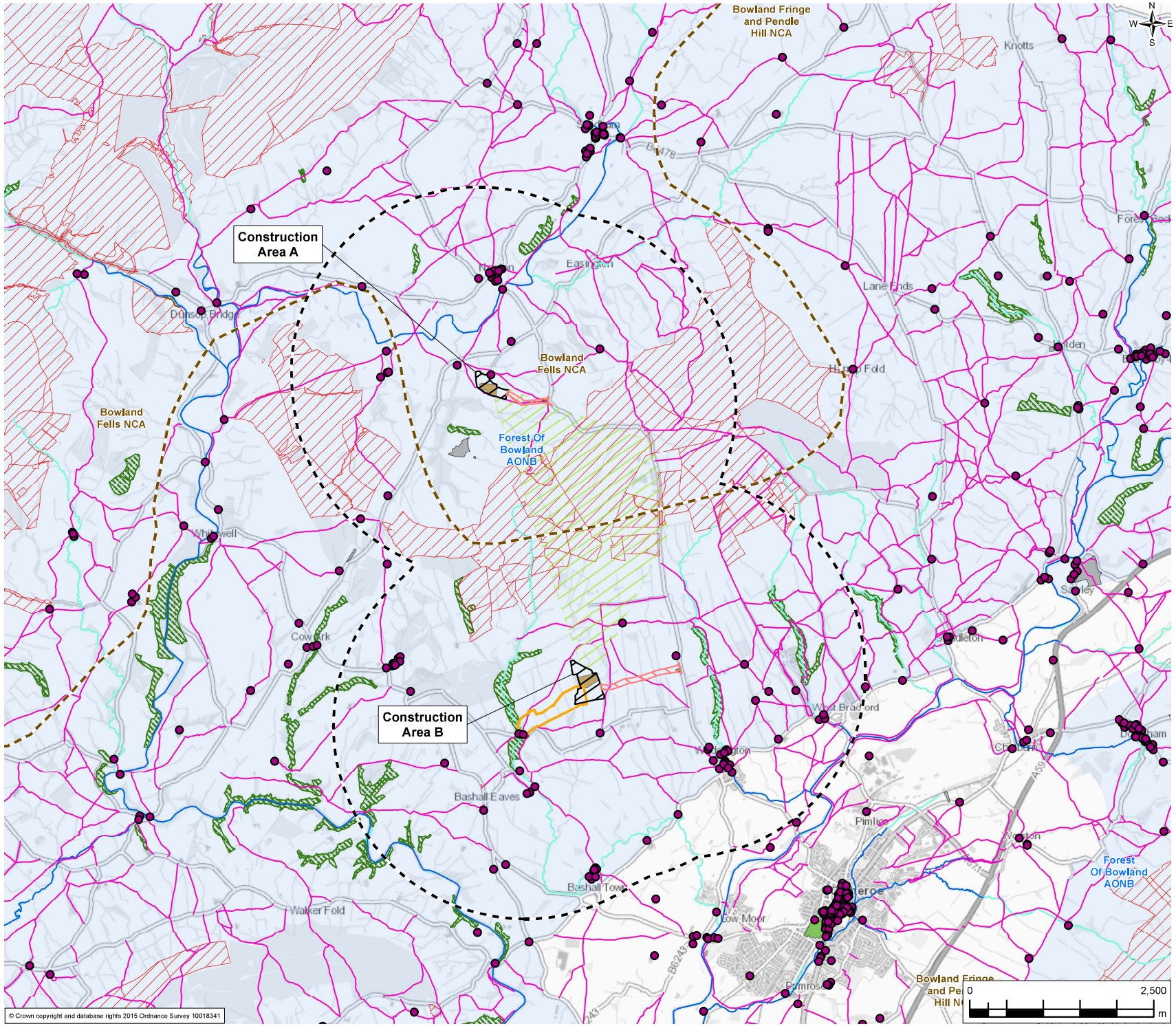
195) A summary of the scope is detailed in Table 6.10

Table 6.10: Matters of significance for landscape and visual effects

Receptor group	Matter / potential effects	Location within assessment area	Comments
National Character Areas: 33. Bowland Fringe and Pendle Hill, and 34. Bowland Fells	Landscape effects	Construction Area A falls within NCA 34, and Construction Area B falls within NCA 33.	Scoped in. The NCAs comprise of strategies and guidance to help inform design and mitigation proposals.
A Landscape Strategy for Lancashire Landscape Character Assessment	Landscape effects	Construction Area A - LCA Undulating Lowland Farmland 5a Upper Hodder Valley, LCA Moorland Fringe 4d Bowland Gritstone Fringe, LCA Rolling Upland Farmland 14a Slaidburn and Giggleswick. Construction Area B - LCA Undulating Lowland Farmland 5g LCA South Bowland Fringe; LCA Moorland Hills 2d Waddington Fell; LCA	Scoped in Provides an assessment of landscape effects proportional to the scale and nature of the Proposed Marl Hill Section and the likely effects, which would largely be of a temporary nature. Assessment would allow development of landscape reinstatement mitigation.

Receptor group	Matter / potential effects	Location within assessment area	Comments
		Moorland Fringe 4d Bowland Gritstone Fringe.	
Forest of Bowland Landscape Character Assessment	Landscape effects	Construction Area A LCA Undulating Lowland Farmland with Parkland G3 Upper Hodder, LCA Enclosed Moorland Hills C3 Easington, LCA Enclosed Moorland Hills C9 Newton and Birket, LCA Rolling Upland Farmland L1 Harrop Fold. Construction Area B LCA Undulating Lowland Farmland with Parkland G7 Browsholme, LCA Enclosed Moorland Hills C3 Easington, LCA Moorland Fringe D7 Moorcock, LCA Enclosed Moorland Hills C9 Newton and Birket.	Scoped in Provides an assessment of landscape effects proportional to the scale and nature of the Proposed Marl Hill Section and the likely effects, which would largely be of a temporary nature. Assessment would allow development of landscape reinstatement mitigation.
Residents, users of PRoW and other outdoor recreation, users of places of worship, educational and community facilities, and places of work, transient receptors	Visual amenity effects	Various settlements and properties. Local PRoW network and areas of open access land. Schools, churches and places of work. Major arterial transport routes and local roads.	Scoped in. Construction activities have the potential to be visually intrusive and cause temporary changes to visual amenity. Permanent features and removed features such as vegetation, have the potential to permanently alter the landscape surrounding these settlements and properties.

FIGURE 6.1



Legend

- 2.5km Assessment Area
- Proposed Tunnel Route - Indicative Corridor
- Proposed Construction Access - Indicative
- Proposed Construction Compound / Laydown Area - Indicative Development Envelope
- Proposed Discharge Pipe - Indicative Corridor
- Proposed Indicative Construction Compound / Laydown Area

Constraints

- Listed Building
- Public Right of Way
- Main River
- Canal network
- National Character Area (NCA)
- CRoW Act 2000 - Access Land
- Area of Outstanding Natural Beauty
- Ancient Woodland
- Registered Park and Garden
- Scheduled Monument

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
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7. Water Environment

7.1 Overview

196) This chapter considers the potential significant effects of the Proposed Marl Hill Section upon the water environment. The water environment is characterised by surface water hydrology (i.e. water quantity and flow), fluvial geomorphology, surface water quality, groundwater (including quantity and quality) and water resources. The assessment also considers aspects relating to the use of water (as a resource) during construction and operation.

197) This chapter also identifies Water Framework Directive (WFD) water bodies within the assessment area. Assessment of the potential effects upon these will be considered in the Preliminary WFD Assessment, which will be carried out in conjunction with the EIA. Flood risk issues and aquatic ecology are addressed separately in Chapters 8 and 9 respectively. The groundwater topic has close alignment to other subject areas, including geology and soils and contaminated land presented in Chapter 11 and ecology contained within Chapter 9.

7.2 Key Legislation and Policy

198) The following section provides a summary of the key legislation and policy of relevance to this chapter.

7.2.1 Legislation

- European Union Water Framework Directive (WFD) (Directive 2000/60/EC)
- Water Environment (WFD) (England and Wales) Regulations 2017
- Water Resources Act 1991
- Environment Act 1995
- Groundwater (England and Wales) Regulations 2009
- Control of Pollution (Applications, Appeals and Registers) Regulations 1996 (SI1996/2971)
- Environmental Protection Act 1990
- Water Supply (Water Quality) Regulations 2016
- Water Act 2003
- Environmental Permitting (England & Wales) Regulations 2016.

7.2.2 Local Policy

- Ribble Valley Borough Council Core Strategy 2008-2028[25]

7.2.3 Additional Policy

- The Environment Agency's approach to groundwater protection (Version 1.2, February 2018).

7.3 Proposed Methodology and Criteria

7.3.1 Scoping Methodology

199) A description of the proposed scoping assessment methodology is given below, with the assessment criteria presented in Appendix 7.1. There are no published technical guidance criteria for assessing and evaluating effects on the water environment for projects of this nature. The assessment will therefore be based on general EIA methodology and criteria developed through professional experience and as used on previous EIAs of a similar nature. For assessing impacts upon water quality, water quantity (excluding flood risk covered in Chapter 8 and water resources where applicable the criteria from the Design Manual for Roads and Bridges (DMRB) HD45/09 Road Drainage and the Water Environment (hereafter referred to as HD45/09)

[25] Ribble Valley Borough Council Core Strategy 2008 – 2028 A Local Plan for Ribble Valley Adoption Version

has been used. The methodology has been based upon discussion with the regulatory bodies during the scoping stage as described in Chapter 5.

7.3.2 Assessment Criteria

200) Features were initially identified by developing an understanding of the catchments from baseline data and an understanding of the Proposed Marl Hill Section. Features were then valued based on the criteria outlined in Appendix 7.1 accounting for their rarity, importance, attributes/processes and sensitivity. The greater the importance or sensitivity the higher the value of feature.

201) Likely significant effects were then identified based upon the nature and extent of the Proposed Marl Hill Section. The magnitude of impact is established using either a quantitative or qualitative assessment based upon professional judgement, the criteria for which are outlined in Appendix 7.1. The magnitude of an impact is not dependent upon the value of a feature.

202) Considering the value of the feature and the potential magnitude of impact, the significance of the effect is based on the combination of the value of the feature and the magnitude of impact using the matrix in Table 7.1.

Table 7.1: Significance of effect

		Magnitude of impact			
		Negligible	**Minor**	**Moderate**	**Major**
Importance / value of feature	**Low**	Neutral	Neutral	Slight	Slight/Moderate
	Medium	Neutral	Slight	Moderate	Large
	High	Neutral	Slight/Moderate	Moderate/Large	Large/Very Large
	Very High	Neutral	Moderate/Large	Large/Very Large	Very Large

203) For the purposes of the water environment appraisal those residual effects described as having a Moderate, Large or Very Large effect are 'significant' in relation to the EIA Regulations. The use of the terms 'neutral' or 'slight' are used to acknowledge that there will be some change from the baseline conditions but that these effects are not significant.

7.3.3 Environmental Statement Methodology

204) For those water resources scoped in for further assessment the following section outlines the proposed methodology for undertaking the EIA.

Surface Water Hydrology, Fluvial Geomorphology and Water Quality

205) The methodology described below sets out a list of criteria for evaluating the environmental effects on fluvial geomorphology, as follows:

- The importance (value) of the resource under consideration on a scale of sensitivity (i.e. high, medium, low or negligible)
- The magnitude of the effect in relation to the resource that has been evaluated, quantified using the scale large, medium, small, or negligible
- The significance of the effect using the scale major, moderate, minor and negligible. For significant effects (moderate and major), additional mitigation may be required to reduce the significance of the effect.

206) An effect may be significant if, in the professional opinion of the expert undertaking the assessment, it would meet at least one of the following criteria:

- It could lead to an exceedance of defined guidelines or widely-recognised levels of acceptable change (e.g. exceedance of an EQS of a water quality parameter)
- It is likely that the planning authority would reasonably consider applying a condition, requirement or legal agreement to the grant of consent to require specific additional mitigation to reduce or overcome the effect
- It threatens or enhances the viability or integrity of an asset or resource group of interest
- It is likely to be material to the ultimate decision about whether the planning applications should be approved.

207) To aid the determination of significance, the assessment of effects will take the following stepped approach:

- Determine the relevant assets and resources
- Derive their value (importance) based on the criteria set out in tables below
- Identify and consider the effects from each activity
- Determine the magnitude of change likely as a result of the effects, as set out in the tables below
- Present the environmentally and ecologically significant effects and then consider how additional mitigation may reduce negative effects.

208) Consultation will be undertaken with the regulators and local authorities to support the assessment and development of mitigation.

209) A Water Framework Directive Assessment will be undertaken to support the ES.

Groundwater

210) The assessment of potential effects described above will be based on an interpretation of data from the scheduled ground investigation. This will characterise the groundwater environment intercepted by the Proposed Marl Hill Section, and confirm groundwater levels (i.e. groundwater pressures above the tunnelled sections, areas of shallow groundwater conditions, geological settings and groundwater quality). Based on this information, a generic dewatering assessment will be carried out to determine an order of magnitude for temporary groundwater volumes expected to be extracted during shaft and tunnel construction through the geological and hydrogeological conditions present in the area. These dewatering assessments will also consider the wider attributes and potential impacts on groundwater abstractions (licensed and unlicensed), GWDTEs and baseflow contributions to surface waters. The ground investigation will also support the assessment of potential groundwater flow disturbances as a result of the proposed decommissioning strategy.

211) GWDTEs will be identified following UK Technical Advisory Group (UKTAG) guidance (UKTAG, 2009). Where GWDTEs are identified, Conceptual Site Models will be developed bringing together available geological and hydrogeological baseline data, together with a view to determine the degree of groundwater dependency and assess any potential impacts. Information used for this assessment will include Groundwater Flooding Susceptibility maps.

212) Potential impacts on groundwater flooding aspects are captured in Chapter 8.

213) Consultations with Ribble Valley Borough Council and land owners will take place to identify Private Water Supplies in addition to licenced abstractions which will be requested from the Environment Agency.

214) The ground investigations will also support the review of groundwater quality to determine whether additional measures should be implemented.

7.4 Existing Conditions

7.4.1 Assessment Area

215) The Groundwater Assessment Area is defined as the indicative development envelope with a further 1 km buffer in all directions. This buffer allows for the identification of groundwater features outside of the location of the physical works, which could be impacted by activities such as a change in groundwater levels caused by dewatering, or disturbance in flow and / or quality of groundwater, which may support features such as groundwater dependent terrestrial ecosystems (GWDTEs) or provide baseflow to local watercourses. The size of the groundwater assessment area is based on professional judgement regarding the maximum potential extent of effects likely on groundwater features in the type of aquifers present, and uncertainties associated with the degree of heterogeneity of these aquifers.

216) For the other aspects of the water environment (i.e. water quality, quantity, fluvial geomorphology and water resources) the assessment area is defined as the indicative development of the Proposed Marl Hill Section with a 500 m buffer in all directions as shown in Figures 7.1 and 7.2. This buffer allows for the consideration of impacts of the Proposed Marl Hill Section on surface water features outside the design envelope, such as surface water flow paths or sediment transportation systems. Where significant downstream impacts are anticipated the buffer is increased to 2 km. The size of the assessment area is based on professional judgement and has been used to identify the relevant features for the assessment; should aspects of the Proposed Marl Hill Section change the assessment area will be reconsidered.

7.4.2 Information Sources

217) The following desk-based sources have been used to inform this scoping chapter:

- Multi-Agency Geographical Information for the Countryside (MAGIC) website http://www.magic.gov.uk/ (accessed July 2019)
- The Environment Agency's Catchment Data Explorer website http://environment.data.gov.uk/catchment-planning/ (accessed July 2019)
- British Geological Survey (BGS) data accessed via http://www.bgs.ac.uk/data/mapViewers/home.html (accessed July 2019)
- Historical maps (http://maps.nls.uk/geo/explore/side-by-side/#, accessed July 2019)
- Aerial imagery (http://www.magic.gov.uk/, access July 2019).

218) A groundwater desk study has been undertaken that comprises the analysis of maps, geological information and publicly available data, originating from the EA and external organisations such as the BGS. No site walkovers or ground investigations have been undertaken at this stage in the project, however a large scale ground investigation is scheduled in the coming months. The following lists the key information and data used to inform the desk study.

- Ordnance Survey (OS) 1: 10,000, 1: 25,000 and 1: 50,000 scale maps. The 1:25,000 OS map has been used to identify where the most significant spring features are likely to occur (that is, springs marked on this scale map). These significant spring discharges are shown in Figure 7.3
- Environment Agency Aquifer Designation Maps (available from DEFRA's MAGIC Map application), which designate aquifers as described in the glossary
- Environment Agency groundwater source protection zones (SPZs). Data on SPZs have been used to assess potential for impacts on public water supplies and groundwater abstractions used for food or drink production. For each source, three zones are defined as described in the glossary, Zone 1 is the most sensitive
- BGS 1: 50,000 scale geological maps (obtained from the BGS Web Map Service)
- BGS geological/lithological information from:
  - Technical Report: Geological notes for the Silurian strata and their Quaternary cover on 1:10k sheets SD48NW, SD58NE (Old Hutton) and SD58NW IR/06/129
  - Technical Report: Geology of the area between Lindale and Witherslack IR/06/079

- BGS baseline groundwater quality information for:
  - The Pennine Coal Measures Group (Technical Report: OR/07/039)
  - The Millstone Grit of Northern England (Technical Report: CR/05/015N)
- Hydrogeological information from:
  - BGS Technical Report: The physical properties of minor aquifers in England and Wales WD/00/04
  - BGS Technical Report: The Carboniferous Limestone of Northern CR/05/076N
  - Hydrogeological Impact Assessment Report
  - BGS Carboniferous Bowland Shale gas study
- Cross sections made available by United Utilities used to determine the depth of existing infrastructure.

7.4.3 Baseline Information

Surface Water Hydrology

219) Within the assessment area there are a number of water features, which include:

- Ordinary Watercourses (i.e. all watercourses that are not designated as Main Rivers and maintained by owners in accordance with the Land Drainage Act 1991 (as amended 1994))
- Water features such as reservoirs, canals and ponds (man-made and natural).

220) Some of the larger watercourses are also classified under the WFD and these have been identified within this assessment.

221) Watercourses are presented in Figure 7.1. No Main Rivers (i.e. those defined in Section 113 of the Water Resources Act (as amended) and maintained by the Environment Agency) have been identified within the assessment area. At this stage approximately 70 Ordinary Watercourses have been identified within the assessment area from OS mapping. They are largely unnamed with the exception of:

- Bonstone Brook
- Sandy Ford Brook
- Cow Hey Brook
- Crag Beck
- Foulscales Brook.

222) Of the Ordinary Watercourses identified within the assessment area, 37 are located within the development envelope of the Proposed Marl Hill Section or immediately adjacent to it. These watercourses have a greater likelihood of being directly impacted by the Proposed Marl Hill Section. All watercourses are likely to be valued as Low or Medium.

223) Seven ponds are located within the assessment area, of which six are flooded gravel pits associated with a quarry. These are valued as Low.

Fluvial Geomorphology

224) The Ordinary Watercourses within the assessment area are generally either land drains or first order streams draining upland areas. Consequently, they exhibit straight planforms with little evidence of significant morphological features or processes. All Ordinary Watercourses are likely to be Medium or Low geomorphological value, except for Bonstone Brook which has been assessed as High due to geomorphological features noted along the channel from aerial imagery.

225) The ponds identified are likely to be of Low geomorphological value due to them being artificially created.

226) Baseline descriptions of the Main Rivers and WFD Watercourses are presented in Table 7.2.

Table 7.2: Fluvial geomorphology baselines for Main River and WFD watercourses

Name	Interaction with Proposed Marl Hill Section	Baseline	Value
Bashall Brook (WFD watercourse)	Discharge from Ribblesdale North Well	A tributary of the River Ribble, the headwaters of the Bashall Brook are located within the assessment area on Newton Fells. It issues from Browsholme Tarn and has a largely straight planform through much of the upper catchment. The channel has a more sinuous planform as it passes through Blackhill Wood, where riparian vegetation cover is dense and dominated by mature trees. Downstream of Blackhill Wood, the Bashall Brook can be seen on aerial imagery to have a range of geomorphological features, including side bars and lengths where the channel becomes braided. Bank erosion was observed on aerial imagery at multiple places downstream of Blackhill Wood. This suggests that the Bashall Brook is geomorphologically active, which is supported by historical map analysis showing meander migration has occurred at several locations throughout catchment. Upstream of Bashall Town a 400 m length of the Bashall Brook has been artificially straightened alongside a road, whilst there is also evidence of extensive poaching by livestock. The vegetated riparian zone is largely dominated by grasses (with the exception of Blackhill Wood), whilst the land use within the floodplain is predominantly pastoral or arable agricultural.	High
Waddington Brook (WFD watercourse)	Within 500 m of indicative tunnel corridor and access road route.	A tributary of the River Ribble, the headwaters of the Waddington Brook are located approximately 200 m east of the assessment area on Sour Dock Hill. The upper reaches of Waddington Brook are visible and display little evidence of geomorphological features or processes. The vegetated riparian zone is comprised of wild grasses/heathland in the upper catchment, with a largely continuous and wide (greater than 5 m) corridor of mature vegetation established approximately 1 km downstream of the headwaters. Extensive riparian vegetation cover makes it difficult to ascertain the geomorphological value of the watercourse as it passes through the assessment area. It is likely that the Waddington Brook is of Very High or High value based on the absence of significant human activities through much of the assessment area and upper catchment, however, this would need to be validated with a site visit.	Very High/High

Surface Water Quality

227) There are seven WFD surface water bodies within the assessment area; the baseline WFD data is outlined in Table7.3. The WFD data provides an indication of water quality as the overall classification comprises of physico-chemical elements which contribute to the ecological status and chemical water quality elements. Further assessment of these WFD water bodies will be carried out as part of the Preliminary WFD Assessment as the EIA develops.

Table7.3: WFD Surface Water Bodies within the assessment area

	Hodder - conf Easington Brook to confluence with the Ribble	Easington Brook	Bashall Brook	Ribble DS Stock Beck
Water body ID	GB112071065560	GB112071065380	GB112071065520	GB112071065612
Catchment size	69.3 km^2	12.8 km^2	17.8 km^2	61.9 km^2
Hydromorphological designation	Not designated artificial or heavily modified	Not designated artificial or heavily modified	Not designated artificial or heavily modified	Not designated artificial or heavily modified
Overall status	Good	Good	Moderate	Moderate
Ecological status	Good	Good	Good	Good
Chemical status	Good	Good	Good	Fail

228) The Ribble downstream of Stock Beck WFD surface waterbody is currently failing for chemical quality due to mercury. The physico-chemical quality elements and all other quality elements are good or High and therefore this waterbody is considered to be of High value. The other WFD waterbodies of Good status are also considered to be of High value. All other watercourses not designated under WFD are considered to be of Low to Medium value.

229) The assessment area does not lie within a Nitrate Vulnerable Zone (NVZ) or a Drinking Water Safeguard Zone.

Groundwater

230) The aqueduct along the Proposed Marl Hill Section is located fully below ground up to a maximum of 130 m bgl.

Groundwater Resource

231) Table 7.4 and Table 7.5 provide descriptions of the lithology of each geological unit present, the aquifer designations for these deposits, and descriptions of the likely hydrogeological characteristics of the strata. Each bedrock formation may comprise several individual members and beds, but for this stage of the assessment, the bedrock stratigraphic units are discussed at the formation level only.

232) Table 7.4 and Table 7.5 also describe the location of the proposed indicative development envelope (including the proposed tunnel route indicative corridor), in relation to the bedrock formations and superficial deposits present, i.e. whether they are directly crossed by the proposed route option, or whether they lie within the wider groundwater assessment area. The aquifer designation maps are shown in Figure 7.1 and Figure 7.2 for the bedrock and superficial deposits respectively.

Table 7.4: Bedrock Aquifer Information

Hydrogeological Unit	Description	Aquifer Designation	Hydrogeology	Relation to Route Proposal
Pendleton Formation	Fine to very coarse-grained pebbly sandstone, interbedded with siltstone and mudstone and subordinate shales, thin coals and seatearths.	Secondary A	Lies stratigraphically within the Millstone Grit Group. Multi-layered aquifer system in which the thick sandstone horizons act as separate aquifers, with the intervening mudstones and shales acting as aquicludes or aquitards.	Crossed by the proposed development envelope

Hydrogeological Unit	Description	Aquifer Designation	Hydrogeology	Relation to Route Proposal
Pendleside Limestone Formation	Fine to coarse-grained, bioclastic, commonly graded, cherty packstones, interbedded with wackestone, sporadic limestone conglomerate, and mudstone in the lower part.	Secondary A	Greatest yields are supported by fracture flow along bedding planes, solution enlarged fractures, and joints. The matrix of the limestones has a very low porosity and permeability, making a negligible contribution to total groundwater flow. There is potential for karstification in places, and thus larger conduits. The unit has been proven to operate in discrete blocks due to extensive faulting. This forms an important local aquifer (multi-layered), providing water for potable and industrial use. Where boreholes have been tested in this formation, yields range from 240 m^3/day to 1920 m^3/day.	Crossed by the proposed development envelope.
Hodderense Limestone Formation	Wackestones, with micritic nodules, sporadic interbedded packstones and common mudstones.	Secondary A	Similar hydrogeological characteristics to the Pendleside Limestone Formation.	Crossed by the proposed development envelope.
Hodder Mudstone Formation	Mudstone, with subordinate detrital limestone, siltstone and sandstone. Mudmound reef limestones, limestone boulder conglomerates and breccias near the base.	Secondary A	Argillaceous strata dominate, acting as aquitards or aquicludes, isolating the occasional sandstone horizons which act as separate aquifers. This is where most of the groundwater storage / movement occurs as both intergranular and fracture flow. Faulting has split the once continuous sandstone horizons into discrete blocks, to which no direct recharge can occur.	Crossed by the proposed development envelope.
Clitheroe Limestone Formation	Packstones, wackestones and subordinate grainstones and mudstones with reef limestones.	Secondary A	Similar hydrogeological characteristics to the Pendleside Limestone Formation.	Crossed by the proposed development envelope.

Hydrogeological Unit	Description	Aquifer Designation	Hydrogeology	Relation to Route Proposal
Bowland Shale Formation	Mainly fissile and blocky mudstone, with subordinate sequences of interbedded limestone and sandstone.	Secondary Undifferentiated	Consists mainly of mudstone with low hydraulic conductivity which inhibits vertical hydraulic continuity. Predominantly an aquitard in this area.	Crossed by the proposed development envelope.
Permian Rocks and Triassic Rocks (Undifferentiated)	N/A	Secondary A	N/A	Crossed by the proposed development envelope.

Table 7.5: Superficial Aquifer Information

Hydrogeological Unit	Description	Aquifer Designation	Hydrogeology	Relation to Route Proposal
Till (diamicton)	Variable lithology, typically sandy, silty clay, with pebbles, but can contain gravel-rich, or laminated sand layers.	Secondary Undifferentiated	Typically mixed flow with varying permeability. Usually acts as an aquitard or aquiclude but can locally comprise productive sand and gravel horizons, which may yield limited amounts of groundwater, although groundwater abstraction is unlikely.	Crossed by the proposed development envelope
Peat	An accumulation of wet, dark brown, partially decomposed vegetation, or an organic rich clay.	Unproductive strata	Typically mixed flow with low permeability. Usually comprises 90 % water and acts as an aquitard, limiting groundwater discharge. Permeability varies with the degree of decomposition and soil compression and often reduces with depth.	Crossed by the proposed development envelope
Alluvium	Typically soft to firm, consolidated, compressible silty clay, that can contain layers of silt, sand, peat, basal gravel, and a desiccated surface zone.	Secondary A	Typically intergranular flow with varying permeability. Where sand/gravel layers are thick and continuous, groundwater yields will be high, making local groundwater abstraction possible, although the dominance of clay in this unit may limit it's potential as an aquifer.	Crossed by the proposed development envelope.
Alluvial fan deposits	Alluvium, with a low-angle cone form.	Secondary A	Typically intergranular flow with high permeability.	Crossed by the proposed

Hydrogeological Unit	Description	Aquifer Designation	Hydrogeology	Relation to Route Proposal
			Similar hydrogeological characteristics to alluvium.	development envelope.
River terrace deposits	Sand and gravel, locally with lenses of silt, clay or peat.	Secondary A	Typically intergranular flow with high permeability. Sand and gravel deposits will typically comprise high porosity and high permeability and can locally yield significant groundwater volumes, if clay lenses are infrequent and sand/gravel deposits are of sufficient thickness. Local groundwater abstraction possible.	Lies within the wider groundwater assessment area.
Hummocky glacial deposits (diamicton)	Lithologically diverse deposits, composed of rock debris, clayey till and poorly-to well-stratified sand and gravel.	Secondary Undifferentiated	Typically intergranular flow with high permeability. Sand and gravel layers are the productive horizons, but the dominance of clay likely causes this unit to act locally as an aquitard. Groundwater abstraction is unlikely.	Crossed by the proposed development envelope.
Glaciolacustrine deposits	Devensian clay and silt.	Unproductive strata	Typically intergranular flow with high permeability. Clay constituent typically causes this unit to act as an aquitard or aquiclude. Despite containing occasional productive silt/sand horizons, the limited extent and thickness of these deposits makes groundwater abstraction unlikely.	Lies within the wider groundwater assessment area.

233) The eastern extent of the indicative development envelope for the proposed route overlaps with an SPZ1 and SPZ2, with another SPZ2 within the eastern extent of the wider Groundwater Assessment Area (see Figure 7.3). Although there is currently no information available relating to these licensed groundwater abstractions, a well and spring are annotated on the Ordnance Survey map within the delineation of the SPZ1.

234) The sandstone, siltstone, and limestone formations that comprise the Secondary A bedrock aquifers could also provide groundwater sources for industrial users, or for agriculture and leisure activities (such as golf courses). The presence and / or locations of these potential abstractions are also currently unknown.

235) There is also no information available at this stage regarding Private Water Supplies within the Groundwater Assessment Area, and this information will be gathered at the following stage through consultation with Local Authorities and land owners.

236) No groundwater level data are currently available, but it is anticipated that groundwater levels are shallowest in watercourse valleys (where present). Multiple springs are shown on Ordnance Survey mapping within the Groundwater Assessment Area (see Figure 7.3). Given that the Proposed Marl Hill Section is below ground

level, throughout its length, it is assumed that groundwater would be encountered at varying depths. The scheduled large scale GI will provide a baseline characterisation of the groundwater environment.

237) In terms of WFD groundwater bodies, the whole of the groundwater assessment area lies within the Ribble Carboniferous Aquifers groundwater body (GB41202G103000). Further details of the WFD groundwater body are provided in Table 7.6.

Table 7.6: WFD groundwater bodies within assessment area

	Ribble Carboniferous Aquifers
Water body ID	*GB41202G103000*
Catchment size	*828.6 km²*
Overall status	*Good*
Quantitative status	*Good*
Chemical status	*Good*

238) Further assessment of these WFD water bodies will be carried out as part of the Preliminary WFD Assessment as the EIA develops.

Groundwater Quality

239) The baseline chemistry of the groundwaters in the Carboniferous Limestone aquifers, the Pennine Coal Measures Group, Hodder Mudstone Formation, and the Bowland Shale Formation is summarised in Table 7.4. There is no information available for the baseline groundwater chemistry of the aquifer(s) that comprise the Permian and Triassic rocks in the groundwater assessment area.

240) The scheduled large scale GI will provide baseline groundwater quality information along the Proposed Marl Hill Section.

Groundwater Dependent Terrestrial Ecosystems

241) An initial scoping list of nature conservation sites to be assessed is provided in Chapter 9 Ecology. It is possible that these sites or some of them could support potential GWDTEs in the groundwater assessment area for the Proposed Marl Hill Section. The criteria to assess potential on GWDTEs is provided in Appendix 7.1.

Water Resources

242) At this stage a search of the Environment Agency's online Public Register for Environmental permits, which includes discharges to surface and ground waters has not been undertaken. There are likely to be existing environmental permits within the assessment area which will be obtained during the assessment stage. The existence of environmental permits for discharges to waters does not affect the identification or valuation of water environment features but is useful to identify constraints to inform the design.

243) Data relating to abstraction licences have not been obtained at this stage and will be considered at the EIA stage. Private water supplies will also be considered and identified at the EIA stage.

244) Pollution incident data has not been obtained and is not considered to be relevant for informing the assessment and will not be considered further.

7.4.4 Key Features

245) To summarise, the key features include:

- The Bashall Brook and Waddington Brook which are designated as WFD watercourses
- The Ribble Carboniferous Aquifer groundwater body within the assessment area as classified under the WFD

- The Secondary A aquifers of the Bedrock Pendleton Formation, Pendleside Limestone Formation, Hodderense Limestone Formation, Hodder Mudstone Formation, Clitheroe Limestone Formation and Permian Rocks And Triassic Rocks (Undifferentiated)
- The Secondary A aquifers of the Superficial Alluvium, Alluvial fan deposits and River terrace deposits.

246) Following the proposed survey for GWDTE, those identified could also become key features for assessment.

7.5 Potential Effects

247) A range of key activities are potentially associated with effects on the water environment. Likely potential effects are set out below for construction, operation and decommissioning activities, including any long-term effects from these activities.

7.5.1 Construction Effects

248) Potential likely significant short-term construction effects of the Proposed Marl Hill Section to be considered in the assessment are as follows:

Surface Water Hydrology

- In channel working as a result of access road crossings could lead to changes to the typical flow regime locally and downstream. De watering activities can result in less flow within the dewatered sections and potential for high velocities in other part of the river channel
- Localised loss of riparian vegetation as a result of vegetation clearance for pipe/road crossings and use of fords across watercourses, leading to an increase in local runoff from bare unvegetated banks. This impact is **Scoped in** for all watercourses crossed by above ground construction activities i.e. access roads
- Temporary crossing structures, such as culverts for haul roads and access tracks, can cause changes in flow depth and velocity under high flow conditions if the flow is constrained by structures. Bridges and culverts can also restrict flows locally with the channel increasing velocities. This impact is **Scoped in** for all watercourses crossed by above ground construction activities i.e. access roads
- Site compounds and materials storage - Change in local runoff patterns and rates associated with compounds, storage areas, stockpiles and temporary drainage; leading to changes in stream flow. This impact is **Scoped in** for watercourses are that could interact with development areas
- Soil compaction (associated with trackways, earthworks etc) can affect local runoff by increasing runoff rates during rainfall events leading to increased stream flow and velocity **– Scoped in**.

Fluvial Geomorphology

249) The following elements are scoped into the EIA pending further investigation, and in cases where watercourses are crossed by above-ground activities.

- Changes in sediment load leading to the adjustment of sediment processes, depositional features and the potential smothering of the channel bed substrate (with subsequent impacts on species and habitats)
- Changes to the flow regime in receiving watercourses, altering the flow processes, capacity of the channel to adjust (due to changes in the energy of the channel) and changes in erosion and deposition, potentially effecting the stability of the channel
- Diversion of watercourses to accommodate construction compounds and pipe/road crossings, affecting the form of the channel, gradient (altering flow processes) and morphological processes. Diversions and crossings could be in place for up to five years.
- Localised loss of riparian vegetation as a result of vegetation clearance for pipe/road crossings, leading to bank instability
- Input of fine sediment from local runoff or via existing and temporary field drainage leading to localised changes in sediment load and the bed substrate

- In-channel working leading to the damage and disturbance of morphological features, e.g. channel banks, depositional features and compaction of bed materials
- Temporary crossing structures, such as culverts for haul roads and access tracks, altering bank stability, removing riparian vegetation and altering geomorphological features
- Disruption of groundwater flow pathways could impact on baseflows in the watercourses crossed, particularly in an ephemeral/winterbourne watercourse, there could be changes to the geomorphological processes and features within the channel.

Surface Water Quality

250) With any construction work undertaken within or close to a watercourse there is an inherent risk of surface water contamination which can impact upon water quality.

- There would be an increased pollution risk from elevated suspended solids and nutrients, caused by the mobilisation of fine sediments which could potentially impact on the physical, chemical and microbiological water quality characteristics of receiving watercourses. The mobilisation of sediments could occur because of activities including dewatering, earthworks, the movement of heavy plant and runoff from stockpiles. **Scoped in** for all watercourses that could interact with above ground construction activities. **Scoped out** for all watercourses crossed by tunnel section, as above ground construction activities along the tunnel corridor are likely to be negligible
- There could be a risk of localised contamination as a result of using polluting substances in the construction process for example cement, oils, lubricants, and tunnel slurry. The pollutants could directly enter watercourses or via runoff with a higher risk of this occurring during storm events. Construction plant may also generate a diffuse source of hydrocarbons and to a lesser extent heavy metals, that could enter watercourses directly or leach into the subsoil and find their way into watercourses. **Scoped in** for all watercourses
- There is a risk of accidental spillage of polluting substances or leakage from general equipment use and the movement of plant around the site (e.g. storage tanks, leaking valves, refuelling, concreting activities and inadequate storage facilities). **Scoped in** for all watercourses that could interact with above ground construction activities.

Groundwater

251) Construction processes have the potential to impact on both groundwater flow and groundwater quality in different ways. The activities with the potential to have significant effect have been identified below and where it is reasonable to conclude there is not significant effect these impacts have been scoped out and highlighted as such.

252) General construction effects on groundwater include:

- Changes to groundwater recharge rates due to temporary changes in ground cover, such as working platforms, laydown areas, temporary access roads, and the removal of vegetation and / or shallow soils. This in turn could impact on groundwater levels and flows. The working area for construction is likely to be relatively small in comparison to the scale of the aquifer(s) being crossed. Any effects, if they were to occur, would therefore likely be negligible, and as such, this effect is **Scoped out** of the assessment, except for where sensitive groundwater environment attributes are present, for e.g. where the proposed development passes through a GWDTE
- Changes to groundwater quality from leaks and spills of chemicals, bentonite, fuels and oils from construction plant or materials used. This includes the storage of such materials, including fuel storage areas in construction compounds. **Scoped in** for areas overlying or directly interacting with highly sensitive aquifers, and / or where sensitive groundwater environment attributes (such as abstractions or GWDTEs) are intercepted by the proposed development
- Changes to groundwater quality due to the use of cementitious materials, which has the potential to change groundwater's pH value by making it more alkaline and affecting major ion concentrations. This would most likely occur when wet concrete is used in fractured bedrock, and these sensitive fractured aquifers will be **Scoped in**.

- Changes to groundwater quality due to mobilisation of soil and rock particles (suspended solids) which can migrate through the aquifer(s). Due to the filtering effect of the unsaturated zone and aquifer material, suspended solids would not migrate to any significant extent in intergranular aquifers or Unproductive strata. However, for aquifers with fracture flow, particularly for flow in karstic features, suspended solids can migrate significant distances and rapidly. This effect is therefore **Scoped out**, except for areas overlying or interacting with sensitive fractured flow dominated aquifers and in particular aquifers with the potential for karst development
- Changes to groundwater quality from the removal of vegetation and disturbance of ground. This could lead to exposed soils which in turn could lead to greater leaching of natural substances in the soils. The working area for construction is likely to be small in comparison to the scale of the aquifer(s) being crossed. Rainfall would naturally percolate through the soils (albeit it at a likely lower rate), leading to leaching of natural substances. Therefore, any effects that occur would likely be negligible, and as such, this effect is **Scoped out** of the assessment.

253) Specific construction impacts also need to be examined for tunnelling and the development of shafts.

- As tunnelling progresses, the lining will be constructed with pre-cast concrete segments. However, changes to groundwater levels and groundwater flow directions may be caused by temporary groundwater dewatering **– Scoped in**
- Shaft construction therefore has the potential to disturb local groundwater flow and levels. Some degree of dewatering may still be expected and could be significant, especially if the shaft is located in vicinity of sensitive attributes **– Scoped in**
- Dewatering effects, whether it is caused by tunnelling or shaft construction, have the potential to mobilise pre-existing pollution by reversing the natural groundwater flow gradient or re-enforcing the existing one. Little is known at the time of writing on pre-existing in-situ groundwater quality and the potential historical contaminated land areas are identified in Chapter 11. Some geological units are also expected to have a pre-existing contamination signature. As a consequence, mobilisation of pre-existing contamination is **Scoped in**
- The discharge of potentially contaminated dewatered groundwater could also be problematic, whether discharged to surface waters or, where no suitable watercourses are present discharged to ground. The use of mitigation measures, such as settlement lagoons or other appropriate treatment would remove silt and suspended solids, however in the absence of understanding of potential pre-existing contamination with groundwater, potential chemical significant impacts cannot be ruled out at this stage at this stage **– Scoped in**
- The potential recharge of abstracted groundwater from dewatering could also cause the groundwater level to rise and the groundwater flow direction to change. This could then lead to new local groundwater flooding developing or enhancing existing ones (discussed further in Chapter 8) **– Scoped in**
- The construction of shafts and trenchless crossing areas if proposed also create vertical pathways for contaminated groundwater to migrate between aquifers currently unconnected **– Scoped in**.

Water Resources

- Potential for any works which leads to a change in water quality and flows to affect downstream abstraction licences from surface waters, including those for private water supplies **– Scoped in**.

7.5.2 Operational

254) Potential operational effects of the Proposed Marl Hill Section to be considered in the assessment are as follows:

Surface Water Hydrology

- At drain down locations the same volumes of water will be discharged as per existing arrangement. Therefore changes in flows from drain down locations have been **Scoped out** of further assessment
- New infrastructure associated with the aqueduct such as valve houses will have an inconsequential effect on water resources **– Scoped out**

- Discharge pipes outfall to local watercourses as emergency discharges and during routine maintenance. Discharge pipes are existing features, the replacement of which is not being considered at this stage of the EIA. If new or modified discharge pipes/discharges are required, these would be assessed in the Environmental Statement. It is assumed that the operation of the aqueduct and the requirements for emergency discharges and maintenance will be similar to existing requirements and therefore has been **Scoped out**
- The decommissioned aqueduct may experience groundwater ingress. This water would be discharged via the existing discharge pipes to local watercourses. The extent of change at each location cannot be quantified at this time and will be **Scoped in**
- Decommissioning works could lead to a change in local runoff and infiltration patterns and rates; leading to changes in stream flow. This cannot be determined until the method of decommissioning is known therefore **Scoped in**.

Fluvial Geomorphology

255) The following outlines some of the potential effects during operation that could affect the fluvial geomorphology features and have been **Scoped in**:

- It has been assumed that no new outfalls would be required. However, an increase in discharge volume from the decommissioned section of the aqueduct could lead to changes in the sediment and flow processes
- During a discharge event there could be a localised increase in flow, disrupting sediment and flow processes. This could also exacerbate any scouring of the channel already experienced by the presence of the outfall(s)
- Localised removal of lateral connectivity between a watercourse and its floodplain by structures crossing the channel and aqueduct infrastructure (e.g. pipe bridges), including the removal of riparian vegetation
- Disruption of geomorphological features and disruption of processes whilst carrying out routine or emergency maintenance on the aqueduct.

Surface Water Quality

- Groundwater may flow into the decommissioned tunnel. This water would be discharged via existing pipes to local watercourses. This could impact upon water quality in receiving watercourses. Ground investigation is programmed for the Proposed Marl Hill Section which will include water quality testing of the groundwater to identify any potential pollutants and the chemistry of the water (i.e. pH). Until this information is available the impact upon surface waters cannot be established and this will be **Scoped in**
- At present chlorine is added to the treated drinking water prior to entering the aqueduct. Consequently, de-chlorination could be required prior to discharging of potable water into watercourses.

Groundwater

256) Potential operational effects on groundwater and associated attributes include:

- Changes to groundwater flow direction or levels due to the below ground aqueduct and other below ground structures. The portion of aquifer(s) lost would likely be small in comparison to the overall volume of aquifer storage available and groundwater flow would be expected to adjust around the aqueduct **– Scoped out**
- The new sections of aqueduct will be more 'water tight' than the neighbouring sections of the existing Haweswater Aqueduct that require replacement. Groundwater ingress into the new aqueduct would therefore be restricted. There is potential therefore, for groundwater to rebound, i.e. for groundwater levels to rise. This could result in localised groundwater flooding (discussed further in Chapter 8). It could also lead to groundwater discharges to areas where groundwater is currently not discharging **– Scoped in.**

257) The interpretation of ground investigation data and development of Conceptual Site Models developed for the construction phase will also be the basis to assess impacts during the operational changes.

Water Resources

258) No effects upon water resources are anticipated, other than the main objective of the Proposed Marl Hill Section which is to improve resilience for public water supplies which is a major beneficial significant effect.

Potential Decommissioning Effects (Including Decommissioning of Existing Haweswater Aqueduct)

259) Decommissioning impacts related to hydrology, fluvial geomorphology, water quality and use of water resources would be similar to those identified for the construction stage of the project.

260) Potential groundwater rebound as a result of the existing aqueduct being decommissioned and the new aqueduct being more 'watertight' is already captured in the potential operational effects above. Other effects specific to the decommissioning phase for groundwater aspects include:

- Changes to groundwater levels and flows if 'open' sections of aqueduct are abandoned. If the aqueduct is not permanently filled with grout or cement then the structure itself could act as a preferential pathway for groundwater migration. This could then lead to groundwater being drained from one area, leading to a reduction in groundwater levels, or changes to groundwater discharge points elsewhere. There is also potential for the aqueduct to collapse, leading to ground settlement, which could cause significant effects to overlying or nearby groundwater environment attributes **– Scoped in**
- If the entire length of the abandoned aqueduct is permanently grouted, with for e.g. concrete or a bentonite slurry, and open ends and connections are sufficiently sealed, then groundwater ingress into the aqueduct would be prevented. The aqueduct could therefore provide a barrier to groundwater flow, which similar to the new aqueduct, could lead to changes in groundwater levels. There would then be the potential for changes to groundwater discharge points. The aqueduct would, however, likely be small compared to the overall thickness of the aquifer unit(s), except where the aqueduct is shallow and at proximity of a sensitivity attribute such as a GWDTE or in areas where groundwater is already shallow. On this basis, this effect is **Scoped out** of the assessment, except for where sensitive groundwater environment attributes are located, or in areas with existing groundwater flooding issues.

7.6 Design and Mitigation

261) Additional mitigation will depend on the issues identified through the assessment and may include but are not limited to:

- Developing the design to avoid sensitive water environment features such as those watercourses identified as High value such as the Bashall Brook, Waddington Brook and GWDTEs. Whilst it may not be possible to change the general route of the aqueduct due to the gradients required for the gravity feed it may be possible to avoid impacts from shafts, site compounds, access roads and other infrastructure associated with the Proposed Marl Hill Section through careful sighting within the development envelopes
- Embedding the outcome of the ground investigation and developed Conceptual Site Models into the developing design to remove or minimise effects
- Embed in the routing and design development to avoid impact on sensitive attributes such as licensed abstractions and GWDTE with national or international designations or GWDTEs with local or no designations that have high or moderate groundwater dependency
- Groundwater breaks incorporated into the design at discrete intervals to prevent continuous groundwater flowpaths in the material surrounding the aqueduct. This would prevent groundwater from being drained in one location and groundwater discharge points being created elsewhere
- Additional measures to prevent vertical migration of pollution in between aquifers
- Reinstatement of the channel cross-section and vegetated riparian corridor following open-cut and access road crossings should be designed and undertaken in a manner that ensures restoration of the natural flow and sediment dynamics of the watercourses affected. This will be key to ensuring there are no significant effects on the fluvial geomorphology following construction.

7.7 Summary Scope for the EIA

262) A summary of the scoping assessment for the water environment is presented below in Table 7.7.

Table 7.7: Matters of significance for Water Environment

Feature group	Matter / potential effects	Location within assessment area	Comments
Construction			
Surface Water Hydrology	In channel working and de-watering leading to changes to the typical flow regime locally and downstream.	All watercourses within the development envelope for above ground construction activities.	Scoped in for all watercourses, as working technique and duration are currently unknown. An assessment on a case-by-case basis for each watercourse will need to be made to determine potential impacts.
	Increase in runoff due to riparian vegetation clearance for road crossings and use of fords across watercourses.	All watercourses within the development envelope for above ground construction activities.	Scoped in for all watercourses crossed by above ground construction activities.
	Restriction of flows (i.e. from culverts, bridges, crossings etc.) leading to changes in flow depth and velocity under high flow.	All watercourses within the development envelope for above ground construction activities	Scoped in for all watercourses, as working technique and duration are currently unknown. An assessment on a case-by-case basis for each watercourse will need to be made to determine potential impacts.
	Site compounds and materials storage- Change in local runoff patterns and rates associated with compounds, storage areas, stockpiles and temporary drainage; leading to changes in stream flow.	Throughout and specifically within development areas.	Scoped in for all watercourses that could interact with development areas.
	Increase in runoff rates due to soil compaction (associated with trackways, earthworks etc.)	All watercourses within the development envelope	Scoped out for all watercourses assuming the CEMP includes mitigation for managing surface water runoff.
Surface Water Quality	Increased pollution risk from the mobilisation of sediments which could potentially impact on the physical, chemical and microbiological water quality of receiving watercourses.	Throughout	Scoped in for all watercourses that could interact with above ground construction activities. Scoped out where watercourses are crossed by tunnel corridor as impact likely to be negligible.

Feature group	Matter / potential effects	Location within assessment area	Comments
	Increased pollution risk as a result of using polluting substances in the construction process for example cement, oils, lubricants, and tunnel slurry.	Throughout.	Scoped in for all watercourses.
	There is a risk of accidental spillage of polluting substances or leakage from general equipment use and the movement of plant around the site.	Throughout.	Scoped in for all watercourses that could interact with above ground construction activities.
Water Resources	Potential change in water quality and flows to affect downstream abstraction licences from surface waters.	Throughout.	Scoped in for all watercourses, as abstraction locations and duration are currently unknown. An assessment on a case-by-case basis for each watercourse will need to be made to determine potential impacts.
Fluvial Geomorphology	Changes to geomorphological processes and features as a result of construction compounds. Loss/modification of riparian vegetation as a consequence of site clearance.	Various watercourses.	Scoped in for Very High and High value features due to sensitive nature of the channel and potential for the works to destabilise the channel bed and lead to erosion. Scoped out for Medium and Low value features as the works would be localised and short-term and it is assumed the channel would be reinstated to pre-work conditions.
	Changes to geomorphological processes and features, and the loss/modification of riparian vegetation as a result of access road crossings.	Various watercourses.	Scoped in for all watercourses, as crossing technique and duration are currently unknown. An assessment on a case-by-case basis for each watercourse will need to be made to determine potential impacts.
	Changes to geomorphological processes and features as a consequence of tunnel-crossings.	Throughout including two WFD Watercourses.	Scoped in for Very High and High value features due to potential changes in flow processes from drawdown in groundwater. Scoped out for Medium and Low value features, unless identified to be an ephemeral watercourse, due to limited potential for changes to flow processes.

Feature group	Matter / potential effects	Location within assessment area	Comments
Groundwater	Changes to groundwater recharge rates due to temporary changes in ground cover.	Throughout.	Scoped out except where aqueduct is shallow and in vicinity of a GWDTE or running through shallow groundwater conditions.
	Changes to groundwater quality from leaks and spills of chemicals, fuels and oils from construction plant or materials used.	Throughout.	Scoped in for areas overlying or directly interacting with highly sensitive aquifers, and / or where sensitive groundwater environment attributes (such as abstractions or GWDTEs) are intercepted by the proposed development.
	Changes to groundwater quality due to the use of cementitious materials.	Throughout.	Scoped out except where the proposed development interacts with sensitive fractured aquifers.
	Changes to groundwater quality from the removal of vegetation and disturbance of ground.	Throughout.	Scoped out.
	Temporary tunnel dewatering.	Throughout.	Scoped in.
	Temporary shaft dewatering.	In the location of proposed shafts.	Scoped in.
	Potential recharge of abstracted groundwater from dewatering could also cause the groundwater level to rise.	Throughout.	Scoped in.
	Creation of vertical pathways by shafts.	In the location of proposed shafts.	Scoped in.
Operation			
Surface Water Hydrology	Discharges from the aqueduct at existing drain down locations	At drain down locations – receiving watercourses.	Scoped out - the same volumes of water will be discharged
	New infrastructure associated with the aqueduct have the potential to increase the amount of impermeable area and thus increase flows to watercourses.	All locations where new infrastructure proposed.	Scoped out as will have an inconsequential effect.
	Discharge pipes outfall to local watercourses as emergency discharges and during routine maintenance.	All locations where discharge pipes outfall to watercourses.	Scoped Out - the operation of the aqueduct and the requirements for emergency discharges and maintenance will be similar to existing requirements and therefore has been scoped out of further assessment.

Feature group	Matter / potential effects	Location within assessment area	Comments
	The existing aqueduct which will be abandoned will over time fill with groundwater. This water will be directed via the existing discharge pipes and will result in new constant discharges to surface waters.	All locations where discharge pipes outfall to watercourses.	Scoped in - the extent of change at each location cannot be quantified at this time and will be assessed at the next stage.
	Decommissioning works could lead to a change in local runoff and infiltration patterns and rates; leading to changes in stream flow.	Throughout.	Scoped in - this cannot be determined until the method of decommissioning is known.
Surface Water Quality	During operation groundwater ingress into the abandoned sections of the existing tunnel would occur. This water would most likely be discharged via pipes to surface watercourses and may impact upon surface water quality in receiving watercourses.	Throughout.	Scoped in - an extensive GI is programmed for the project which will include water quality testing of the groundwater to identify any potential pollutants and the chemistry of the water (i.e. pH). Until this information is available the impact upon surface waters cannot be established and this will require further assessment.
Fluvial Geomorphology	Discharges from drain down locations into channel effecting flow and sediment processes	Various watercourses and water features including one WFD Watercourse.	Scoped in for all watercourses due to potential for changes in flow and sediment processes.
Groundwater	Changes to groundwater flow direction or levels due to the below ground aqueduct and other below ground structures.	Throughout.	Scoped out except where the aqueduct is shallow and in vicinity of a GWDTE or running through shallow groundwater conditions.
	Water-tight new aqueduct may result in groundwater rebound.	Throughout.	Scoped in
	Decommissioning: the aqueduct is not permanently filled with grout or cement.	Throughout.	Scoped in
	Decommissioning: the aqueduct is permanently filled with grout or cement	Throughout.	Scoped out except for where sensitive groundwater environment attributes are located, or in areas with existing groundwater flooding issues

Appendix 7.1 Detailed Water Environment Assessment Methodology and Significance Criteria

A.1 Introduction

263) There are no standard methods for evaluating likely effects on the water environment for projects of this nature. To fulfil the requirements of the EIA Regulations the methodology used for undertaking the assessment to determine any significant effects as a result of the Proposed Marl Hill Section is based upon that prescribed in the Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3 Part 10: HD45/09, Road Drainage and the Water Environment, professional judgement and past EIA experience. The methodology sets out a list of criteria for evaluating the environmental effects, as follows:

- The importance (value) of the resource under consideration on a scale of sensitivity (i.e. very high, high, medium or low) as shown in Table A7.1A
- The magnitude of the effect in relation to the resource that has been evaluated, quantified using the scale very high, high, medium or low as shown in Table A7.1B
- The significance of the effect using the scale major, moderate, minor and negligible using the diagram as shown in Table A7.1C. This is based on the value of the resource under consideration and the magnitude of the effect.

264) The criteria defined for GWDTEs follows the UK Technical Advisory Group (UKTAG) guidance (UKTAG, 2009) to identify, prioritise and assess potential impacts on these attributes.

A.2 Proposed Assessment Criteria

A.2.1 Value of Receptors

265) Establishing the baseline environment allows water environment receptors to be identified. Following this a value is assigned to each receptor based on the criteria in Table A7.1A below.

266) The value of resources are derived to reflect the importance of features outlined in key policy documents and legislation.

Table A7.1A: Estimating the Importance/Value of Water Environment Attributes

Importance/ Value	Criteria	Typical Examples
Very High	Attribute has a high quality and rarity on regional or national scale	**Surface Water Hydrology and Quality** • Main Rivers • EC Designated Salmonid/Cyprinid fishery* • Water Framework Directive (WFD) Class 'High' for overall status • Site protected/designated under EC or UK habitat legislation (SAC, SPA, SSSI, Water Protection Zone (WPZ), Ramsar site, salmonid water)/ • Supports water-dependent species protected by EC legislation • Supports major surface water abstraction for potable supply.
		Fluvial Geomorphology A watercourse that appears to be in complete natural equilibrium and exhibits a natural range of morphological features (such as pools and riffles). There is a diverse range of fluvial processes present, free from any modification or anthropogenic influence. Morphological features and processes would be highly sensitive to change as a result of temporary or permanent works.
		Groundwater

Importance/ Value	Criteria	Typical Examples
		Principal bedrock and superficial aquifers. Groundwater flow and yield associated with licensed groundwater abstractions. Groundwater quality associated with SPZ1 (Inner Protection Zone) associated with licensed abstractions. Buildings of regional or national importance, such as scheduled monuments, hospitals, power stations and industrial buildings. Water feeding GWDTEs with a high or moderate groundwater dependence with a high environmental importance and international or national value, such as Ramsar sites, Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Sites of Special Scientific Interest (SSSIs).
High	Attribute has a high quality and rarity on local scale	**Surface Water Hydrology and Quality** • Main River • WFD Class 'Good' for overall status or Moderate overall status with good chemical quality and good physico-chemical elements. • Major Cyprinid Fishery* • Species protected under EC or UK habitat legislation • Supports licensed small-scale substitutable abstraction for potable supply or extensive non-licensed private water abstractions (i.e. feeding ten or more properties or supplying large farming / animal estates).
		Fluvial Geomorphology A watercourse that appears to be in natural equilibrium and exhibits a natural range of morphological features (such as pools and riffles). There is a diverse range of fluvial processes present, with very limited signs of modification or other anthropogenic influences. Morphological features and processes would be sensitive to change as a result of temporary or permanent works.
		Groundwater Secondary A aquifers. Groundwater flow and yield and quality associated with extensive non-licensed private water abstractions (i.e. feeding ten or more properties or supplying large farming / animal estates). Groundwater quality associated with SPZ2 (Outer Protection Zone) associated with licensed abstractions. Residential and commercial properties. Water feeding GWDTEs of low groundwater dependence with a high environmental importance and international or national value, such as Ramsar sites, SACs, SPAs and SSSIs; or water feeding highly or moderately GWDTE with a national non-statutory UK Biodiversity Action Plan (BAP) priority.
Medium	Attribute has a medium quality and rarity on local scale	**Surface Hydrology and Water Quality** Main River or Ordinary watercourse WFD Class 'Moderate' overall with Moderate or poor chemical quality and moderate or poor physico-chemical elements. WFD Class 'Poor' overall status. Supports water dependent BAP habitats or local sites of importance for nature conservation. Supports limited non-licensed abstraction for non-potable supply.
		Fluvial Geomorphology

Importance/ Value	Criteria	Typical Examples
		A watercourse showing signs of modification, recovering to a natural equilibrium, and exhibiting a limited range of morphological features (such as pools and riffles). The watercourse is one with a limited range of fluvial processes and is affected by modification or other anthropogenic influences. Morphological features and processes could be sensitive to change as a result of temporary or permanent works.
		Groundwater Secondary B and Secondary Undifferentiated aquifers. Groundwater flow and yield and quality associated with small scale private water abstractions (i.e. feeding fewer than ten properties). Groundwater quality associated with SPZ3 (Source Catchment Protection Zone) associated with licensed abstractions and with licensed abstractions for which no SPZ is defined. Vacant residential properties and buildings. Water feeding GWDTEs of low groundwater dependence with a national non-statutory UK BAP priority; or water feeding highly or moderately groundwater dependent GWDTE sites with no conservation designation.
Low	Attribute has a low quality and rarity on local scale	**Surface Water Hydrology and Quality** Ordinary watercourse (note – man-made drains that serve purely a drainage function or man-made features such as SuDS ponds can be included in this category or excluded from assessment based upon the nature of the Proposed Marl Hill Section). Non - WFD designated watercourses. WFD water body status of Poor and failing to achieve chemical quality. Habitats dependent upon fluvial or pluvial water sources not designated (i.e. wetlands etc.). No surface water abstractions.
		Fluvial Geomorphology A highly modified watercourse that exhibits no morphological diversity and has a uniform channel, showing no evidence of active fluvial processes. Has likely been significantly affected by anthropogenic factors which may include modification of flow regime, resulting in a dry channel during prolonged dry periods. Morphological features and processes would be unlikely to be sensitive to temporary or permanent works.
		Groundwater Very poor groundwater quality and / or very low permeability make exploitation of groundwater unfeasible. No active groundwater supply. Industrial buildings that are currently not utilised, all derelict buildings and infrastructure that serves a single dwelling. Water feeding GWDTEs of low groundwater dependence with no designation or groundwater that supports a wetland not classified as a GWDTE, although may receive some minor contribution from groundwater.

267) It should be noted that the values assigned to various SPZs are to acknowledge the differing sensitivities between the three categories and are based on assessment criteria that have been widely used and accepted for other development projects. It should be noted that although the criteria distinguish between the different SPZ categories, this does not detract from the need for the assessment to identify appropriate mitigation measures for aquifer and source protection.

A.2.2 Magnitude of Impacts

268) Impacts are then identified based upon the nature and extent of the Proposed Marl Hill Section. The magnitude of impacts is established using either quantitative or qualitative assessment based upon professional judgement. The magnitude of change is a measure of the scale or extent of the change in the baseline condition, irrespective of the value of the resource(s) affected. In determining magnitude, the extent of the physical change would be considered in the context of other factors such as the likelihood of effect, existing long-term trends, the timescale over which the effect occurs and whether the effect is temporary or permanent. The magnitude of potential impacts may be beneficial or adverse.

269) Estimating the magnitude of adverse impacts is based on the criteria presented in Table A7.1B. The nature, duration (i.e. long term, short term) and characteristics of impacts are identified to enable their magnitude to be determined.

270) Whilst beneficial impacts may result from the Proposed Marl Hill Section it is not intended to qualitatively or quantitatively determine the magnitude of these and therefore these will be noted in the assessment as appropriate but not assigned a magnitude or significance. It is highly unlikely a project would achieve any significant beneficial effects unless the project was purely for improving the water environment.

Table A7.1B: Scale for recording the magnitude of adverse predicted effect.

Importance/ Value	Criteria	Typical Examples
Major Adverse	Results in loss of attribute and / or quality and integrity of the attribute.	**Surface water hydrology and quality** Loss or extensive change to a Nature Conservation Site or Fishery. Total loss of water environment receptor. Reduces resource availability resulting in change to assessment point status. Reduction in major potable abstraction (quantity or quality). Derogates existing water quality (e.g. exceedance of an EQS of a water quality parameter) or impacts on ability of the water body to achieve WFD objective.
		Fluvial Geomorphology Loss or extensive damage to habitat due to extensive modification of natural channel planform, and / or sediment and flow processes. Replacement of a large extent of the natural bed and / or banks with artificial material.
		Groundwater Major or irreversible change to groundwater aquifer(s) flow, water level, quality or available yield which endangers the resources currently available. Groundwater resource use / abstraction is irreparably impacted upon, with a major or total loss of an existing supply or supplies. Changes to water table level or quality would result in a major or total change in, or loss of, a groundwater dependent area, where the value of a site would be severely affected. Changes to groundwater aquifer(s) flow, water level and quality would result in major changes to groundwater baseflow contributions to surface water and / or alterations in surface water quality, resulting in a major shift away from baseline conditions such as change to WFD status. Dewatering effects create significant differential settlement effects on existing infrastructure and buildings leading to extensive repairs required.
Moderate Adverse	Results in effect on integrity of attribute, or	**Surface water hydrology and quality** Partial loss in productivity of fishery Impacts on WFD measure(s) ability to deliver benefits but not on achievement of objectives.

Importance/ Value	Criteria	Typical Examples
	loss of part attribute	Reduces local small scale resource availability but no discernible change to assessment point status.
		Fluvial Geomorphology Moderate deterioration from baseline conditions, with partial loss or damage to habitat due to modifications and / or changes to natural fluvial forms and processes. Replacement of the natural bed and / or banks with artificial material.
		Groundwater Moderate long term or temporary significant changes to groundwater aquifer(s) flow, water level, quality or available yield which results in moderate long term or temporarily significant decrease in resource availability. Groundwater resource use / abstraction is impacted slightly, but existing supplies remain sustainable. Changes to water table level or groundwater quality would result in partial change in or loss of a groundwater dependent area, where the value of the site would be affected, but not to a major degree. Changes to groundwater aquifer(s) flow, water level and quality would result in moderate changes to groundwater baseflow contributions to surface water and / or alterations in surface water quality, resulting in a moderate shift from baseline conditions upon which the WFD status rests. Dewatering effects create moderate differential settlement effects on existing infrastructure and buildings leading to consideration of undertaking minor repairs.
Minor Adverse	Results in some measurable changes in attributes quality or vulnerability	**Surface water hydrology and quality** Structures and changes to flow which cause deviation from natural flow regime. Slight deterioration in baseline water quality conditions but not significant enough to be measurable. Localised small scale reduction in resource availability.
		Fluvial Geomorphology Slight deterioration from baseline conditions, with partial loss/damage to habitat due to modifications and / or changes to natural fluvial forms and processes.
		Groundwater Minor changes to groundwater aquifer(s) flow, water level, quality or available yield leading to a noticeable change, confined largely to the Proposed Marl Hill Section. Changes to water table level, groundwater quality and yield result in little discernible change to existing resource use. Changes to water table level or groundwater quality would result in minor change to groundwater dependent areas, but where the value of the site would not be affected. Changes to groundwater aquifer(s) flow, water level and quality would result in minor changes to groundwater baseflow contributions to surface water and / or alterations in surface water quality, resulting in a minor shift from baseline conditions (equivalent to minor but measurable change within WFD status). Dewatering effects create minor differential settlement effects on existing infrastructure and buildings which may need to be monitored but where repairs may be avoidable.
Negligible	Results in effect on attribute, but	**Surface water hydrology and quality** Structures and changes to flow which cause deviation from natural flow regime

Importance/ Value	Criteria	Typical Examples
	of insignificant magnitude to affect the use or integrity.	Slight deterioration in baseline water quality conditions but not significant enough to be measurable. No impact on WFD measures and / or their ability to achieve WFD water body objectives. No change in resource availability.
		Fluvial Geomorphology Very slight change from surface water baseline conditions, approximating to a 'no change' situation.
		Groundwater Very slight change from groundwater baseline conditions approximating to a 'no change' situation. Dewatering effects create no or no noticeable differential settlement effects on existing infrastructure and buildings.

A.2.3 Significance of Effect

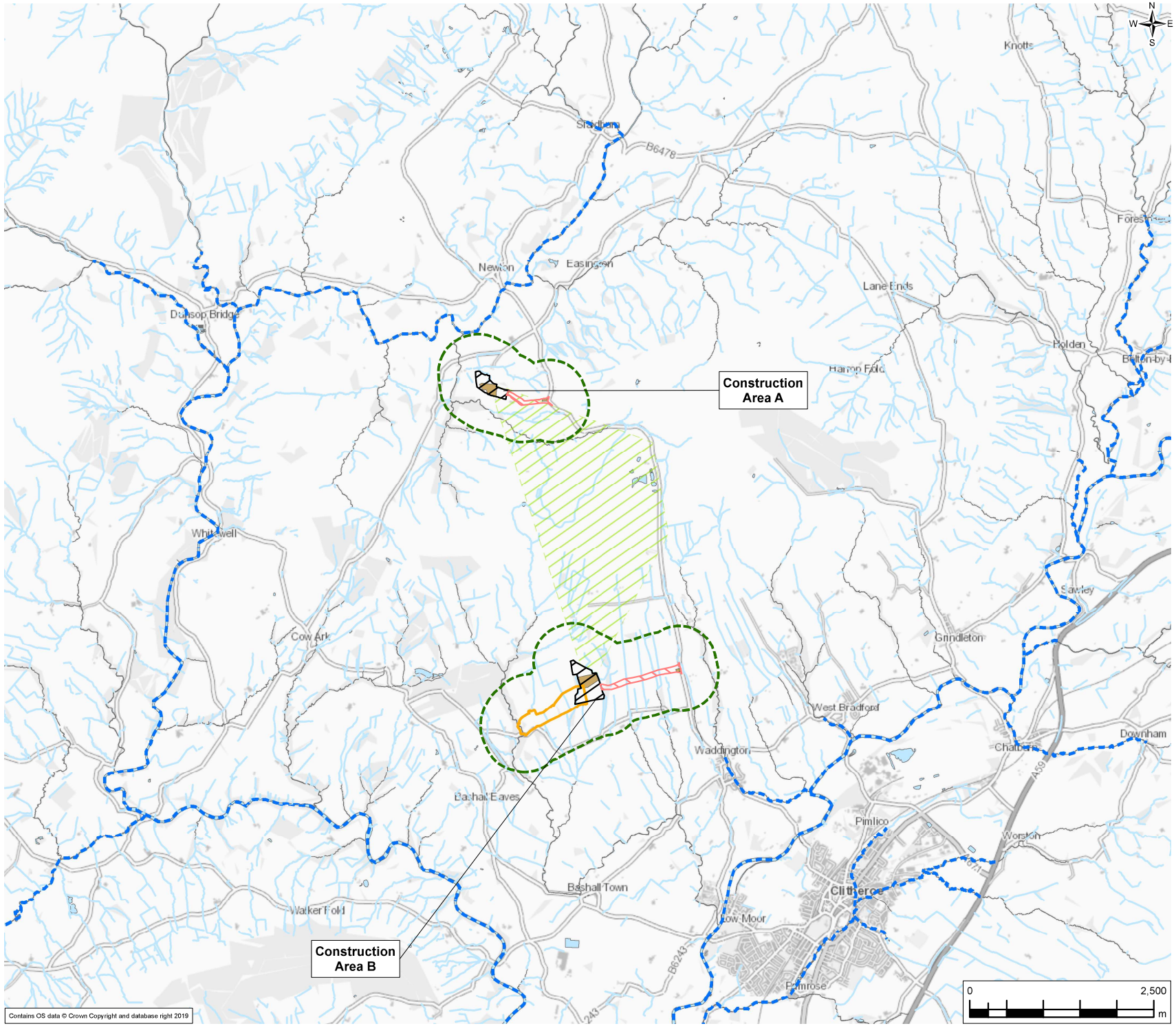
271) Considering the value of the feature and the potential magnitude of impact, the significance of the effect is based on the combination of the value of the feature and the magnitude of impact using the matrix in Table A7.1C. Potential effects can be either beneficial or adverse. The level of significance is assigned initially after consideration of any embedded mitigation to enable additional mitigation requirements to be identified and then finally following any additional proposed mitigation. The assessment assumes that all mitigation identified is appropriately implemented and maintained where necessary.

Table A7.1C: Significance of effect

		Magnitude of impact			
		Negligible	**Minor**	**Moderate**	**Major**
Importance / value of feature	**Low**	Neutral	Neutral	Slight	Slight/Moderate
	Medium	Neutral	Slight	Moderate	Large
	High	Neutral	Slight/Moderate	Moderate/Large	Large/Very Large
	Very High	Neutral	Moderate/Large	Large/Very Large	Very Large

272) For the purposes of the EIA regulations those residual effects described as having a Moderate, Large or Very Large significance effect upon a feature are usually considered to be significant in terms of the EIA Regulations and thus are material considerations when determining planning applications. The use of the terms 'neutral' or 'slight' are used to acknowledge that there will be some change from the baseline conditions but that these effects are not significant.

FIGURE 7.1



Legend

- Surface Water Assessment Area
- Proposed Tunnel Route - Indicative
- Proposed Construction Access - Indicative
- Proposed Construction Compound / Laydown Area - Indicative Development Envelope
- Proposed Indicative Construction Compound / Laydown Area
- Proposed Discharge Pipe - Indicative

Surface Water Features

- Main River
- Ordinary Watercourse
- Surface Water Body

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
0	OCT 19	Initial Issue	LT	JM	TA	SH

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Project: HAWESWATER AQUEDUCT RESILIENCE PROGRAMME

Drawing Title: SURFACE WATER FEATURES PROPOSED MARL HILL SECTION SHEET 1 OF 1

Drawing Status: FINAL

Scale @ A3	1:50,000	DO NOT SCALE
Jacobs No.	B27070CG	
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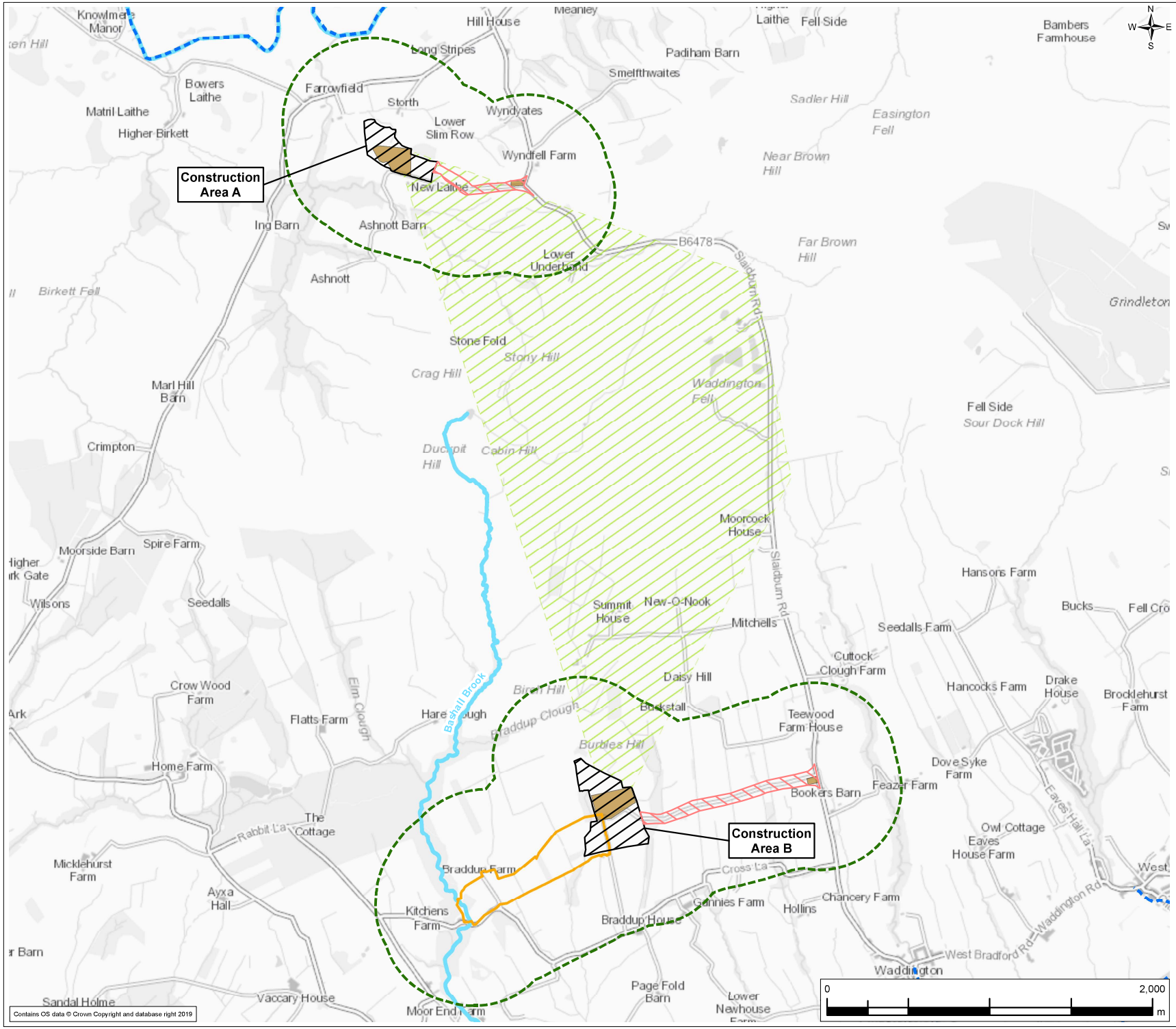

FIGURE 7.2

Legend

- Surface Water Assessment Area
- Proposed Tunnel Route - Indicative Corridor
- Proposed Construction Access - Indicative Route
- Proposed Construction Compound / Laydown Area - Indicative Development Envelope
- Proposed Indicative Construction Compound / Laydown Area
- Proposed Discharge Pipe - Indicative Corridor

Water Features

- Main River
- WFD Watercourses

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Drawing Title: MAIN RIVERS AND WFD WATERCOURSES PROPOSED MARL HILL SECTION SHEET 1 OF 1

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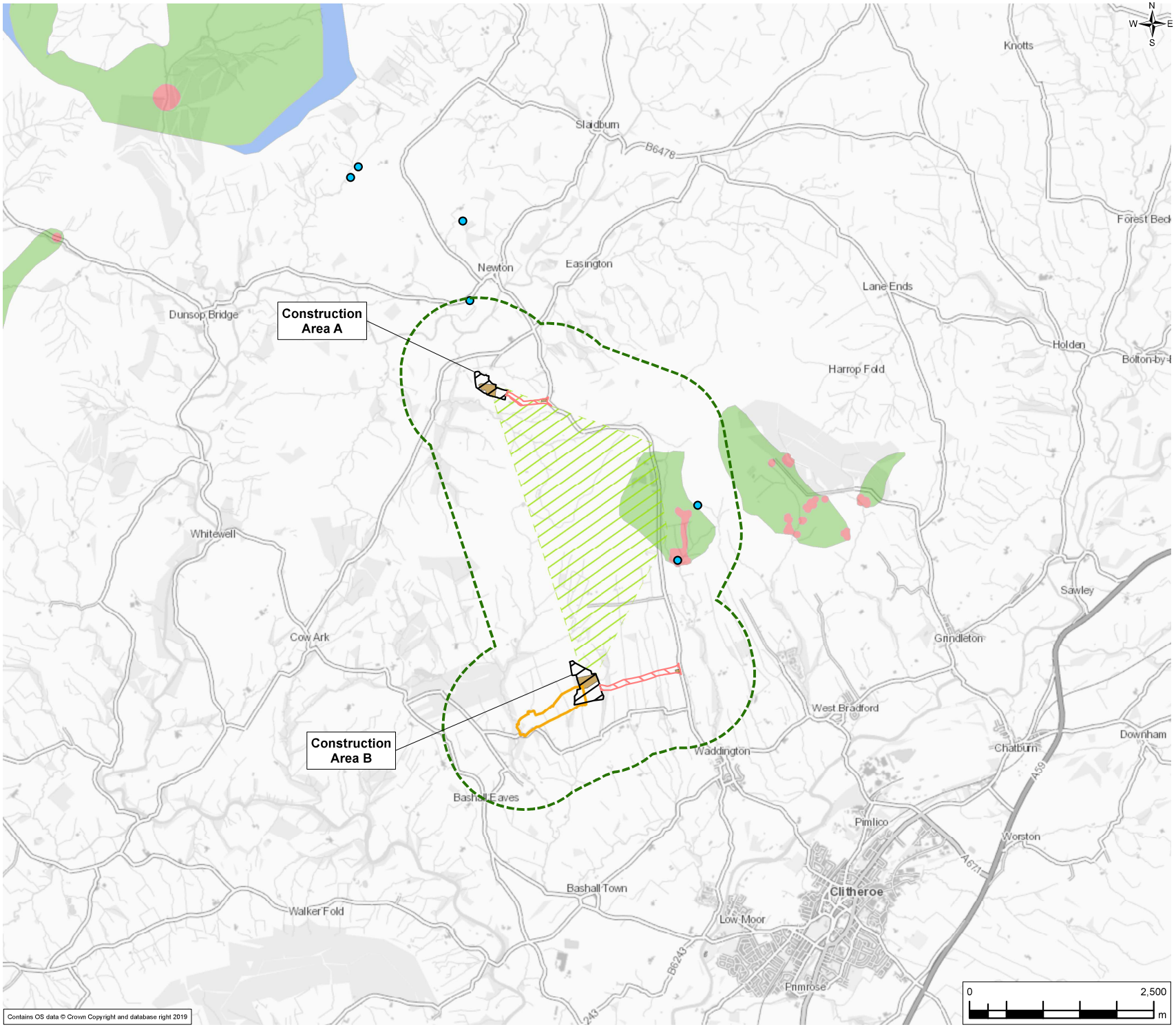
FIGURE 7.3



Legend

- Groundwater Assessment Area
- Proposed Tunnel Route - Indicative Corridor
- Proposed Construction Access - Indicative
- Proposed Construction Compound / Laydown Area - Indicative Development Envelope
- Proposed Indicative Construction Compound / Laydown Area
- Proposed Discharge Pipe - Indicative

Constraints

- Springs shown on Ordnance Survey maps
- Source Protection Zone 1
- Source Protection Zone 2
- Source Protection Zone 3

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
0	OCT 19	Initial Issue	LT	JM	TA	SH

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Project: HAWESWATER AQUEDUCT RESILIENCE PROGRAMME

Drawing Title: SOURCE PROTECTION ZONES AND SPRING DISCHARGES AS RECORDED ON ORDNANCE SURVEY MAPS PROPOSED MARL HILL SECTION SHEET 1 OF 1

Drawing Status: FINAL

Scale @ A3	1:50,000	DO NOT SCALE
Jacobs No.	B27070CG	
Client No.		
Drawing No.	B27070CG_ESR_07_03	

8. Flood Risk

8.1 Overview

273) This chapter presents the outcome of the scoping exercise in relation to potential flood risk effects on the Proposed Marl Hill Section. Flood risk can arise from a range of sources including:

- Rivers – also known as fluvial flooding
- The sea – high tides and wave overtopping can cause flooding in coastal areas. It can also combine with high river levels. The Proposed Marl Hill Section is located entirely inland and is remote from sources of tidal risk. Therefore, this source has been scoped out
- Surface water – rainfall that has not yet entered a formal watercourse and poses a risk of flooding in areas away from rivers or the sea
- Groundwater – the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground, through natural processes, under conditions where the 'normal' range of groundwater levels and groundwater flows are exceeded
- Artificial sources – this includes flooding from reservoirs, canals, water mains and sewers.

274) In this chapter, the flood risk baseline is summarised, and provisional consideration of the potentially significant effects is provided. The scope of the flood risk impact assessment that will be undertaken to inform the EIA and its technical methodology is described below.

275) The NPPF [26] defines the requirements for flood risk assessments within England which is supplemented by guidance provided by the Environment Agency.[27]

8.2 Proposed Methodology

276) The assessment will be undertaken in accordance with the NPPF, and will draw on previous experience of similar projects, professional judgement and knowledge of local flood risk within which the Proposed Marl Hill Section will be delivered.

277) An assessment of the existing risk will be undertaken to establish the baseline conditions. This will include:

- A review of national flood risk datasets including the Environment Agency's flood map for planning, the flood map for surface water, the British Geological Survey (BGS) Susceptibility to Groundwater Flooding dataset, and reservoir flood risk maps. This will be cross referenced with Ordnance Survey (OS) mapping to identify existing and potential future receptors to flood risk
- Consultation with the Environment Agency, Lead Local Flood Authorities (LLFA) and the Coal Authority as required, to identify areas of historical flooding and known 'problem' areas (for example due to mine water rebound); existing flood risk management schemes; and proposed new schemes. This consultation will include a review of catchment flood management plans and strategic flood risk assessments
- A flow routing analysis to identify existing surface water flow paths and catchment boundaries
- A review of groundwater level data collected during future ground investigations, as well as from ongoing groundwater monitoring, hydrogeological information obtained from the groundwater assessment carried out in Chapter 7 Water Environment, and evidence of groundwater discharge points (springs, seeps, flushes, water wells and baseflow component to watercourses)
- Identification of artificial infrastructure including reservoirs, canals, water supply and waste water infrastructure from OS mapping and consultation with United Utilities and the Canals and Rivers Trust

[26] National Planning Policy Framework (2012) Department for Communities and Local Government
[27] Flood Risk Assessment for Planning Applications (2017) Environment Agency, Available online at https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications [Accessed July 2019]

- Identification of property and infrastructure that is potentially at risk from impacts on flood risk as a result of the Proposed Marl Hill Section from OS mapping and consultation with the LLFAs covering Lancashire, the Environment Agency and United Utilities.

278) In accordance with the NPPF, following the identification of baseline flood risk, an assessment will be undertaken to determine the flood risk posed to the Proposed Marl Hill Section and the potential for the Proposed Marl Hill Section to increase flood risk elsewhere over the life of the works. This will include:

- A review of the development proposals including enabling works and drainage designs. The assessment will be based on professional judgement and will investigate the potential interaction between components of the construction process or completed scheme with sources of flood risk identified during the baseline assessment
- Discharges of groundwater would be subject to a level of assessment dependent on downstream receptors, size of receiving watercourse and the magnitude and timing of the discharge. It is noted that the multi siphon drain down locations currently in place would be retained and used by the Proposed Marl Hill Section. Also, the replacement of sections of the aqueduct will reduce the likelihood of failure. Therefore, no detailed assessment of discharges from overflows and drain down pipes is currently proposed
  - Where discharges are to large watercourses in areas remote of sensitive receptors, the assessment may consider the use of a managed discharge regime to assess if discharges would pose a risk to downstream receptors without the need for hydraulic modelling
  - Where the volume of discharge would increase compared to the baseline and would pose a potential risk to sensitive receptors, detailed assessments would be made which may include hydraulic modelling
- The methodology for the assessment of watercourse crossings will be determined on a case by case basis following an initial review once further details of the design have been established. No detailed assessment is currently proposed for watercourse crossings that are tunnelled under, or where existing crossings are retained unchanged. Detailed assessments such as hydraulic modelling may be undertaken where significant new watercourse crossings are proposed or where sensitive land uses are identified that could be impacted by new or upgraded crossings. The methodology of these detailed assessments will be agreed with the relevant regulator on a case by case basis
- Hydrological analysis will be undertaken to derive design flows within sub-catchments to inform the design of any significant channel diversions required in any sections of open-cut
- The groundwater flood risk assessment methodology would initially comprise a detailed review of the data and information made available from future ground investigations and ongoing groundwater monitoring. Groundwater head pressures would be identified, seasonal groundwater levels would be analysed and a Conceptual Site Model would be developed.

8.3 Proposed Assessment Criteria

279) It is a key principle of the NPPF that new developments should take place in low flood risk areas. However, there is an acknowledgement that essential utility infrastructure that has to be located within flood risk areas for operational reasons can be appropriate, providing that it can remain operational during times of flood and that it does not increase flood risk elsewhere.

280) Assessing the significance of flood risk impacts can be complex and can depend on changes in flood extent, depth, hazard and frequency as well as the sensitivity of the receptor to these components of flood risk. Therefore, set assessment criteria to define the importance of receptors and the magnitude of the impacts will not be defined but will be based upon professional judgement on a case by case basis.

281) This chapter will summarise the flood risk baseline for the assessment area and identify receptors where there is potential for significant effects to arise. It will also set out the methodology that will be used to quantify, assess and mitigate these effects. A brief description of the existing conditions is also included.

8.4 Existing Conditions

282) The process of scoping commenced with the definition of a preliminary assessment area within which existing flood risk would be evaluated to assist in the identification of potential effects.

8.4.1 Assessment area

283) The assessment will initially consider an area that includes Construction Areas A and B and haul roads to the compounds along sections of existing track. It is anticipated that there would be approximately 4.1 km of tunnel between these areas. The shafts would link to the existing Haweswater Aqueduct by short lengths of open cut pipework.

284) The decommissioning proposals for the existing Haweswater Aqueduct have not yet been finalised. However, if the tunnels are left in-situ, water would be collected at the end of the decommissioned sections and would be discharged to local watercourses. Overflow equipment and potential discharge routes are already in place into Bashall Brook.

285) The flood risk assessment does not have a fixed assessment area. The assessment will focus on the development envelope, but the assessment will be extended downstream, if appropriate, due to the magnitude of the impacts and the sensitivity of the potential receptors.

8.4.2 Information Sources

286) The following desk-based sources have been used to inform this scoping chapter:

- Environment Agency flood risk mapping
- The Strategic Flood Risk Assessment for Ribble Valley Borough Council
- The Ribble Catchment Flood Management Plan
- Hydrogeological approach contained within Chapter 7 Water Environment
- British Geological Survey Mapping
- A web search for historic flood incidents
- Information related to environmental constraints entered onto the project GIS database.

8.4.3 Fluvial Flooding

287) The two proposed compounds and the access tracks are located entirely within Flood Zone 1 as shown on Figure 8.1, indicating that the annual risk of flooding from major fluvial sources is less than 0.1 %. No main rivers are crossed by either the compounds or the proposed access routes with the closest main rivers being the River Hodder which flows from east to west approximately 500 m to the north of the Construction Area A envelope before it flows south and then south east before joining the River Ribble more than 6 km south of Construction Area B at the southern extent of the Proposed Marl Hill Section. The pipe route will be tunnelled between the two compounds and will pass beneath any watercourses. Therefore, the flood risk from main rivers to the Proposed Marl Hill Section is considered to be very low.

288) Ordnance Survey mapping indicates that the Construction Area A envelope crosses some minor tributaries of Foulscales Brook but the access track from the B6478 would not require any crossings. In contrast, the southern Construction Area B, would be in close proximity to Sandyford Brook and the access track that would be potentially used crosses several minor watercourses that are un-named on OS mapping. These ordinary watercourses are small, first or second order streams that are likely to have flashy surface water dominated regimes which can rise and fall very quickly, giving little warning of flooding.

289) Although there are isolated properties in close proximity to some of these minor watercourses, the Ribble Valley SFRA and web sources have not identified any historical flooding associated with them.

290) Approximately 700 m downstream of the existing overflow, Bashall Brook flows past several residential properties. Environment Agency flood mapping indicates that these cottages are currently at risk of flooding, but it is noted that the resolution of the floodplain mapping is very low in this area. The discharge pipe is located approximately 1.8 km upstream of a caravan park on the outskirts of Clitheroe that is partially within Flood Zone 3.

8.4.4 Surface water

291) The Environment Agency's flood map for surface water, as shown on Figure 8.2 identifies that the risk of surface water flooding within the compound locations is very low (less than 0.1 % AEP). This is generally the case along the course of the proposed corridor. Narrow areas of higher risk are identified along the minor watercourses that cross through the corridor. However, these will not pose a risk to the tunnelled elements of the Proposed Marl Hill Section.

8.4.5 Groundwater

292) Groundwater level data are currently unavailable at the time of writing. However, it is anticipated that groundwater levels are shallowest adjacent to the small ordinary watercourses that are crossed by the development and mentioned above. Two springs are also shown to be present on Ordnance Survey mapping, within the Groundwater Assessment Area (see Figure 7.5). These areas of springs are indicative of groundwater flooding conditions, however additional or wider groundwater flooding areas are also likely to occur.

293) Given that the aqueduct is below ground level (bgl) throughout this section (up to 130 mbgl), it is likely that groundwater will be encountered at varying depths. The development is expected to cut through several Secondary A bedrock aquifers, which comprise highly productive horizons, and which form important local aquifers for water supply (see Chapter 7 Water Environment). It is therefore possible that significant artesian pressure heads are present at the depth of the proposed tunnel, although this would need to be confirmed following the results of scheduled ground investigations.

8.4.6 Artificial Infrastructure

294) The existing Haweswater Aqueduct underlies the site.

295) No reservoirs have been identified upstream of the Proposed Marl Hill Section and the Environment Agency reservoir flood map does not identify any areas of reservoir flood risk in the vicinity.

296) No other existing artificial water infrastructure has been identified at this stage and the baseline risk is assumed to be to be low.

8.4.7 Key Receptors

297) Key receptors include:

- Agricultural land
- Isolated farm properties
- The transport network including minor local roads
- The Proposed Marl Hill Section itself.

8.5 Potential Effects

298) The following potential effects on flood risk were identified during the preliminary flood risk investigations and will need to be addressed as the design of the section develops. However, it should be noted that these risks would be adequately mitigated with appropriate planning and design.

8.5.1 Construction

299) Preliminary investigations have indicated that the construction phase has the potential to cause the following effects:

- An increase in fluvial flood risk as a result of any construction works within the floodplain of Main Rivers or Ordinary Watercourses which disrupt flood flows and reduce floodplain volume. No Main River Crossings are currently identified
- An increase in fluvial flood risk in the location of any temporary above ground watercourse crossings due to the constriction of flood flows

- An increase in surface water flood risk due to the creation of temporary site compounds and the storage of construction materials within the natural surface water catchments due to a decrease in permeability
- An increase in surface water flood risk due to linear infrastructure such as small open cut sections and sections of track disrupting natural catchments
- Changes to groundwater flood risk because of groundwater levels and flows being altered by:
  - Temporary dewatering activities (for tunnelling, shaft and open cut) drawing down the level of the groundwater table and therefore temporarily reducing groundwater flooding risks (refer to Chapter 7)
  - The release of artesian groundwater pressures within bedrock aquifers
  - The potential discharge to ground (in the absence of surface water feature to discharge to) of dewatered groundwater could cause groundwater levels to rise.

8.5.2 Operation

300) The potential effects caused by the development once the Proposed Marl Hill Section is fully operational are likely to be similar to the construction phase and are summarised below:

- Should the development involve the construction of any permanent above ground infrastructure within the floodplain or surface water flow paths, the development would have the potential to increase the risk of flooding due to the alteration of natural flood storage mechanisms and flow regimes
- Any permanent above ground infrastructure has the potential to increase the rate of surface water runoff generated within their sites. This would have the potential to increase the risk of fluvial flooding from an increase in surface water entering Main Rivers and Ordinary Watercourses
- Any above ground watercourse crossings for associated infrastructure such as permanent access tracks, have the potential to increase fluvial flood risk elsewhere as a result of reduced channel capacity and flow accumulation behind the structure
- Any above ground infrastructure such as permanent access tracks has the potential to increase the risk of surface water flooding due to the creation of low permeability surfaces and the likely increase in the amount of surface water runoff generated by the site
- Where elements involve re-profiling of the land surface and localised changes in ground level, the Proposed Marl Hill Section has the potential to alter surface water flow paths and increase surface water flood risk elsewhere. If the groundwater table is already shallow, there is also potential for the ground level to be reduced in relation to the groundwater level, and potentially increase the likelihood of groundwater emerging at the ground surface, thus increasing groundwater flood risk
- Changes to groundwater flood risk due to groundwater levels and flows being altered by:
  - The potential for groundwater to rebound, as the new pipeline would be more water-tight than the existing aqueduct, which would limit groundwater ingress
  - The pipeline could provide a barrier to groundwater flow, which could cause groundwater levels to rise on the up-gradient side of the pipeline and cause groundwater flood risk to increase (would be very localised to adjacent sensitive receptors)
- Discharges from existing overflows into Bashall Beck during the draining down of the pipe or overflows are currently not expected to differ from the current situation and therefore there will be no potential to increase flood risk.
- Any new connections from the existing tunnel to watercourses to facilitate drainage of groundwater seeping into it, would also have the potential to increase the risk of flooding downstream of outfall locations.

8.6 Design and Mitigation

301) An optimised design will be developed that includes mitigation to help reduce likely significant flood risk effects. This would include:

- Design optimisation of surface level construction activities to avoid areas of risk if possible
- Design of the Proposed Marl Hall Hill Section, including construction phase in accordance with established good practice as identified within CIRIA and other industry standard guidance
- Management of discharges to minimise the impact on receiving watercourses
- Detailed ground investigations and groundwater level monitoring.

302) Additional mitigation may include the identification of opportunities to reduce baseline flood risk to sensitive receptors as part of the design through measures such as the restoration of areas disturbed through the construction process.

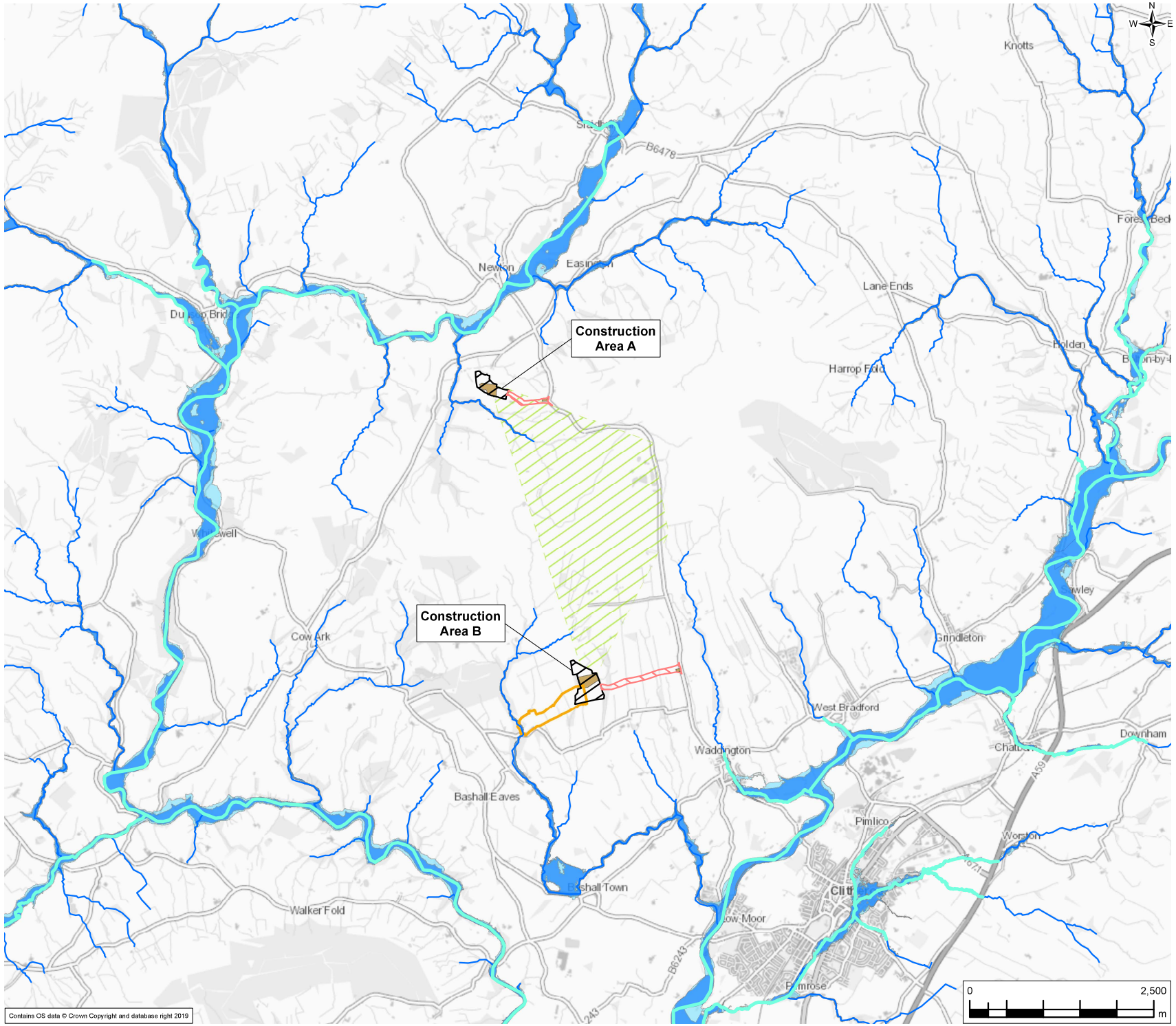
8.7 Summary Scope for the EIA

303) Very minor open-cut construction techniques may be required in this location (short connections from new tunnel to existing multi-line), and so impacts associated with this are currently included within the scope of the EIA. A summary of the scope is detailed in Table 8.4 below.

Table 8.4: Matters of significance for flood risk effects during both construction and operation

Receptor group	Matter / potential effects	Location within assessment area	Comments
Local isolated properties	Increase in flood risk	Refer to Figure 8.1 and 8.2	Scoped in. Provides an assessment of flood risk effects proportional to the scale and nature of the Proposed Marl Hill Section and the likely effects, which would largely be of a temporary nature. Assessment would allow development of flood risk mitigation.
Agricultural land and uncultivated moorland	Increase in flood risk	Assessment area wide	Scoped in. Although receptor is low sensitivity, there is potential for significant impacts which may require mitigation.
Transport infrastructure	Increase in flood risk	Minor local roads.	Scoped in. Provides an assessment of flood risk effects proportional to the scale and nature of the Proposed Marl Hill Section and the likely effects, which would largely be restricted to the construction period. Assessment would allow development of flood risk mitigation.
The Proposed Marl Hill Section	Increase in flood risk	Refer to Figure 8.1 and 8.2	Scoped in. Construction activities and temporary infrastructure could be at risk as could any permanent above ground infrastructure associated with the scheme.

FIGURE 8.1



Legend

- Proposed Tunnel Route - Indicative Corridor
- Proposed Construction Access - Indicative Route
- Proposed Construction Compound / Laydown Area - Indicative Development Envelope
- Proposed Open Cut Route - Indicative Corridor
- Proposed Indicative Construction Compound / Laydown Area
- Proposed Discharge Pipe - Indicative Corridor

Constraints

- Statutory Main Rivers
- OS Watercourse
- Flood Map for Planning Rivers and Sea Flood Zone 2
- Flood Map for Planning Rivers and Sea Flood Zone 3

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
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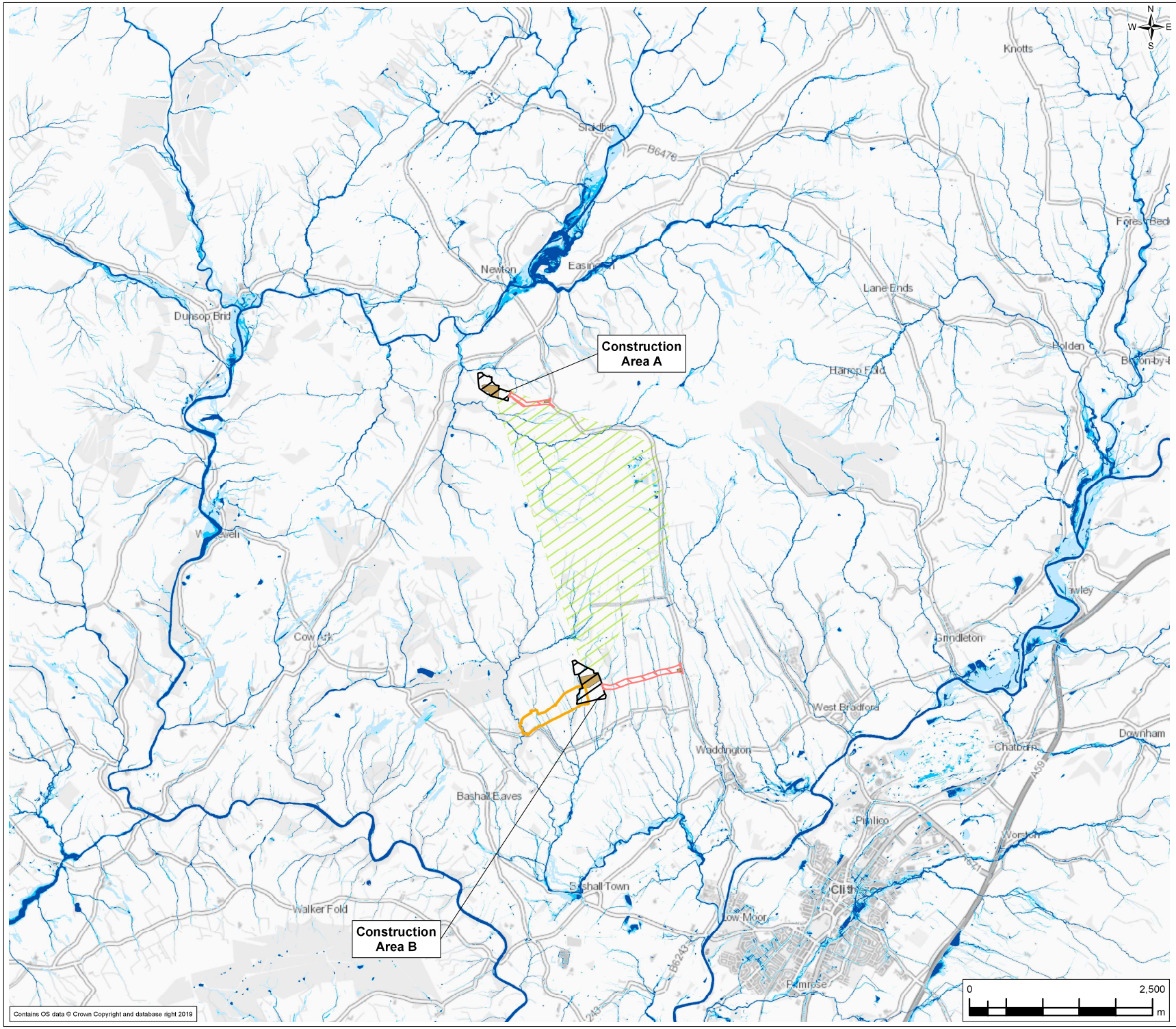
FIGURE 8.2



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Legend

- Proposed Tunnel Route - Indicative Corridor
- Proposed Construction Access - Indicative Route
- Proposed Construction Compound / Laydown Area - Indicative Development Envelope
- Proposed Open Cut Route - Indicative Corridor
- Proposed Indicative Construction Compound / Laydown Area
- Proposed Discharge Pipe - Indicative Corridor

Surface Water Flood Risk

- Surface Water Flood Extent 3.33% AEP
- Surface Water Flood Extent 1% AEP
- Surface Water Flood Extent 0.1% AEP

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Drawing Status: FINAL

Scale @ A3	1:50,000	DO NOT SCALE
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9. Ecology

9.1 Overview

304) This chapter presents the outcome of the scoping exercise in relation to potential terrestrial and aquatic ecological effects associated with the Proposed Marl Hill Section. The Proposed Marl Hill Section includes options for construction activities that would occur at ground level and also below the surface. It is expected that underground construction activities (i.e. the indicative tunnel corridor shown in Figure 3.1) would have no ecological impacts (either directly or indirectly). The proposed tunnel route corridor has therefore not been considered within this chapter. This will continue to be reviewed throughout the EIA delivery programme. Chapter 7 – Water Environment considers the interaction between ground water dependent ecosystems and sub-surface works. The results of this assessment would be included within the ecology review process. Should any potential impacts be identified from sub-surface works; additional ecological surveys may be required.

305) For the purpose of this chapter, the development envelopes considered within this scope include the proposed construction compounds / laydown areas, the proposed construction access route and the proposed discharge pipe and are shown in Figure 9.1.

306) This chapter presents the current ecological baseline for the Proposed Marl Hill Section and how this was established. It considers the nature conservation value / importance for biodiversity of the ecological features present, the means by which the Proposed Marl Hill Section may potentially affect those features, and provides the ecological surveys and methodologies required to address gaps and limitations in existing data to inform the impact assessment for the EIA.

9.2 Proposed Methodology

9.2.1 Desk study

307) Data gathering from a combination of web-based sources and local biological records centres was undertaken in August 2018 by United Utilities and subsequent data gathering undertaken in August 2019 by Jacobs. Most of the data gathering exercise was completed in August 2018 during the early concept phase when detailed design information was not available. Subsequently, part of the desk study data provided in this report have been compiled from early scheme design and not the detailed development envelopes shown in Figure 9.1.

308) Additional desk study searches will be undertaken where it is considered that existing information is insufficient to appropriately assess likely significant ecological effects. This particularly relates to desk study searches for non-statutory designated sites of nature conservation interest and protected / notable species.

309) A summary of the desk study searches undertaken as part of this assessment is provided below:

- A search for statutory designated sites of nature conservation interest within 5 km (restricted to 2 km for Local Nature Reserves) of the Proposed Marl Hill Section
- A search for non-statutory designated sites of nature conservation interest and protected / notable species within 2 km of the Proposed Marl Hill Section (based on early scheme design). It is acknowledged that these searches will need to be updated to cover a 2 km search from additional development envelopes that have / will be developed through the detailed design phase
- A search for European Protected Species Mitigation Licences (EPSML) within 2 km of the Proposed Marl Hill Section.

310) As part of the desk study the following data sources were contacted or accessed for records:

- Lancashire Environment Record Network (LERN) for protected / notable species and non-statutory designated sites data (data received September 2018)
- The Multi Agency Geographic Information for the Countryside (MAGIC) website (https://magic.defra.gov.uk/MagicMap.aspx) - accessed in July and August 2019. For statutory designated sites, search for European Protected Species Mitigation Licences (EPSML) and to identify

if the Proposed Marl Hill Section falls within any of Natural England's Impact Risk Zones for Sites of Special Scientific Interest (SSSI)[28]

- Google maps (https://www.google.co.uk/maps) – accessed in July and August 2019. To identify potential habitat and species present within the Proposed Marl Hill Section and wider area including a search for ponds which may support amphibians up to 500 m from the Proposed Marl Hill Section
- Environment Agency (North West region Analysis and Reporting team) – information requested August 2019. In addition to Open Government (https://data.gov.uk/), macroinvertebrate / macrophyte site and metric data, a request for data relating to freshwater invertebrates, freshwater macrophyte and diatom, and protected species records was submitted for selected watercourses across the Proposed Marl Hill Section.

9.2.2 Field Surveys

311) The following field surveys were undertaken by Bowland Ecology on behalf of United Utilities between April and June 2019. Field surveys are still ongoing; therefore it has been possible to incorporate only data gathered from July 2019 onwards into this report. Advanced surveys which have been completed to date were determined by an advanced scoping exercise undertaken by United Utilities. Surveys were selected based on professional judgement. Field surveys will continue throughout the EIA process to address any data gaps and provide further baseline information where appropriate. Surveys will be completed prior to submission of the ES. Surveys have undertaken in accordance with the survey methodologies outlined in Table 9.5.

Extended Phase 1 Habitat Surveys

312) Extended Phase 1 Habitat Surveys (EP1HS) were undertaken for the Proposed Marl Hill Section between April and June 2019. The E1PHS survey area was defined prior to the development envelopes being finalised and as such some areas within the Proposed Marl Hill Section have not been surveyed. Access limitations also restricted a comprehensive survey of the Proposed Marl Hill Section. Where this occurred, aerial imagery was used to identify potential habitats and provide descriptions. Aerial imagery was not used for mapping purposes.

313) The EP1HS results undertaken to date, are shown in Figure 9.5.

Hedgerow Surveys

314) Hedgerow surveys were undertaken within the EP1HS area where access was permitted between April and June 2019. The EP1HS area (i.e. hedgerow survey area) was defined prior to the development envelopes being finalised and as such some hedgerows within the Proposed Marl Hill Section have not been surveyed. An assessment of each hedgerow within the EP1HS area was made in accordance with the Hedgerow Regulations (1997).

Great Crested Newt Surveys

315) Great Crested Newt (GCN) (*Triturus cristatus)* environmental DNA (eDNA) surveys were undertaken on ten ponds identified within 250m of the Proposed Marl Hill Section to determine presence or absence within nearby waterbodies. Surveys were undertaken between April and June 2019.

316) A negative eDNA result was returned for all ten ponds indicating an absence of GCN.

Breeding Bird Surveys

317) One breeding bird survey transect was undertaken where suitable breeding bird habitat was identified. This was undertaken within the northern section of the Proposed Marl Hill Section, to the south of Newton. The transect survey comprised three visits undertaken between April and June 2019 (one visit per month). Access limitations restricted breeding bird surveys elsewhere across the Proposed Marl Hill Section.

[28]These have been identified by Natural England for use by Local Planning Authorities to assess planning applications for likely impacts on SSSIs / SACs / SPAs and Ramsar sites and to determine when to consult Natural England

Aquatic Surveys

318) In addition to data gathered from desk study searches outlined above, an additional data request has been made to the Environment Agency for species level data, which is not freely available. Data have been requested for macroinvertebrates and aquatic flora; fish data is available online in its entirety.

319) The Proposed Marl Hill Section comprises a tunnelled section with a very small length of connecting open-cut pipeline. The tunnelling option is assumed to have no significant effect on macroinvertebrates, so whilst data coverage is presented here it is assumed that no pathway to effect exists. However, tunnelling would have associated construction activities that could potentially effect macroinvertebrates. These include; construction areas, compound / laydown areas, access tracks and associated infrastructure (e.g. discharge pipes) which may affect nearby watercourses (habitat loss, changes in water quality or quantity from site run off) and therefore these areas have been assessed.

320) Existing macroinvertebrate data has been assumed to be relevant if:

- Sites lie within surface level construction envelopes
- Sites lie on watercourses hydrologically connected to surface level construction within the wider assessment area (5 km) buffer. Sites beyond 5 km are unlikely to be affected by construction activities
- Data are less than ten years old. Data have, however, been requested as far back as 1995, to provide an indication of long-term trends at each site. It is noted, however, that data published before 2010 may not be representative of current conditions or environmental value.

9.3 Proposed Assessment Criteria

9.3.1 Field Surveys

321) The scope of further field survey work needed to inform the EIA has been determined based upon current baseline knowledge of the assessment area and a review of current good practice survey guidance and nature conservation legislation / policy frameworks (e.g. National Planning Policy Framework (NPPF) 2019, Natural Environment and Rural Communities (NERC) Act 2006 Section 41 list etc.).

9.3.2 Evaluation of Ecological Features

322) This scoping report and the EPH1S results, along with data obtained from the further field surveys are intended to form the framework for the completion of an Ecological Impact Assessment (EcIA). The EcIA will be undertaken using guidance from the Guidelines for Ecological Impact (CIEEM, 2019)[29]. The EcIA will in turn form part of the EIA for the Proposed Marl Hill Section.

323) The preliminary evaluation of the importance of ecological features identified within this scoping report has been based on Section 4 of the Guidelines for Ecological Impact Assessment (CIEEM, 2019). This includes the following geographical frame of reference;

- **International and European**
- **National** (England)
- **Regional** (north west England)
- **County** (e.g. Lancashire)
- **District** (local authority e.g. Ribble Valley Borough Council)
- **Local** (the feature is of ecological importance beyond the Proposed Marl Hill Section but is not considered to be of District importance for biodiversity)
- **Less than local** (the feature does not meet the criteria for local importance).

[29] Guidelines for Ecological Impact Assessment in the UK and Ireland Terrestrial, Freshwater, Coastal and Marine September 2018

9.4 Existing Baseline and Preliminary Evaluation

9.4.1 Designated Sites

Statutory Designated Sites of Nature Conservation

324) Twelve statutory designated sites were identified within 5km of the Proposed Marl Hill Section. This included two international site designations ((the North Pennines Dales Meadows Special Area of Conservation (SAC), Bowland Fells Special Protection Area (SPA)), and eight nationally designated SSSIs.

325) There are no locally designated statutory designated sites (LNRs) within 2 km of the Proposed Marl Hill Section.

326) The data search also revealed that the Proposed Marl Hill Section falls within the Natural England's Impact Risk Zone for three of the SSSIs. This is a defined zone around the SSSI that reflects the particular sensitivities of the features for which it is notified and is used by local planning authorities to indicate the types of development proposals that could potentially have adverse impacts on the site. Further information relating to these statutory designated sites are presented in Table 9.1 below and shown in Figure 9.2.

Non-Statutory Designated Sites of Nature Conservation

327) Seventeen non-statutory designated sites were identified within 2 km of the early design buffer, of which three are located within or immediately adjacent to the Proposed Marl Hill Section. Further information relating to these designated sites is presented in Table 9.1 below and also shown in Figures 9.3.

328) An updated desk study search for non-statutory sites will be undertaken which would include a 2 km search from the Proposed Marl Hill Section. This would ensure that all designated sites which may be ecologically and / or hydrologically linked to the Proposed Marl Hill Section are identified

Table 9.1: Designated sites for nature conservation baseline information and preliminary evaluation

Site name	Designation	Area	Location and distances	Reason for designation	Falls within SSSI Impact Risk Zone	Preliminary evaluation
Statutory Designated Sites of Nature Conservation Interest within 5 km (and 2 km for LNR) of the Proposed Marl Hill Section						
North Pennine Dales Meadows	SAC	497.09 ha	3.53 km north-east of the access route for Construction Area A	A series of isolated mountain hay meadows supporting a range of rare and local meadow species.	N/A	International / European
Bowland Fells	SPA SSSI	16,0002.3 ha	4.03 km north of Construction Area A	An area of upland fells supporting Lancashire's largest expanse of blanket bog and heather moorland. The site provides habitat suitable for a diverse upland breeding bird community including Annex I upland breeding birds, hen harrier (*Circus cyaneus*) and merlin (*Falco columbarius*), and an internationally important breeding population of lesser black-backed gull (*Larus fuscus*).	N/A Yes	International / European
Langcliffe Cross Meadows	SSSI	5.3 ha	3.5 3km north east of Construction Area A	An area of northern hay meadow containing 19 grass species. Forms part of the North Pennine Dales Meadows SAC.	Yes	National
Bell Sykes Meadows	SSSI	13.68 ha	4.46 km north east of the access route for Construction Area A	Six fields of unimproved, enclosed, herb-rich grassland supporting a rich floral community. Forms part of the North Pennine Dales Meadows SAC.	Yes	National
Myttons Meadows	SSSI	10.0 ha	3.81 km north-east of Construction Area A	Three fields below Myttons Farm and part of a fourth field to the south representing the largest traditionally managed, species-rich hay meadows. The site forms part of the North Pennine Dales Meadows SAC.	No	National
Field Head Meadow	SSSI	3.29 ha	4.1 km north east of Construction Area A	An area of herb-rich hay meadow forming part of the North Pennine Dales Meadows SAC.	No	National
Hodder River Section	SSSI	7.4 ha	3.89 km south of the proposed discharge pipe corridor	A section of the River Hodder designated for important geological features.	No	National

Site name	Designation	Area	Location and distances	Reason for designation	Falls within SSSI Impact Risk Zone	Preliminary evaluation
Non-Statutory Designated Sites of Nature Conservation Interest within 2km of the Proposed Marl Hill Section						
Braddup Wood North	BHS	17.92 ha	Located within the proposed discharge pipe corridor	Large semi-natural woodland occupying the steep sides of Bashall Brook and its tributary along Braddup Clough.	N/A	County
Braddup Wood South	BHS	6.29 ha	Immediately south of the proposed discharge pipe corridor.	Broadleaved woodland situated on steep banks adjoining Bashall Brook.	N/A	County
Cross Lane Roadside Verges	BHS	0.37 ha	Immediately south of the proposed discharge pipe corridor.	Species rich roadside verges notable for presence of green figwort (*Scrophularia umbrosa*).	N/A	County
Gibb's Wood and Bonstone Wood	BHS	4.15 ha	0.1 km south of Construction Area A	No description provided.	N/A	County
Bonstone Brook Pastures	BHS	14.77 ha	0.15 km south of Construction Area A	Two pastures containing species-rich semi-natural grassland.	N/A	County
Feazer Wood	BHS	4.89 ha	0.3 km east of Construction Area B	Semi-natural clough woodland.	N/A	County
Hospital Wood	BHS	8.46 ha	0.36 km east of Construction Area B	Semi-natural clough woodland.	N/A	County
Moor Piece	BHS	16.19 ha	0.43 km north west of proposed discharge pipe corridor.	No description provided.	N/A	County

Site name	Designation	Area	Location and distances	Reason for designation	Falls within SSSI Impact Risk Zone	Preliminary evaluation
Bradford Fell, Easington Fell and Harrop Fell	BHS	517.97 ha	0.44 km south east of Construction Area A	Extensive area of upland heath and mire.	N/A	County
Waddington Fell and Browsholme Moor	BHS	268.03 ha	0.48 km south of Construction Area A	Extensive area of moorland with upland heath, blanket bog, acid grassland and mires.	N/A	County
River Hodder	BHS	94.9 ha	0.53 km north of Construction Area A	Large section of the River Hodder from Confluence with River Ribble Upstream to Cross of Greet Bridge / Bowland Fells SSSI is important for otter (*Lutra lutra*), Atlantic salmon (*Salmo salar*), brown trout (*Salmo trutta*), bullhead (*Cottus gobio*), dace (*Leuciscus leuciscus*) and stone loach (*Barbatula barbatula*).	N/A	County
Ashnott Wood	BHS	2.55 ha	0.55 km south of Construction Area A	No description provided.	N/A	County
Crag House Roadside Verges	BHS	0.75 ha	0.68 km west of the Construction Area A	No description provided.	N/A	County
Ashnott Meadow	BHS	2.63 ha	0.87 km south west of Construction Area A	Damp, semi-natural, neutral grassland meadow notable for containing heath spotted-orchid (*Dactylorhiza maculate subsp. Ericetorum*).	N/A	County
Waddington Fell Road, Roadside Verges	BHS	0.22 ha	0.88 km north east of Construction Area A	Species-rich roadside verges.	N/A	County
Rabbit Lane Meadow	BHS	3.04 ha	1.23 km west of the proposed discharge pipe corridor.	A field of semi-natural marshy and neutral grassland bordered by two sides of plantation woodland.		County

Site name	Designation	Area	Location and distances	Reason for designation	Falls within SSSI Impact Risk Zone	Preliminary evaluation
Birkett Fell, Hodder Bank Fell and Mossthwaite Fell	BHS	231.14 ha	1.55 km west of Construction Area A	Large area of upland heath and blanket bog with scattered flushes.	N/A	County

9.4.2 Habitats and Species of Principal Importance

329) Under the provisions of the Natural Environment and Rural Communities (NERC) Act 2006 Section 40, all public bodies, including local authorities and statutory undertakers (including United Utilities), are required to take account of the conservation of species and habitats of Principal Importance for biodiversity. Section 41 (S41) of the Act requires the Secretary of State to publish and maintain a list of habitats and species which are of principal importance for the conservation of biodiversity in England (commonly referred to as 'priority' habitats / species).

330) These habitats and species generally form the basis for local Biodiversity Action Plan targets. Lancashire's Local Biodiversity Action Plan (LBAP) was designed to implement national biodiversity targets at a local level, but with a focus on local priorities. The effects of the Proposed Marl Hill Section on priority habitats and species listed within local Biodiversity Action Plans (BAPs) should also be considered, even though not all these habitats / species are legally protected.

331) Several of these habitats and species were found to be either present or potentially present within the Proposed Marl Hill Section. These are summarised in Tables 9.2 and 9.3 below.

9.4.3 Habitats within the survey area

332) The following habitats have been identified within the Proposed Marl Hill Section during the EP1HS. Several of these habitats have been identified as habitats of nature conservation value / importance. An assessment of the value / importance for biodiversity is provided in Table 9.2 below.

Table 9.2: Preliminary evaluation of habitats found within the Proposed Marl Hill Section survey area

Phase 1 habitat classification	Description / extent	Habitat of Principal Importance (NERC Act, 2006)	LBAP Habitat	Preliminary evaluation / importance
Broadleaved semi-natural woodland	Limited in the survey area to small blocks, one of which, Bonstone Wood is associated with Bonstone Brook. This habitat is part of Gibb's Wood and Bonstone Wood BHS. Oak (*Quercus sp.*) and alder (*Alnus glutinosa*) dominate with additional species including sycamore (*Acer pseudoplatanus*), silver birch (*Betula pendula*), beech (*Fagus sylvatica*) and ash (*Fraxinus excelsior*). The ground flora is botanically interesting and includes species such as bluebells (*Hyacinthoides non-scripta*), ramsons (*Allium ursinum*), wood avens (*Geum urbanum*), moschatel (*Adoxa moschatellina*), enchanter's nightshade (*Circaea lutetiana*), remote sedge (*Carex remota*) and early purple orchid (*Orchis mascula*). Lowland, deciduous, broad-leaved woodland is a Habitat of Principal Importance in England and is listed on the Lancashire LBAP. Areas of semi-natural broadleaved woodland recognised by local authorities are considered of County importance for biodiversity.	Yes	Yes	County
Mixed plantation woodland	A thin linear strip bordering Sandy Ford Brook contains mixed broadleaf and coniferous tree species including sycamore, oak, alder, rowan (*Sorbus aucuparia*) and Scots pine (*Pinus sylvestris*). The understory is scattered gorse (*Ulex europaeus*) and bramble (*Rubus fruticosus*). The ground flora is dominated by Himalayan balsam (*Impatiens glandulifera*) (WCA Schedule 9 invasive species), with foxglove (*Digitalis purpurea*) and common male fern (*Dryopteris filix-mas*) also recorded. Mixed plantation woodland is not listed as a Lancashire LBAP habitat or as a Habitat of Principal Importance in England and is not considered to be of significant ecological value. Therefore, this habitat is of Local importance for biodiversity.	No	No	Local
Scattered scrub	Individual scattered hawthorn (*Crataegus monogyna*) scrub is occasional throughout the EP1HS area along the field and track margins, possibly as a remnant from historical hedgerows. Scattered scrub does not qualify as a Habitat of Principal Importance in England or a Lancashire LBAP habitat. Therefore this habitat is of Less than local importance for biodiversity.	No	No	Less than local
Parkland / Scattered trees	Scattered trees are occasional throughout the open fields and tracksides of the EP1HS area. Species present are predominantly oak and sycamore. Mature trees are a nationally declining resource but are not listed as a Lancashire LBAP habitat or a Habitat of Principal Importance in England and are therefore considered of Local importance.	No	No	Local

Phase 1 habitat classification	Description / extent	Habitat of Principal Importance (NERC Act, 2006)	LBAP Habitat	Preliminary evaluation / importance
Semi-improved neutral grassland	Semi-improved grassland is found in large sections of the EP1HS area. These areas are less-intensively managed and maintain a high sward height. Species recorded include crested dogs-tail (*Cynosurus cristatus*), sweet vernal grass (*Anthoxanthum odoratum*), rough meadow grass (*Poa trivialis*), marsh foxtail (*Alopecurus geniculatus*), great burnet (*Sanguisorba officinalis*), yellow rattle (*Rhinanthus minor*), eyebright (*Euphrasia* sp.), Yorkshire fog (*Holcus lanatus*), soft rush (*Juncus effusus*), red fescue (*Festuca rubra*), tufted hair grass (*Deschampsia cespitosa*), creeping buttercup (*Ranunculus repens*), creeping thistle (*Cirsium arvense*), annual meadow grass (*Poa annua*), common nettle (*Urtica dioica*), cuckoo flower (*Cardamine pratensis*), common mouse-ear (*Cerastium fontanum*), tall fescue (*Festuca arundinacea*), field woodrush (*Luzula campestris*), meadow buttercup (*Ranunculus acris*), pignut (*Conopodium majus*), lesser stitchwort (*Stellaria graminea*) and heath bedstraw (*Galium saxatile*). One field within the eastern extent of the EP1HS area is particularly sedge-rich and includes the species carnation sedge (*Carex panicea*), oval sedge (*Carex leporina*), star sedge (*Carex echinata*), glaucous sedge (*Carex flacca*), common sedge (*Carex nigra*), yellow sedge (*Carex demissa*) and hairy sedge (*Carex hirta*). Small areas of semi-improved neutral grassland are found within unmanaged sections of species-poor semi-improved grassland also, including within fenced areas with no access for cattle, and along roadside verges. This habitat potentially qualifies as lowland meadow, a Habitat of Principal Importance, and as a Lancashire LBAP habitat. Therefore, this habitat is considered to be of Local - District importance.	Yes	Yes	Local to District
Semi-improved acid grassland	A very small area of semi-improved acid grassland was recorded within the EP1HS area, characterised by the presence of tormentil (*Potentilla erecta*), heath bedstraw (*Galium saxatile*), sweet vernal grass (*Anthoxanthum odoratum*) and crested dog's-tail (*Cynosurus cristatus*). This habitat qualifies as lowland acid grassland, a Habitat of Principal Importance in England but is not listed as a Lancashire LBAP habitat. This habitat is considered of Local importance for biodiversity.	Yes	No	Local
Poor semi-improved grassland	This habitat is the most common in the survey areas and is generally grazed by sheep. Soft rush is a common occurrence in the grassland. Bonstone Brook Pastures BHS lies immediately adjacent to the southern boundary of the survey area.	No	No	Less than local

Phase 1 habitat classification	Description / extent	Habitat of Principal Importance (NERC Act, 2006)	LBAP Habitat	Preliminary evaluation / importance
	These areas were dominated by common grass species and do not qualify as Lancashire LBAP habitat or Habitat of Principal Importance in England. The low ecological value of this habitat type is considered of Less than local importance for biodiversity.			
Marshy grassland	This habitat is common within the EP1HS area and is generally sheep or cattle grazed. These areas are not typically species-rich and species assemblage includes soft rush compact rush (*Juncus conglomeratus*), common sorrel (*Rumex acetosa*), creeping thistle and common nettle. This habitat was dominated by common species and does not qualify as Lancashire LBAP habitat or a Habitat of Principal Importance in England and is therefore considered of Less than local importance for biodiversity.	No	No	Less than local
Tall ruderal	Tall ruderal vegetation was typically recorded in small stands throughout the species-poor semi-improved grassland and typically comprises common nettle, broadleaved dock (*Rumex obtusifolius*) and common hogweed (*Heracleum sphondylium*). These areas were dominated by species of low botanical diversity and would not qualify as Lancashire LBAP habitat or Habitat of Principal Importance in England. It is therefore considered to be of Less than local importance for biodiversity.	No	No	Less than local
Standing water	Ponds were recorded throughout the EP1HS area with varied characteristics. Several ponds excavated within the last ten years were present. Other ponds recorded included fenced ponds adjacent to broadleaved woodland and ponds within fields surrounded by semi-improved grassland, access tracks and hedgerows. Ponds are a Habitat of Principal Importance in England but are not listed as a priority habitat within the Lancashire LBAP. This habitat is considered of Local importance for biodiversity.	Yes	Yes	Local
Running water	Bonstone Brook is part of Gibb's Wood and Bonstone Wood BHS and flows through the EP1HS area. Other more minor ditches are present in the survey area. Sandy Ford Brook runs through the EP1HS area; however, this was mostly dry at the time of survey with only small areas of standing water remaining. The watercourses associated with the Proposed Marl Hill Section are hydrologically connected to the River Hodder and River Ribble. These two rivers and associated tributaries qualify as Habitats of	Yes	Yes	Local to District

Phase 1 habitat classification	Description / extent	Habitat of Principal Importance (NERC Act, 2006)	LBAP Habitat	Preliminary evaluation / importance
	Principal Importance in England and are a priority habitat within the Lancashire LBAP. This habitat is considered to be of Local to District importance for biodiversity.			
Introduced shrub	Himalayan balsam (WCA Schedule 9 invasive species) is frequent within the EP1HS area as the understory of the woodland bordering Sandy Ford Brook and also along the access road (Cross Lane). Introduced shrub is of negligible biological interest and therefore considered to be of Less than local importance for biodiversity.	No	No	Less than local
Wall	Dry stone walls were present in the central and southern sections of the EP1HS area and provide habitat for a diverse range of bryophytes, lichens, ferns, birds, reptiles and amphibians. These habitats are of low biological interest, do not qualify as a Habitat of Principal Importance in England or a priority habitat within the Lancashire LBAP.	No	No	Less than local
Dry ditches	A small number of minor ditches were noted within the EP1HS area, along field margins and within marshy grassland, which were dry at the time of survey. Dry ditches do not qualify as a Habitat of Principal Importance in England or a priority habitat within the Lancashire LBAP. This habitat is considered of Less than local importance for biodiversity.	No	No	Less than local
Bare ground	Bare ground includes hardstanding, gravel and bare earth. It is infrequent in the survey area, and is largely associated with roads, farm tracks, parking areas etc. Bare ground has no intrinsic biodiversity value and is of Less than local importance for biodiversity.	No	No	Less than local
Buildings	A small number of buildings are present in the survey area. Some of these are commercial buildings and some are disused and, in some cases, dilapidated barns/agricultural buildings. Occupied residential buildings are also present, some associated with farms. Buildings are of low biological interest, do not qualify as a Habitat of Principal Importance in England, and is not listed as a priority habitat within the Lancashire LBAP.	No	No	Less than local