

1362578) with one house including adjoining farm buildings (Asset 1071588), two 19th century houses (Assets 1072250, 1163486), two 17th century agricultural buildings (Assets 1071590, 1163475) and two 18th century agricultural buildings (Assets 1317455, 1362584). The remaining assets include a medieval cross base (Asset 1163860), five further 18th century assets include a public house (Asset 1318254), a bridge (Asset 1163370) and a Quaker meeting house (Asset 1072245) and two sets of boundary features including gateposts and piers (Assets 1362271, 1163422). The remaining three historic buildings date to the 19th century, a guidepost (Asset 1072230) and a former school (Asset 1072251) and a bridge (Asset 1318203).

Table 10.4: Summary of the value of heritage assets in the Proposed Bowland Section

Asset name	NHLE/HER reference (used as asset number)	Designation (Listed building)	Value
Botton Mill Cottage	1071556	Grade II	Medium
Hole House Farmhouse	1071572	Grade II	Medium
High Park House Farmhouse and farm building adjoining to south	1071588	Grade II	Medium
Lower Thrushgill Farmhouse	1071589	Grade II	Medium
Farm Store adjoining at right angles, north of Park Farmhouse	1071590	Grade II	Medium
Guidepost, 50 m north west of Harrisons	1072230	Grade II	Medium
Friends' Meeting House and cottage adjoining to south west	1072245	Grade II	Medium
Newton Hall	1072246	Grade II*	High
East View	1072247	Grade II	Medium
The Old Reading Room	1072248	Grade II	Medium
Lowlands Cottage Newton House	1072249	Grade II	Medium
Hydes Farmhouse	1072250	Grade II	Medium
The Old School	1072251	Grade II	Medium
Lowlands Farmhouse and barns adjoining to north and south	1072252	Grade II	Medium
Boarsden Farmhouse	1072253	Grade II	Medium
Foulscales	1072254	Grade II	Medium
Newton Bridge	1163370	Grade II	Medium
Crag House	1163405	Grade II	Medium
Gatepiers south east of Salisbury Hall	1163422	Grade II	Medium
Sunnyside	1163458	Grade II	Medium
Barn south west of Hydes Farmhouse	1163475	Grade II	Medium
Schoolhouse Cottage	1163486	Grade II	Medium
Long Stripes Farmhouse	1163535	Grade II	Medium
Cross Base at Cross Gates	1163860	Grade II	Medium
Helks and farm buildings in same range	1165124	Grade II	Medium

Asset name	NHLE/HER reference (used as asset number)	Designation (Listed building)	Value
Park House Farmhouse	1165157	Grade II	Medium
Barn north east of Park House Farmhouse	1317455	Grade II	Medium
Leyland Farmhouse	1317767	Grade II	Medium
Ellerbeck Hall	1318036	Grade II	Medium
Giddy Bridge	1318203	Grade II	Medium
Parkers's Arms	1318254	Grade II	Medium
Wall, Gatepiers and gates south of Newton Hall	1362271	Grade II	Medium
Salisbury Hall	1362272	Grade II	Medium
Summersgill Farmhouse	1362578	Grade II	Medium
Southern farm building at scale farm	1362584	Grade II	Medium

10.4.5 Historic Landscape Types

381) The Proposed Bowland Section lies within a rural landscape to the south of the M6 motorway, south-west of the river Hyndburn and its tributaries, crossing the Forest of Bowland AONB. The terrain is undulating and divided into pasture fields separated by dry stone walls or hedges at lower levels. Some upland areas are marked as scrub with fewer boundaries usually of modern stock fencing. There are areas of plantation, reservoirs and quarries and settlement is generally represented by dispersed farmsteads and stone cottages. The few settlements tend to assume a linear form along roads, watercourses or confined by the topography.

10.5 Potential Effects

382) The Proposed Bowland Section has the potential to impact on known and unknown heritage assets. This includes both physical impacts during construction or operation of the scheme and impacts resulting from the changes to the settings of heritage assets.

383) Potential effects on heritage assets are divided into two categories:

- Physical – the loss or damage to heritage assets occurring during the construction and operation of the proposed development
- Non-physical – impacts on the setting of a heritage asset that affects the value of the asset during the construction and operation of the proposed development.

10.5.1 Physical Impacts

384) A likely significant effect may occur through damage to known and / or unknown heritage assets during construction and operation. Damage can occur in the following ways:

- The removal of archaeological remains during site clearance and construction
- Damage to the fabric of an historic building during construction and operation (maintenance)
- The removal of a component of an historic landscape type during construction.

10.5.2 Archaeological Remains

385) There is the potential for previously unknown archaeological remains to be physically impacted by the scheme during ground works, such as topsoil stripping.

10.5.3 Historic buildings

- 386) One listed building, Summersgill Farmhouse, lies within the footprint of the scheme and no historic buildings, there is no intention to demolish any buildings. There may be potential for buildings close to the scheme to be physically impacted by subsidence or to be impacted by vibrations from increased road traffic associated with the scheme.
- 387) There may be some changes to the setting of some of the historic buildings, however whether this would impact on the significance of the asset would require more detailed assessment

10.5.4 Historic Landscape Types

- 388) Due to the depth of the tunnelling belowground, impacts on the historic landscape are confined to the construction areas and temporary works, such as access roads and haulage routes. The technique requires the tunnelling equipment to be lowered through shafts which along with any haul roads and construction areas would introduce an industrial element into the rural landscape, however the impact of the construction areas and haul roads would be temporary. The impact of the shafts would depend on whether the shafts are kept open for maintenance purposes or sealed following construction. (It is currently anticipated that any shafts will be capped and buried or at worst have an access cover.)

10.5.5 Setting of Heritage Assets

- 389) The setting of a heritage asset is defined in the NPPF Glossary as:
- 390) *'The surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance or may be neutral.'*
- 391) Aspects of a heritage assets setting that may be impacted by the scheme may include visual or noise intrusion during construction or operational maintenance, or temporary road closures.
- 392) Many of the assets along the route of the scheme have a rural setting. The presence of tunnel boring or mechanical excavation equipment, pipes or other equipment has the potential to create an industrial element within the setting of some assets, which may temporarily reduce the rural element of the assets setting. This may result in a negative impact on the assets significance.
- 393) Effects on historic landscape character are likely to derive from modifications to the physical landscape and how this is experienced, for example, potential removal of hedgerows during excavations, the temporary storage of spoil or construction materials.
- 394) 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 to the landscape resulting from the new tunnel and associated aqueduct. Further information on some of the landscape and noise changes can be found in Chapter 6: Landscape and Visual and Chapter 17: Noise and Vibration.

10.6 Design and Mitigation

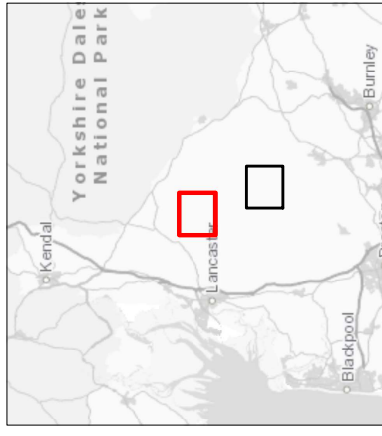
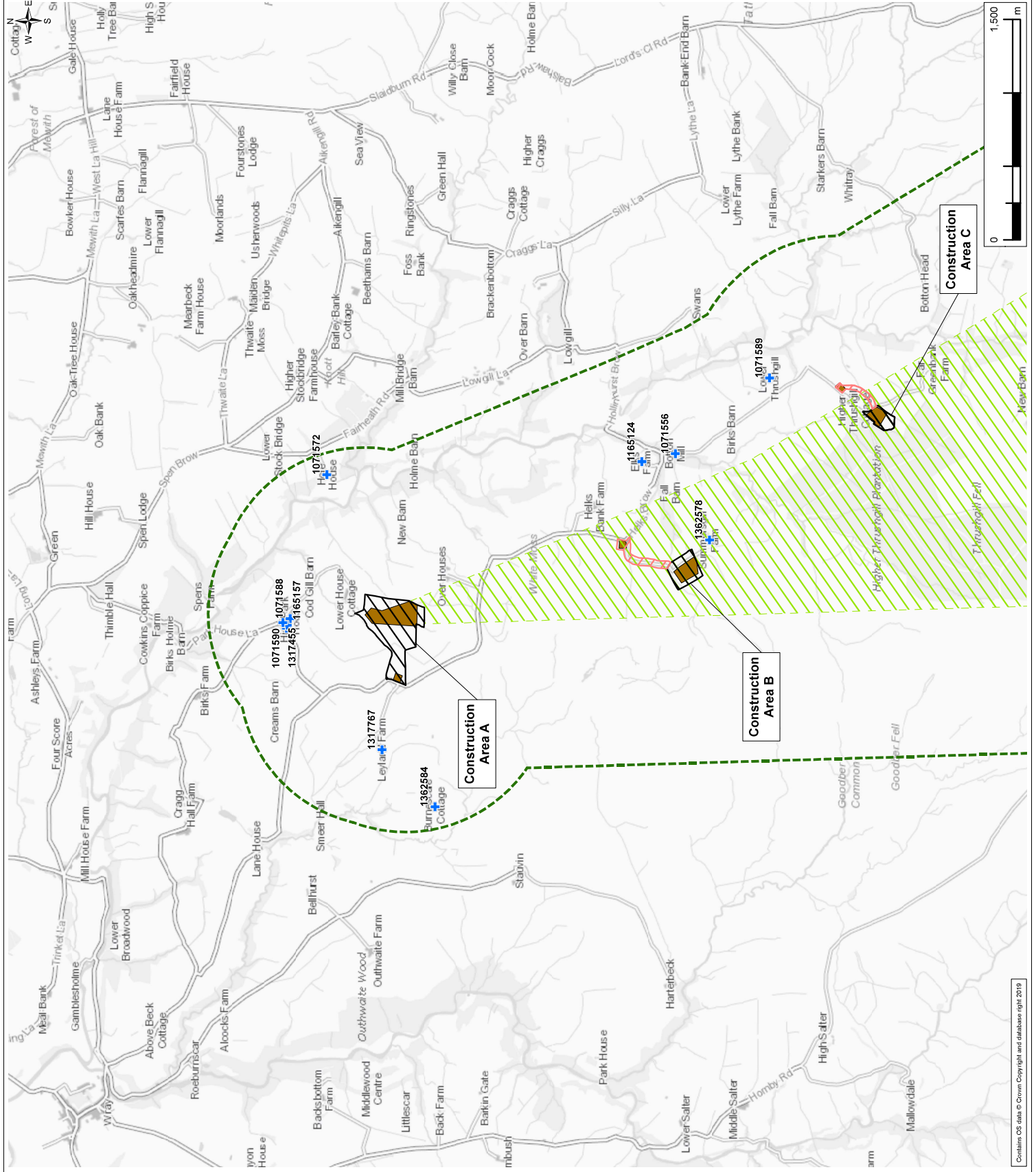
- 395) An optimised design will be developed that includes mitigation to help reduce likely significant cultural heritage effects. This could include:
- Scheme design avoiding areas of significant known archaeology
 - Access routes being chosen away from sensitive heritage assets.
- 396) Additional mitigation may include:
- Careful reinstatement of hedgerows, drystone walls and ground levels
 - Intrusive or non-intrusive archaeological investigation, where appropriate.

10.7 Summary Scope for the EIA

397) For the Cultural Heritage chapter of the ES, a 200 m assessment area around the scheme will be used for a historic environment record (HER) search for known, non-designated heritage assets. Designated assets would be assessed within a 1km assessment area or within a zone of visual influence (ZVI), if available, to assess any impacts on the settings of heritage assets. Heritage assets will be assessed in accordance with the criteria presented in Design Manual for Roads and Bridges (DMRB) HA 208/07 and Historic England guidance. The assessment will be undertaken using professional judgement, guided by DMRB criteria. Designated heritage assets will be identified using the National Heritage List for England (NHLE) and non-designated heritage assets will be identified using HER data, registers of locally listed buildings and data gathered during site walkover surveys. The EIA will be informed by a cultural heritage desk-based assessment undertaken in accordance with current Chartered Institute for Archaeologists guidance. Further evaluation may be required to clarify the potential for archaeological remains, such as geophysical survey and / or trial trenching, particularly in construction areas, open-cut sections and shaft accesses. The requirement for and scope of such investigations will be agreed with the local authority archaeological advisors.

FIGURE 10.1

- Legend**
- 1km 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
 - Cultural Heritage Assets
 - Grade II Listed Building



Rev	Date	Initial Issue	LT	IM	RH	CS
0	02/19	Purpose of revision	Drawn	Checked	Revised	Approved

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United Utilities

Client: **HAMESWATER AQUEDUCT RESILIENCE PROGRAMME**

Project: **LOCATION OF DESIGNATED CULTURAL HERITAGE ASSETS PROPOSED BOWLAND SECTION SHEET 1 OF 2**

Drawing Title	FINAL	DO NOT SCALE
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11. Soils, Geology and Land Quality

11.1 Overview

398) This chapter presents the outcome of the scoping exercise in relation to potential soils, geology and land quality effects of the Proposed Bowland Section.

399) Soils and geology are key factors in determining the environmental character and quality of any given geographic area. Underlying rocks are a key determinant of landform, while the physical and chemical properties of the rocks and the overlying soils influence the type and variety of vegetation that will grow, agricultural quality, flood risk and water storage capacity. This chapter will cover potential effects on Human Health, Geological and Ecological Designated Sites and Mineral Resources, noting that Human Health is also addressed in Chapter 14: Communities and Health. Surface water and groundwater will be assessed in the Chapter 7: Water Environment.

11.2 Proposed Methodology and Assessment Criteria

400) Using the criteria set out in Table 11.1 below, a preliminary review has been undertaken to establish the relative value (or sensitivity) of indicative receptors potentially applicable to the Proposed Bowland Section. (These criteria have been assigned across the respective EIAs for each of the proposed sections forming the Proposed Programme of Works. It is acknowledged that not all criteria or receptor types will be applicable to each of the proposed sections but are included for consistency at a programme level.)

Table 11.1: Sensitivity criteria for Soils, Geology and Land Quality

Sensitivity	Receptor Type	Examples of Receptors
Very high	Human Health	<ul style="list-style-type: none"> Construction workers Schools and playing fields, children's nurseries, nursing homes or residential homes for the elderly
	Infrastructure	Hospitals, fire stations and other essential public buildings
	Geologically Designated Sites	Internationally Important Geology: <ul style="list-style-type: none"> Earth Heritage Sites (designated for their geological importance / geodiversity) Designated European GeoParks Special Protection Areas (SPAs) (and potential SPAs) and Special Areas of Conservation (SACs) (and candidate SACs) where underlying geology is considered a material consideration in their designation SSSIs designated for their international geological importance / geodiversity World Heritage Sites.
	Ecologically Designated Sites	Internationally important ecological sites: <ul style="list-style-type: none"> SACs (and candidate SACs) SPAs Ramsar sites.
	Mineral Resources	Proven mineral reserve or measured mineral resource
High	Human Health	<ul style="list-style-type: none"> Future site users / maintenance workers Residential areas and allotments

Sensitivity	Receptor Type	Examples of Receptors
	Infrastructure	Significant transport links e.g. railway, airport, significant utilities (e.g. high pressure gas main, water or sewage works, trunk mains).
	Geologically Designated Sites	Nationally Important Geology, including: <ul style="list-style-type: none"> • SSSIs • Sites protected by a Limestone Pavements Order (if not qualifying as a “Very High” receptor by virtue of an international designation) • National Nature Reserves • National Parks.
	Ecologically Designated Sites	Nationally important ecological sites, including: <ul style="list-style-type: none"> • SSSIs • National Nature Reserves • National Parks.
	Mineral Resources	Probable Mineral Reserve or Indicated Mineral Resource
Medium	Human Health	<ul style="list-style-type: none"> • Future site users / maintenance workers • Commercial / industrial land use
	Infrastructure	Residential or industrial / commercial developments
	Geologically Designated Sites	Regionally Important Geology: <ul style="list-style-type: none"> • Local Geological Sites • Local Nature Reserves.
	Ecologically Designated Sites	Regionally important ecological sites: <ul style="list-style-type: none"> • Local Nature Conservations Sites • Sites of Interest to Nature Conservation.
	Mineral Resources	Feasibility mineral resource or pre-feasibility mineral resource
Low	Human Health	<ul style="list-style-type: none"> • Users of adjacent land • No built development but land is open to public access
	Infrastructure	Local infrastructure / services
	Geologically Designated Sites	Locally important geology
	Ecologically Designated Sites	Locally important ecology
	Mineral Resources	Inferred mineral resource or reconnaissance mineral resource
Negligible	Human Health	No access to land
	Infrastructure	None
	Geologically Designated Sites	None - little or no geological outcrop
	Ecologically Designated Sites	None
	Mineral Resources	No mineral occurrences / prospects

- 401) For the purposes of scoping, the assessment area encompassed the indicative development envelopes, with historical and land use searches generally restricted to a 250 m buffer around the envelopes excluding the indicative tunnel corridor. In areas of historical mining and potential ground gas, the assessment area would include a buffer around the proposed tunnel route indicative corridor. At the time of undertaking production of the Environmental Statement (ES), professional judgment will be applied to the methodology outlined above to define an appropriate assessment area.
- 402) Potential implications of identified pollutant linkages and impact upon designated sites and mineral resources to United Utilities in their ownership, proposed use, and potential future use of the built infrastructure will be assessed cognisant of the current regulatory framework, in particular the National Planning Policy Framework and Part 2A of the Environmental Protection Act 1990.
- 403) Current guidance for the assessment of land contamination is contained in Land Contamination: risk management (Environment Agency, 2019) and will be followed. The impact on identified receptors will be initially assessed by production of a Preliminary Risk Assessment (PRA) containing a Conceptual Model. Baseline conditions of potential sources of land contamination will be presented within this report, which will form part of the baseline conditions reference material used to develop the assessment. This will involve a detailed review of the environmental setting of specific sites, and will identify any potentially contaminative historical land-uses via environmental record searches (e.g. Landmark Envirocheck) and through consultation with the appropriate regulatory authorities.
- 404) Depending on the outcome of the PRA, ground investigation and laboratory analysis of soil groundwater samples may be required, the results of which may be subject to generic or detailed Quantitative Risk Assessment. The findings of the risk assessments (if required) will determine whether a Remediation Options Appraisal and implementation of a Remediation Strategy is required.
- 405) The scope of assessment for the key receptor types identified for the Proposed Bowland Section is summarised below.

11.2.1 Human Health

- 406) Impacts upon human health will be assessed by following the standard UK approach for assessment of land contamination, as set out above. Potentially contaminated sites will be initially assessed through desk-based review of the historical land uses and their potential to impact health.
- 407) The assessment of risks to human health will be undertaken using appropriate published generic assessment criteria such as Environment Agency Soil Guideline Values and other industry Generic Assessment Criteria. If necessary, a detailed quantitative risk assessment, using an appropriate model (most likely the Environment Agency's CLEA v1.0.7 model) will be undertaken to generate site specific assessment criteria.
- 408) The risk assessment process will be undertaken during the early programme of engineering works, and will be used to develop the impact assessment, to demonstrate whether land contamination and ground gases have the potential to impact the Proposed Bowland Section during construction and operation.

11.2.2 Infrastructure

- 409) The impacts related to infrastructure will be assessed by development of a Conceptual Site Model (CSM), to identify sources and associated pathways by which the Proposed Bowland Section could influence issues such as construction materials or services.

11.2.3 Geologically Designated Sites

- 410) Potential impacts upon Geologically Designated Sites (e.g. Geological SSSI's and Local Geological Sites (LGS)) will be undertaken through consultation with Natural England and local GeoConservation Groups to confirm the presence or otherwise of LGS.

11.2.4 Ecologically Designated Sites

- 411) Potential impacts upon Ecologically Designated Sites (e.g. Groundwater Dependent Ecosystems) will be covered in Water Environment (chapter 7) and Ecology (chapter 9).

11.2.5 Mineral Resources

- 412) Should Mineral Safeguarding Areas or mineral sites such as quarries or clay pits be identified within the Proposed Bowland Section, impacts will be assessed, and further consultation will be undertaken.
- 413) The assessment will be reported using guidance presented within DMRB Volume 11, Section 3, Part 11 Geology and Soils (HMSO, 1993), and will consider the effects of the Proposed Bowland Section on the baseline conditions. It will identify mitigation measures to reduce / eliminate potentially adverse impacts. As no specific criteria exist for this type of assessment, generic guidance within DMRB Volume 11, other good practice guidance and professional judgement have been used to develop a series of criteria (presented in Table 11.1 above) which will be used in the assessment.
- 414) The sensitivity of receptors will be defined in four categories ('Very High', 'High', 'Medium' or 'Low').
- 415) Magnitude of impact will be defined by the amount of change from the baseline, using the scales presented in Table 11.2 below.
- 416) Significance will be assessed based on the degree of change between baseline and construction/operation phases.

Table 11.2: Magnitude Criteria for Soils and Geology

Magnitude	Receptor Type	Negative Effect
Major	Human Health	Significant harm as defined by Part 2A ³⁹
	Infrastructure	Total permanent loss of infrastructure
	Geologically Designated Sites Ecologically Designated Sites	Total or significant (greater than 50%) permanent loss of the designated site
	Mineral Resources	Total sterilisation of the reserve/resource
	Soil Quality	Previously re-useable soils rendered totally unsuitable for re-use
Moderate	Human Health	Effects on health occur (less than significant harm under Part 2A)
	Infrastructure	Total temporary loss of infrastructure Permanent loss of part (<50%) of infrastructure
	Geologically Designated Sites Ecologically Designated Sites	Permanent loss of part (15% - 50%) of the designated site Total temporary loss of the site
	Mineral Resources	Permanent loss of part (<50%) of resource Total temporary loss of all or significant part (>50%) of resource
	Soil Quality	Previously re-usable soils rendered unsuitable for re-use without remediation / treatment.
Minor	Human Health	n/a
	Infrastructure	Temporary loss of part of infrastructure e.g. during construction works.
	Geologically Designated Sites Ecologically Designated Sites	Permanent loss of minor part (less than 15%) of designated site. Temporary loss of (15-50%) of designated site.
	Mineral Resources	Permanent loss of minor part (<15%) of resource.

³⁹ Environment Protection Act 1990: Part 2A Contaminated Land Statutory Guidance

Magnitude	Receptor Type	Negative Effect
		Temporary loss of part (<50%) of resource.
	Soil Quality	High quality soils (suitable for use in residential / open space areas) rendered suitable for use in commercial / industrial areas only.
Negligible	Human Health	n/a
	Infrastructure	n/a
	Geologically Designated Sites Ecologically Designated Sites	Temporary loss of a negligible (<15%) part of the designated site.
	Mineral Resources	Temporary loss of a negligible (<15%) part of the resource.
	Soil Quality	n/a
No change	All Receptors	n/a

11.3 Existing Conditions

417) An initial desk-based review of data relating to known geological, soil and ground conditions has been undertaken, supplemented by consultation with Lancashire County Council, Lancaster City Council, Ribble Valley Borough Council and the Environment Agency.

418) The following characteristics and interests have been identified in relation to regional stratigraphy⁴⁰ (see Figures 11.1 and 11.2).

- Made ground is unlikely to be present within the assessment area beyond that associated with agriculture, the existing Haweswater Aqueduct, the local road network or other utility services
- Superficial deposits, where present, appear to largely comprise Glacial Till (Diamicton – glacial clay) and peat. There are large areas where superficial deposits are absent, typically associated with higher ground. Where works are proposed in proximity to known or potential peat resources, we will define further scopes of assessment and how to assess this resource in consultation with Natural England and other stakeholders
- Solid deposits largely comprise rocks of the Millstone Grit Group consisting of mudstone, siltstone and sandstone. In the south of the assessment area, in the vicinity of Dunsop Bridge, are deposits of Bowland High Group and Craven Group (undifferentiated) comprising mudstone, siltstone, sandstone and limestone
- Four soil types appear to be present in the assessment area, namely slowly permeable seasonally wet acid loamy and clayey soils, blanket bog peat soils, slower permeable seasonable wet slightly acid but base-rich loamy and clayey soils, and very acid loamy upland soils with a wet peaty surface. Preliminary Agricultural Land Classification has identified soils of Grades 3, 4 and 5 within the assessment area.
- Where works are proposed in proximity to known or potential peat resources, we will define further scopes of assessment and how to assess this resource in consultation with Natural England and other stakeholders.

419) Mineral Safeguarding Areas have been identified within the area of search⁴¹. Further consultation will be required to identify the protected and currently worked mineral resource and its significance.

⁴⁰ British Geological Survey, Geology of Britain Viewer <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

⁴¹ Lancashire County Council (2014), Minerals & Waste Local Plan – Guidance note on Policy M2 – Safeguarding Minerals (Minerals Safeguarding Areas)

- 420) The assessment area is not located within the Bowland Shale Gas Prospective or Petroleum Exploration Development License area⁴².
- 421) The Indicative Radon Atlas of England and Wales⁴³ indicates the assessment area is within an area where between 1 % and 30 % of homes may be above the action level for radon gas.
- 422) Environment Agency data⁴⁴ indicates bedrock formations underlying the assessment area are classified as Secondary A aquifers, with a small area of Secondary (undifferentiated) in the south of the assessment area. Where superficial deposits are present, these are largely classified as Secondary (undifferentiated) aquifers. There is a limited extent of Secondary A aquifer materials associated with stream and river corridors. Localised variations in material properties could cause variability in aquifer properties and extent of groundwater encountered.
- 423) There are a limited range of historical land uses within proximity to the assessment area that could have led to ground contamination. These are principally related to agriculture, the construction or operation of the existing Haweswater Aqueduct, the local road network or other utility services. Further consultation and desk study will be undertaken to identify potentially contaminated land. These will be identified during the Preliminary Risk Assessment process and their potential impact assessed initially by development of a Conceptual Model. This assessment will also include consideration of risk from ground gases from natural and anthropogenic sources.
- 424) Given the land use characteristics of the site, there is unlikely to be significant land quality constraints at this stage.
- 425) The Zetica Regional Bomb Risk Map⁴⁵ identifies this area of Lancashire as having a low risk of encountering unexploded ordnance.
- 426) The assessment area does not cross any main rivers, however, within the development envelope boundary, several smaller rivers and streams are indicated, including the River Hodder, Eller Beck, Croasdale Beck and River Hindburn (see Chapter 7).
- 427) Ecologically Designated Sites with potential biodiversity importance (see Chapter 9) may be associated with sensitive soils, geology or hydrogeology.
- 428) The distribution of agricultural land and soils within the “Agricultural Land Classification” are presented in Chapter 14 Communities and Health of this report.

11.4 Potential Effects

- 429) The process of scoping identified that construction of infrastructure associated with the Proposed Bowland Section has the potential to give rise to effects on identified receptors through interactions with the ground, including excavation, soil handling and storage and ground engineering during construction.
- 430) The process also noted that the nature and condition of soil and underlying rocks may present a potential constraint to the design-development process, and that construction work could potentially compound environmental effects caused by previous activity (e.g. pollution mobilisation).
- 431) Potential operational effects are those attributable to the permanent presence of the proposed aqueduct and other assets such as proposed discharge pipe locations, access roads and valve house buildings.
- 432) Table 11.3 below summarises the potential effects on geological, soils and hydrogeological interests associated with the construction and operational phases.

⁴² Oil & Gas Authority Onshore Oil and Gas Activity – <https://decc-edu.maps.arcgis.com/apps/webappviewer/index.html?id=29c31fa4b00248418e545d222e57ddaa>

⁴³ HPA, BGS 2007 Indicative Radon Atlas of England and Wales

⁴⁴ Environment Agency bedrock and superficial aquifer classification – data obtained from <https://magic.defra.gov.uk/MagicMap.aspx>

⁴⁵ Zetica Regional Bomb Risk Map, accessed online from <https://zeticauxo.com/downloads-and-resources/risk-maps/>

Table 11.3: Potential Construction and Operational Effects

Aspect	Construction Phase	Operational Phase	Likely significant effect/ scoped in or out
Human Health (Construction Workers/ Maintenance Workers)	<p>Whilst significant risks to human health are unlikely to be realised, at the current stage of design development, it cannot be discounted. Whilst it is not envisaged, the potential remains for the disturbance of land contamination to result in unacceptable risks to health via acute exposure to land contamination. Exposure pathways could include accidental ingestion, dermal contact, and the inhalation of soil vapours and / or contaminated fugitive dust particles. Ground gas could also accumulate within confined spaces, presenting a potential health risk.</p>	<p>Whilst unlikely, there could be potential exposure to unacceptable risks to health, via acute exposure pathways, if contaminated soils are disturbed.</p> <p>Relevant exposure pathways could include accidental ingestion, dermal contact, and the inhalation of soil vapours and / or contaminated fugitive dust particles.</p> <p>Ground gas could also accumulate within built development, presenting a potential health risk.</p>	Scoped in
Human Health (Others)	<p>Soils disturbance may result in fugitive dust particles and the off-site transport of potentially contaminated soils on the wheels of construction vehicles or the inhalation of soil vapours and / or contaminated fugitive dust particles. Ground gas could also accumulate within confined spaces, presenting a potential health risk.</p>	<p>Ground gas could accumulate within adjacent built development, presenting a potential effect during the operational phase.</p>	Scoped in
Infrastructure	<p>Subsurface infrastructure may be at risk from construction activities which could disrupt local private and public utilities, and from aggressive ground conditions leading to degradation or failure of building materials.</p>	<p>The aqueduct will be a potential receptor for aggressive ground conditions during operation. Subsurface infrastructure may be at risk from aggressive ground conditions or geological features that could compromise the integrity of the pipeline leading to an impact occurring.</p> <p>Ground gas could accumulate within built development, presenting a potential effect during the operational phase.</p> <p>Subsurface infrastructure may be at risk from the presence of the new infrastructure.</p>	Scoped in
Geologically Designated Sites	<p>Permanent loss of part of, or the full site; temporary loss of part of, or the whole site; or, enhancement</p>	<p>Potential effects could be realised through long term changes, such as reducing (or</p>	Scoped in

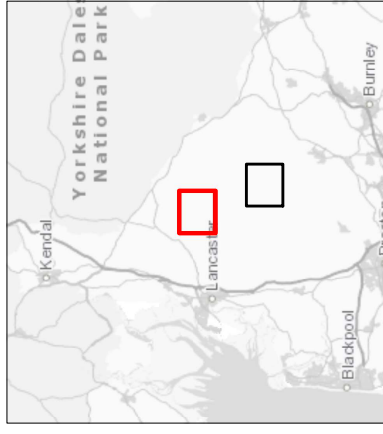
Aspect	Construction Phase	Operational Phase	Likely significant effect/ scoped in or out
	though increased exposed geology or accessibility.	increasing) the exposure, changing the environmental setting of the exposure or reducing (or enhancing) access or study opportunities.	
Ecologically Designated Sites	Permanent loss of part of, or the full site; temporary loss of part of, or the whole site; or, enhancement though increased exposed ecology.	Potential for effects arising from mobilisation of extant land contamination to groundwater and subsequently surface waters impacting on ecology	Scoped in
Mineral Resources	Loss of part of the reserve, or prevention or restriction of their operation.	Potential operational effects on identified quarries could be realised by limits on blasting/ quarrying activities or restricting the expansion of a quarry due to the presence of sensitive infrastructure.	Scoped in
Soil Quality	Disturbance to or permanent removal of areas associated with construction or site compounds, resulting in damage to soil quality or a permanent loss of soil resources.	The soil environment may be disturbed or potentially permanently removed in areas of maintenance works or compounds, which could cause damage to soil quality or a permanent loss of soil in specific areas.	Scoped in

11.5 Summary Scope for the EIA

- 433) Although unlikely, the presence of potentially contaminated made ground, associated with historical development, farming and agriculture, quarrying and waste disposal activities could be present and cannot be discounted at this stage. These factors have the potential to affect human health, soil, surface water, groundwater and infrastructure receptors, and require further assessment.
- 434) Mineral safeguarding areas have been identified within the assessment area, as such the potential impact on mineral resources will be assessed.
- 435) Based on the review of available baseline information, it is considered that an assessment of unexploded ordnance can be scoped out of the assessment.
- 436). Pollution incidents and the potential for foot and mouth or other animal disease burial pits within the assessment area will also be considered in the assessment.
- 437) Following design development, consultation with regulators and stakeholders, it is anticipated that certain elements of the soils, geology and land quality study could be scoped out, particularly in sections of the route where deeper tunnelling will be carried out. At this stage, therefore it is not considered that the EIA and subsequent ES can be significantly de-scoped. The environmental baseline has not been adequately characterised to allow potential impacts in respect of soils, geology and land quality receptors to be discounted.

FIGURE 11.1

- Legend**
- 1km Assessment Area
 - Proposed Tunnel Route - Indicative
 - Proposed Construction Access - Indicative
 - Proposed Construction Compound / Laydown Area - Indicative
 - Development Envelope
 - Proposed Indicative Construction Compound / Laydown
 - Solid Geology and Hydrogeology
 - Fault at rockhead
 - MILLSTONE GRIT GROUP (SEE ALSO MIGR) - MUDSTONE, SILTSTONE AND SANDSTONE



Rev	Date	Initial Issue	LT	IM	SH	CS
0	02/19	Purpose of revision	Drawn	Checked	Rev'd	App'd



HAMESWATER AQUEDUCT
RESILIENCE PROGRAMME

SOLID GEOLOGY AND HYDROGEOLOGY
PROPOSED BOWLAND SECTION
SHEET 1 OF 2

Drawing Status	FINAL	DO NOT SCALE
Scale @ A3	1:25,000	
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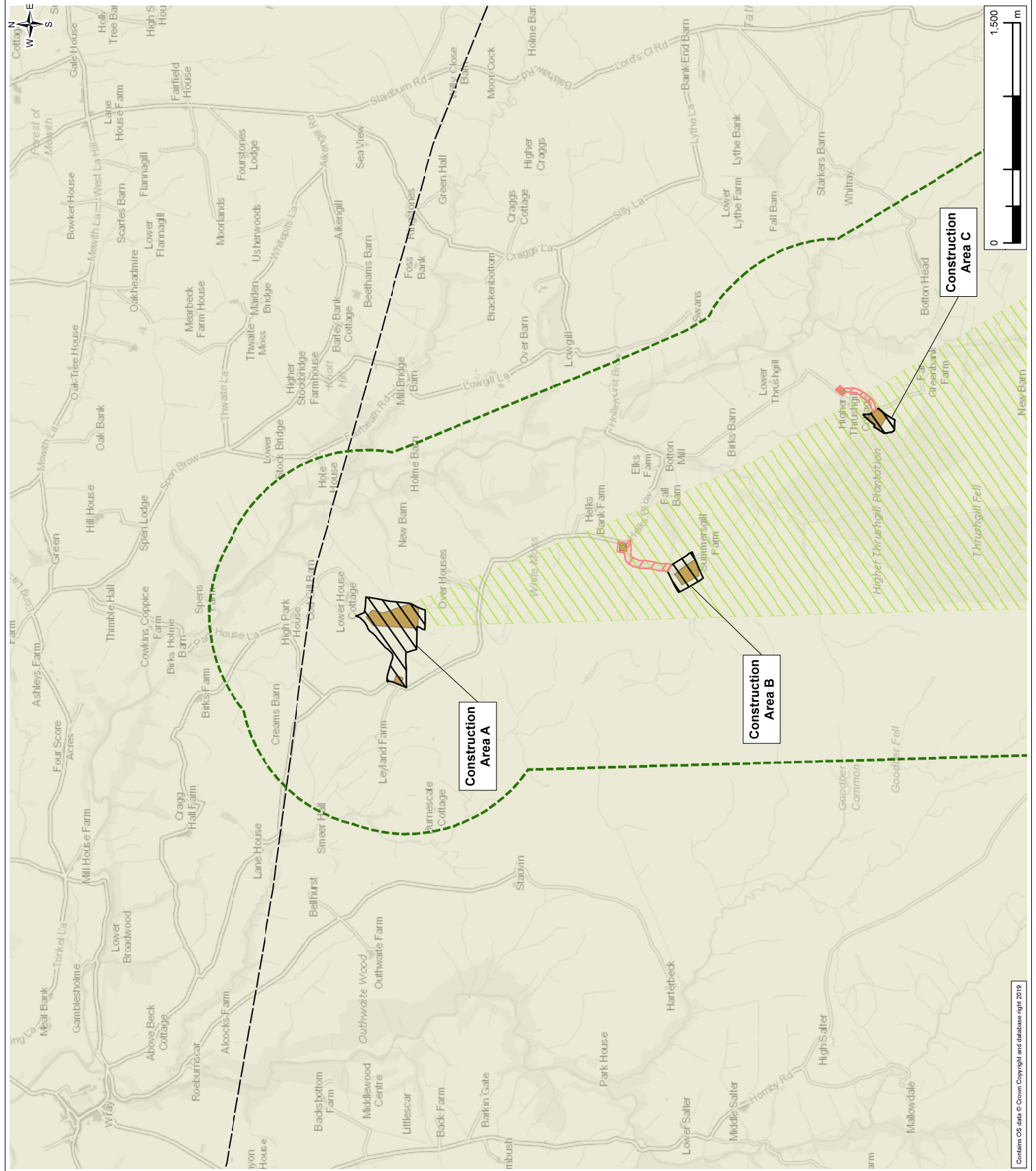
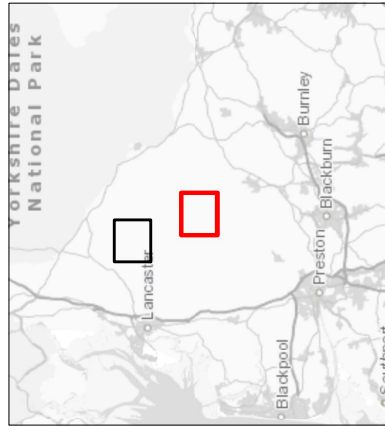
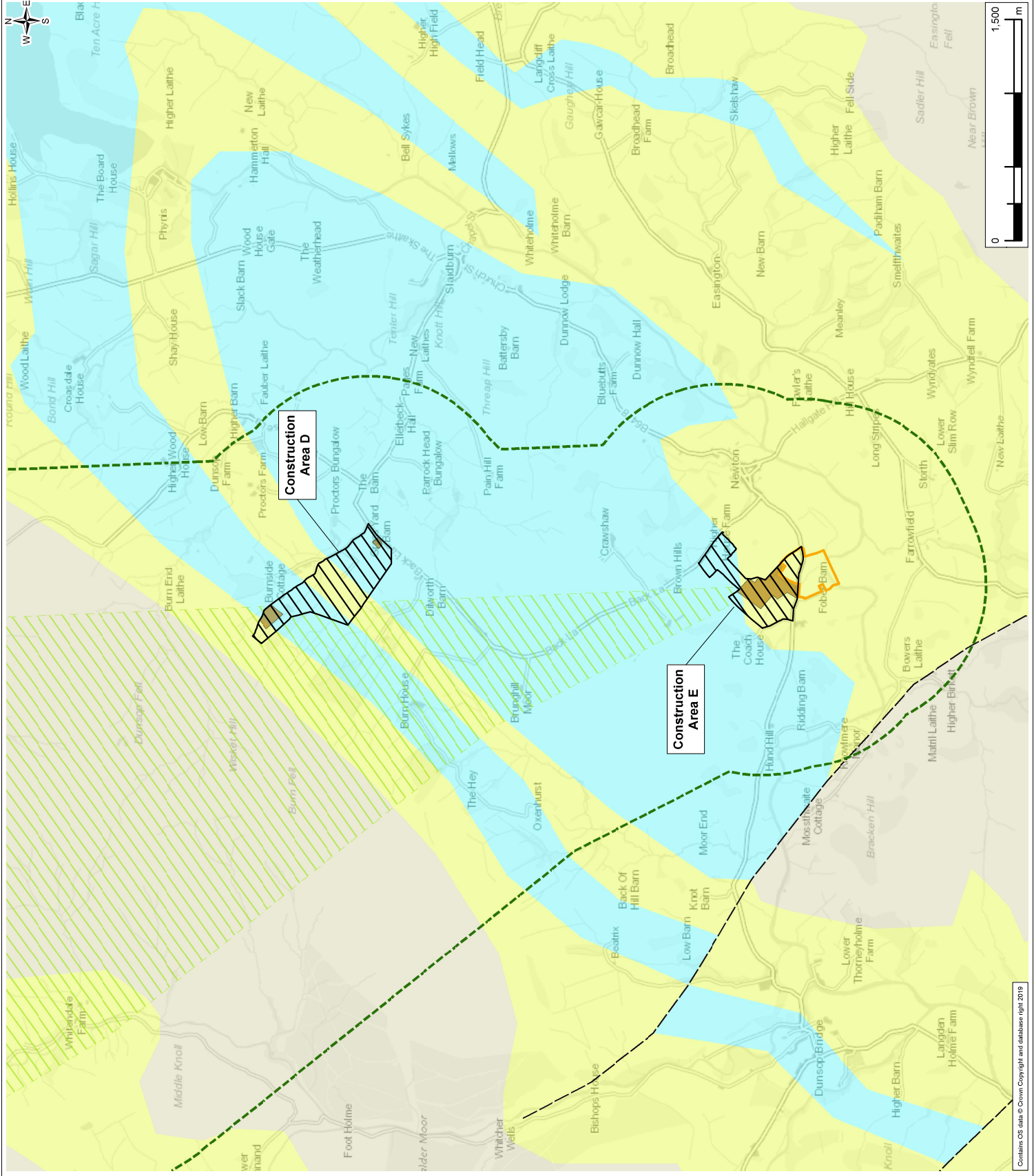


FIGURE 11.1

- Legend**
- 1km Assessment Area
 - Proposed Tunnel Route - Indicative
 - Proposed Construction Compound / Laydown Area - Indicative
 - Development Envelope
 - Proposed Indicative Construction Compound / Laydown
 - Proposed Discharge Pipe - Indicative Corridor
 - Solid Geology and Hydrogeology
 - Fault at rockhead
 - MILLSTONE GRIT GROUP (SEE ALSO MIGR) - MUDSTONE, SILTSTONE AND SANDSTONE
 - BOWLAND HIGH GROUP AND CRAVEN GROUP (UNDIFFERENTIATED) - LIMESTONE
 - BOWLAND HIGH GROUP AND CRAVEN GROUP (UNDIFFERENTIATED) - MUDSTONE, SILTSTONE AND SANDSTONE



Rev	Date	Initial Issue	LT	IM	SH	CS
0	OCT 19	Purpose of revision				
			Drawn	Checked	Revised	Approved



Client: **HAMESWATER AQUEDUCT RESILIENCE PROGRAMME**

Drawing Title: **SOLID GEOLOGY AND HYDROGEOLOGY PROPOSED BOWLAND SECTION SHEET 2 OF 2**

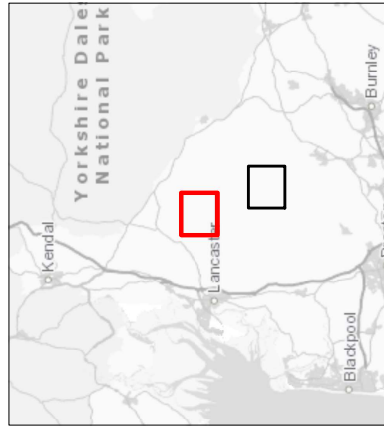
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FIGURE 11.2

- Legend**
- 1km 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
 - Superficial Geology**
 - RIVER TERRACE DEPOSITS (UNDIFFERENTIATED) - SAND AND GRAVEL
 - TILL - DIAMCTION



0	OCT 19	Date	LT	IM	TA	SH
		Purpose of revision	Drawn	Checked	Revised	Approved

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Client
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Drawing Title
 SUPERFICIAL GEOLOGY
 PROPOSED BOWLAND SECTION
 SHEET 1 OF 2

Drawing Status	FINAL	DO NOT SCALE
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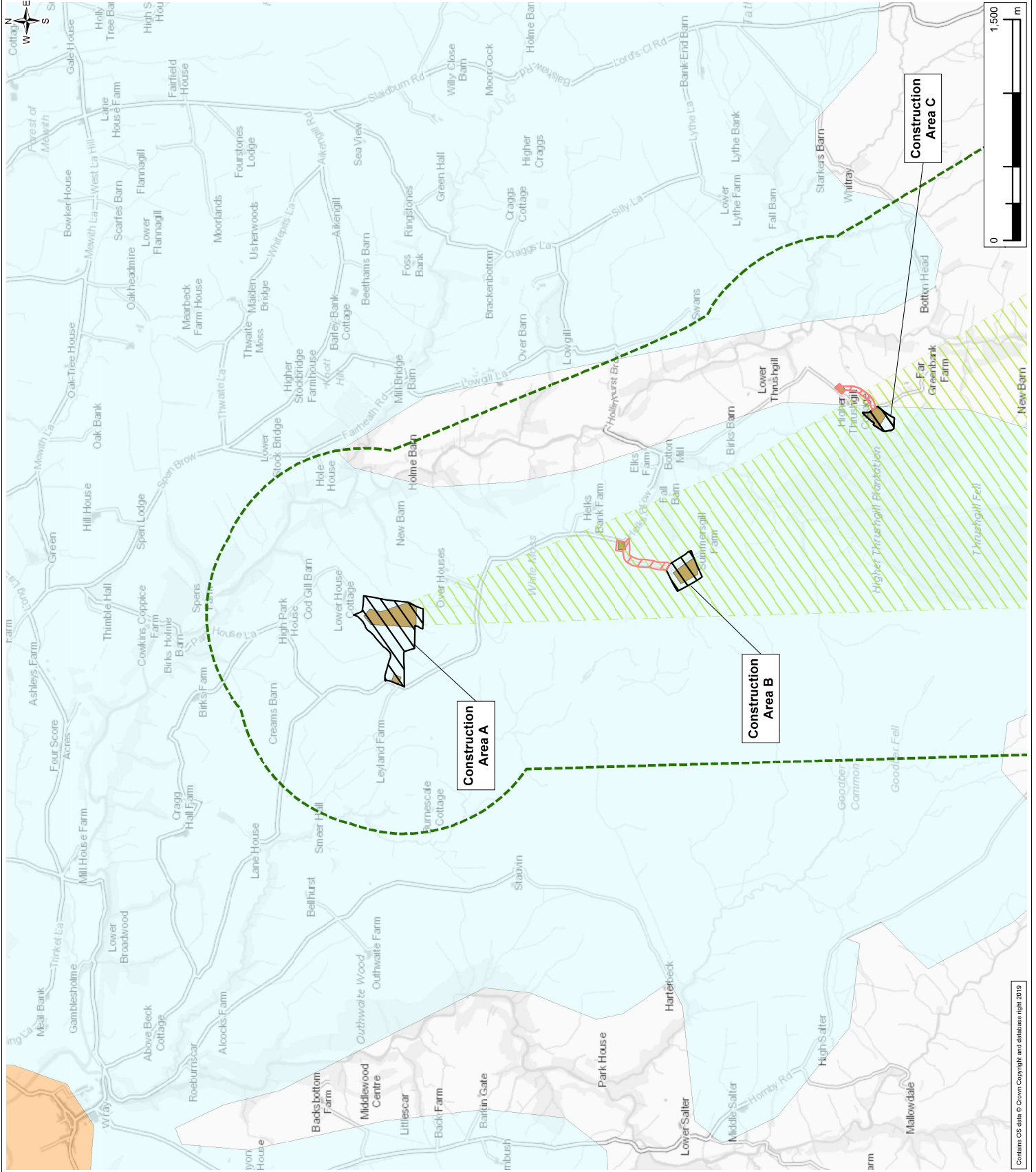
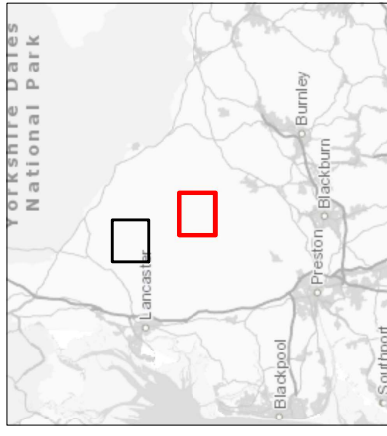
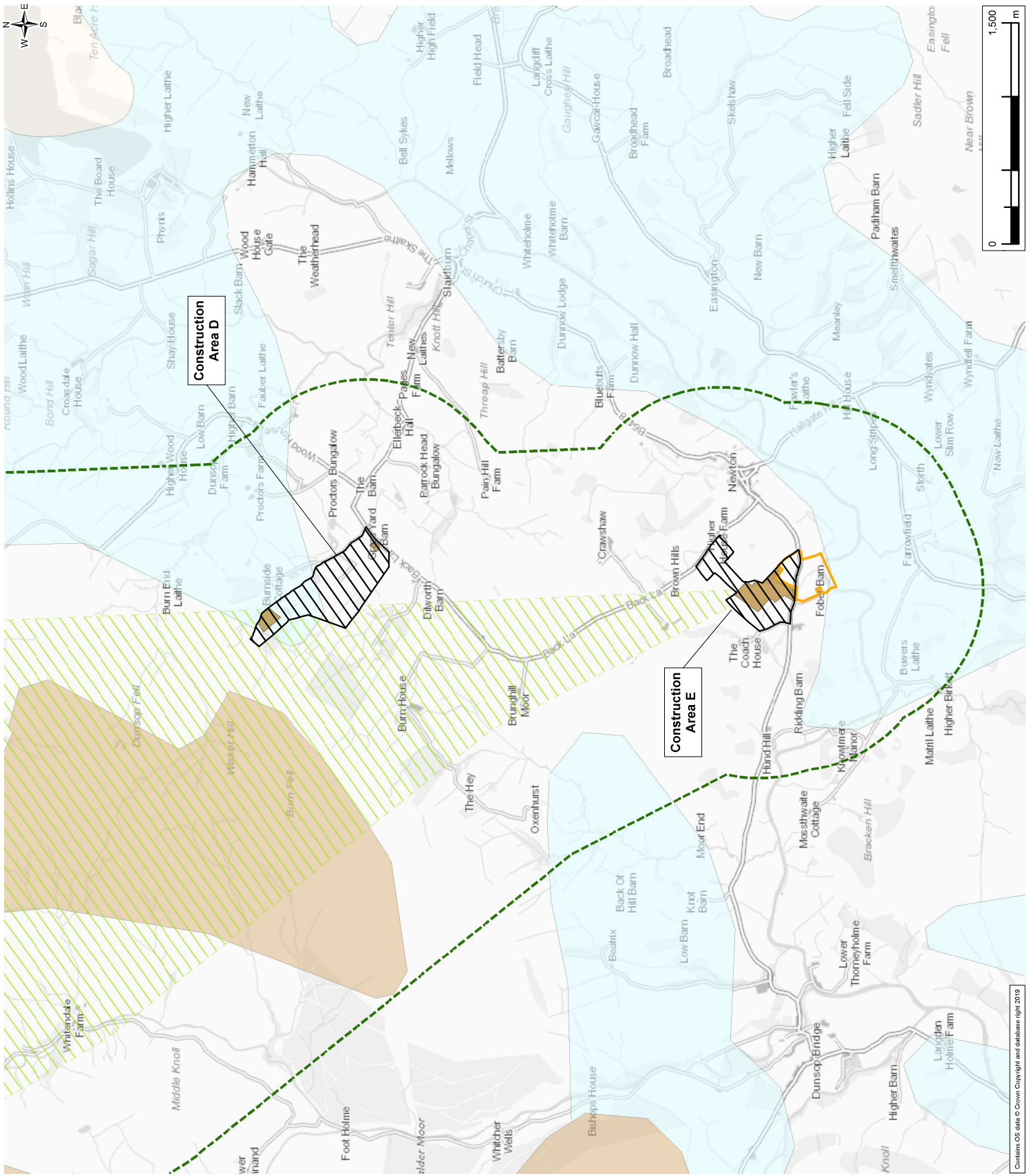


FIGURE 11.2

- Legend**
- 1km Assessment Area
 - Proposed Tunnel Route - Indicative
 - Proposed Construction Compound / Laydown Area - Indicative Development Envelope
 - Proposed Indicative Construction Compound / Laydown Area
 - Proposed Discharge Pipe - Indicative
- Superficial Geology**
- PEAT-PEAT
 - TILL - DIAMICTON
 - DRIFT GEOLOGY - UNKNOWN LITHOLOGY



Rev	Date	Initial Issue	LT	IM	TA	SH
0	02/19	Purpose of revision	Drawn	Checked	Revised	Approved



Client	United Utilities					
Project	HAMSWATER AQUEDUCT RESILIENCE PROGRAMME					
Drawing Title	SUPERFICIAL GEOLOGY PROPOSED ROW/LAND SECTION SHEET 2 OF 2					
Drawing Status	FINAL					
Scale @ A3	1:25,000	DO NOT SCALE				
Jacobs No.	B270702G					
Drawing No.	B270702G_ESR_11_02					

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12. Materials

12.1 Overview

438) This chapter describes the scope of the material and waste arisings assessment for the Proposed Bowland Section. The management and fate of surplus material will be a key environmental aspect of the Proposed Bowland Section. Additionally, it is anticipated that surplus materials management for the Proposed Bowland Section may need to link into an over-arching surplus materials strategy for some or all of the Proposed Programme of Works.

439) For the purposes of this report materials and waste are defined as:

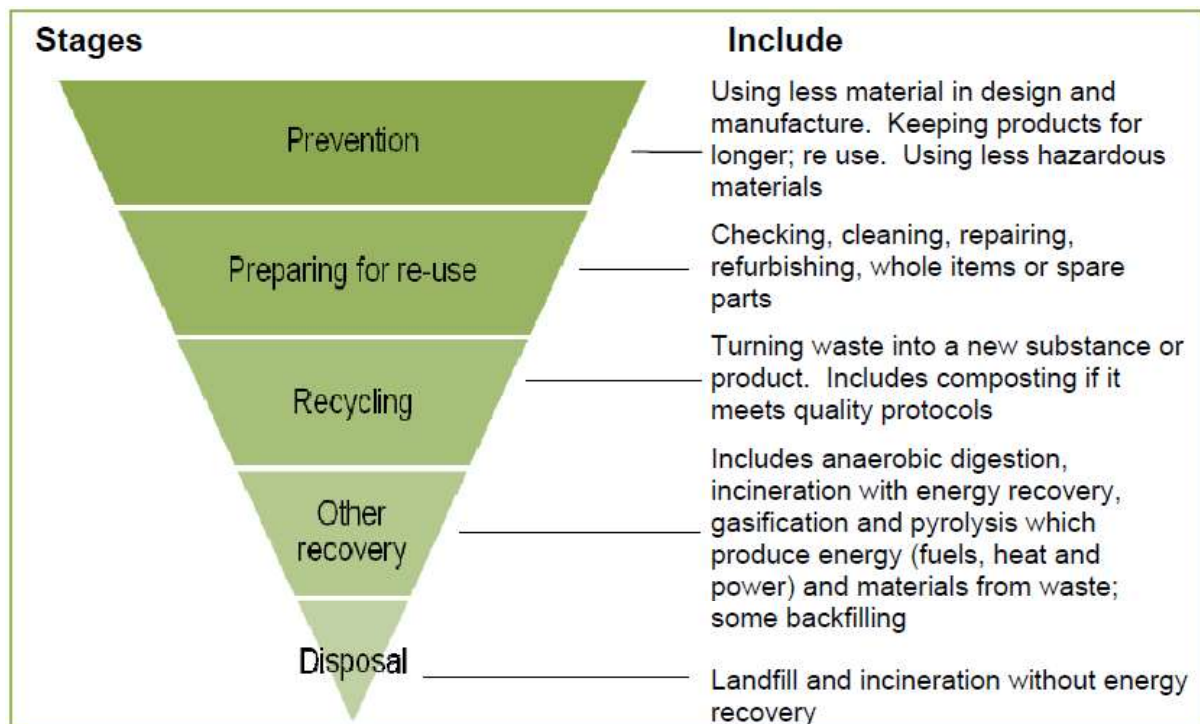
- The use of material resources
- The generation and management of waste.

440) Material resources are defined as the materials and construction products required for the construction, improvement and maintenance. Material resources include primary raw materials such as aggregates and minerals, and manufactured products for construction.

441) Waste is defined as per the Waste Framework Directive (2008/98/EC) as "any substance or object which the holder discards or intends or is required to discard."

442) The Proposed Bowland Section will aim to prioritise waste prevention, followed by preparing for re-use, recycling and recovery and lastly disposal to landfill as per the internationally recognised waste hierarchy shown in Figure 12.1 below.

Figure 12.1: Waste Hierarchy⁴⁶



443) This assessment has been undertaken using Highways Agency LA 110 *Material Assets and Waste* (August 2019) and supplemented by guidance contained in Highways England's (2018) *Major Projects' Instructions* (MPI) 57-052017 (Rev 1). This guidance has been prepared for those undertaking assessment of the

⁴⁶ Guidance on applying the Waste Hierarchy June 2011

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69403/pb13530-waste-hierarchy-guidance.pdf

environmental effects associated with the use of material resources and the generation and management of waste in highway construction, improvement, and maintenance projects.

444) This guidance provides environmental assessment advice which reflects both legislative and best practice requirements. It seeks to ensure information about the environmental effects of projects is collected, assessed and used to inform option choice, design and decision making in a timely and cost-effective manner. In the absence of industry specific guidance, this scoping exercise has referred to Highways England's environmental assessment guidance as it provides a comprehensive and consistent approach large infrastructure projects. This guidance has been recently and successfully deployed on a wide range of infrastructure projects in the UK.

12.2 Proposed Methodology

445) The assessment area will comprise the indicative development envelope boundaries as shown in Figure 3.1 and the wider North West region within which waste management facilities are located and construction materials may be sourced.

446) An assessment will be undertaken to assess the impacts of the material resources and waste arisings from the Proposed Bowland Section. As part of this detailed assessment, the following tasks will be carried out:

- The relevant waste legislation, policies and guidance will be reviewed to identify material use and waste management objectives and targets
- The likely types of material resources and waste arisings will be identified, and the quantities estimated for each of the proposed sections
- The impacts will be evaluated against the national materials markets and the capacity of the regional waste infrastructure
- Opportunities to reduce, re-use, recover and / or recycle material resources and waste arisings will be identified through a review of the proposed development (including proposed building materials, construction methods and design, where available) and in accordance with industry best practices
- Coordinated and documented consideration and identification of circular economy opportunities during the Proposed Bowland Section early design stage.

447) The main outputs from the detailed assessment will be:

- Identification of likely significant effects associated with material resources and waste arisings
- Measures which will be implemented to mitigate these significant effects.

448) There are potential sources of contamination within the assessment area that may impact the characterisation and management of the material resources and waste arisings. The extent of any soil contamination and any associated impacts are discussed in Chapter 11 Soils, Geology and Land Quality. The intrusive ground investigation and existing information will provide an indication on the physical and chemical properties of the excavated arisings within the route alignment. This will help identify the suitability for re-use of the excavated arisings and the facilities or locations that could manage any arisings removed from site.

449) The tunnelling will produce a significant volume of excavated surplus material. The opportunities to re-use or recover this material will depend on the volume produced, the type of excavation method used (which may impact the physical and chemical properties of the spoil) and the environmental constraints in the area. The capacity of the local road network to accommodate the movement of surplus material consignments will also need to be taken into account. The assessment will identify and assess a range of management routes for the spoil, which may include both on-site and off-site options. This may include identifying facilities or locations which may be suitable for reuse, recovery or disposal of the tunnel spoil.

450) Only very short (around 400 m) sections of open-cut trenching would be undertaken for the Proposed Bowland Section. Therefore, there would clearly be far less surplus material requiring an off-site management solution. In practice on open-cut water pipeline projects excavated material is often reinstated in the trench after the pipe has been laid and commissioned.

- 451) These options would be assessed against a range of criteria to identify their feasibility and environmental performance, with preference given to options which would avoid the need for disposal.
- 452) A short-list of potentially feasible options for tunnel spoil management would be developed, and where applicable, preferred options would be identified. The technical and regulatory aspects of these options would be described.
- 453) As discussed above there are no recognised significance criteria against which direct and indirect waste effects for the construction of the Proposed Bowland Section can be assessed. As such, the criteria for the assessment have been derived from professional experience previously gained from the application of EIA to large-scale infrastructure projects, which will consider:
- The net change in solid waste arisings overall attributable to the Proposed Bowland Section
 - The magnitude of the quantity of waste requiring landfill disposal (inert, non-hazardous and hazardous)
 - The availability of landfill disposal capacity (inert, non-hazardous and hazardous) in the local and regional area.
- 454) Table 12.1 below provides the outline for the assessment.

Table 12.1: Net Impact on landfill capacity (cubic metres)

Value	Net Impact on Landfill Capacity
Very High	Net increase in waste arisings relative to the future baseline leading to a severe, national and regional scale reduction in landfill void space capacity. (Inert >10M, Non-Hazardous >250K, Hazardous >100K)
High	Net increase in waste arisings relative to the future baseline leading to regional scale reduction in landfill void space capacity. New large-scale facility need to be constructed (Inert 2M >10M, Non-Hazardous 50K >250K, Hazardous 20K >100K)
Medium	Net increase in waste arisings relative to the future baseline leading to local scale reduction in landfill void space capacity. New small-scale facility needing to be developed (Inert 500K <2M, Non-Hazardous <50K, Hazardous <20K)
Low	Some net increase in waste arisings relative to the future baseline or reduction in landfill void space capacity for waste. Waste can be accommodated in existing infrastructure without additional facilities needed maybe some inert landfill <500K
Negligible	No net increase in waste arisings relative to the future baseline or reduction in landfill void space capacity for waste.

12.3 Proposed Assessment Criteria

455) The following section covers the relevant documents and regulations which may be relevant to the assessment of materials and waste, broken down in to national policy, local plans and other relevant documents.

12.3.1 National Policy

- 456) The following national planning policy documents and regulations are relevant to the assessment of materials and waste:
- Waste (England and Wales) Regulations 2011 (as amended)
 - The Environmental Permitting (England and Wales) Regulations 2016
 - Hazardous Waste (England and Wales) Regulations 2005 (as amended)
 - Environmental Protection Act 1990 (as amended)
 - Waste Management Plan for England
 - National Planning Policy for Waste.

12.3.2 Local waste planning policy

457) The following local planning policy documents and regulations are relevant to the assessment of materials and waste:

- Lancashire Minerals and Waste Local Plan (currently under review).

12.3.3 Other Relevant Documents

458) The following policy documents and regulations may also be relevant to the assessment of materials and waste:

- CL:AIRE Definition of Waste Code of Practice (Version 2, however we are aware of the potential revision which is underway, which will reflect Landfill Tax changes and Deposit for Recovery Appeal decision).

12.4 Baseline Conditions

459) Baseline waste conditions comprising existing quantities of waste generated along with the location of current facilities will be established. Baseline information will consist of the current capacity of the waste infrastructure and waste arisings in the waste disposal areas for the North West planning regions.

460) Detailed information on baseline conditions will be collected from sources such as planning documents published by North West planning regions and data on waste facility capacity published by the Environment Agency.

461) The Environment Agency Waste information 2017⁴⁷ includes information about waste sent to landfills and remaining capacity in the North West. Table 12.2 and 12.3 below show the available capacity in the relevant sub-regions based on mandatory reporting of permitted and licensed sites for waste treatment which is collated by the Environment Agency, this shows there is currently significant capacity in the sub-regions. (It should be noted that it will not be possible for United Utilities to prescribe which particular landfill(s) a contractor or contractors should use – this is a commercial matter which will be decided at a later stage in the development process).

⁴⁷ <https://data.gov.uk/dataset/d18fbf9a-eeca-43d7-84e3-1dea6b91425d/waste-data-interrogator-2017>

Table 12.2: North West Landfill Capacity 2017

Landfill Type	Sub-Region					North West
	Cheshire	Cumbria	Greater Manchester	Lancashire	Merseyside	
Hazardous Merchant	1,531	-	-	1,815	3,062	6,409
Hazardous Restricted	-	-	-	150		150
Non Hazardous with SNRHW cell*	-	1,776	4,992	1,869		8,637
Non Hazardous	6,398	1,447	2,777	7,111		17,734
Non Hazardous Restricted	1,912	-	3,000			4,912
Inert	900	1,045	1,529	1,728	625	5,827
Total	10,741	4,268	12,297	12,674	3,687	43,669

*Some non-hazardous sites can accept some Stable Non-Reactive Hazardous Wastes (SNRHW) into a dedicated cell, but this is usually a small part of the overall capacity of the site.

The void space figure provided by the operator for this site was reduced substantially from that provided in previous years.

Table Notes:

Data for 2017 is classified into Landfill Directive categories.

2017 landfill capacity data was obtained from environmental monitoring reports required by permits or directly from the operator. All figures are provided in 000s cubic metres

Source: Environment Agency

Table 12-3: Yorkshire and Humber Landfill Capacity 2017

Landfill Type	Sub-Region				YORKSHIRE AND THE HUMBER
	Former Humberside	North Yorkshire	South Yorkshire	West Yorkshire	
Hazardous Merchant	851	-	-	1,815	2,666
Hazardous Restricted	-	-	-	-	-
Non Hazardous	21,907	3,684	3,867	12,157	41,615
Non Hazardous Restricted	1,642	14,096	-	-	15,738
Inert	3,393	1,162	6,573	3,008	14,136
Total	27,793	18,942	10,440	16,980	74,155

Table Notes:

Data for 2017 is classified into Landfill Directive categories.

2017 landfill capacity data was obtained from environmental monitoring reports required by permits or directly from the operator. All figures are provided in 000s cubic metres

Source: Environment Agency

12.5 Assumptions, Limitations and Uncertainties

462) In undertaking this scoping exercise, the following assumptions have been made:

- Information on the types and quantities of materials used and waste generated will be produced during the design development process
- The assessment may identify potentially suitable management routes for major waste streams (including tunnel spoil) and may, where necessary, identify preferred options, but it will not be prescriptive in terms of defining precisely which facilities or locations must be used.

463) The likely significant environmental effects from the use of materials (e.g. aggregate, concrete, brick and steel) for the construction of the Proposed Bowland Section will not be addressed in the ES.

464) Waste management and materials impacts during operation of the Proposed Bowland Section have been scoped out because material use, and waste generation is expected to be very small during operation.

13. Public Access and Recreation

13.1 Overview

465) This chapter presents the outcome of the scoping exercise for Public Access and Recreation effects arising from the Proposed Bowland Section.

466) The public access and recreation topic area considers the following aspects.

- Public access – the potential effects on Public Rights of Way (PRoWs) including footpaths, bridleways, restricted byways and byways open to all traffic (BOATs), permissive paths and Access Land. The effects considered physical access to features as well as the recreational amenity of people using them
- Recreation – the potential effects on formal and informal recreational activities. Formal recreational activities include but are not limited to; leisure centres, sports centres, sports clubs and sports grounds. Informal recreational activities include but are not limited to; horse riding, cycling, water activities and the use of open space and playgrounds, including any facilities enabling recreation users to access these activities.

467) Baseline data relating to public access and recreation has been gathered from consultation with Lancashire County Council and through desk based research using web-based data sources including (but not limited): local authority websites; Multi Agency Geographic Information for the Countryside (MAGIC) interactive mapping⁴⁸; SusTrans⁴⁹; Rowmaps⁵⁰ and the Long Distance Walkers Association website⁵¹.

468) The public access and recreation assessment will not consider economic effects on 'paid for' recreational facilities. Such effects are considered within Chapter 14 Communities and Health.

469) Lancashire County Council has been consulted in order to obtain data regarding locations of public rights of ways.

13.2 Proposed Methodology

470) The assessment will consider potential significant effects on users of the various recreational routes and access land within local and regional assessment areas, and on users of recreational facilities. The assessment areas will be:

- Local – at this level the focus will be on the public access routes that will be directly affected by the Proposed Bowland Section (e.g. where the development envelope boundary crosses a Public Right of Way). This will focus on all development areas except for the proposed tunnel corridor, as this will be below ground. An additional buffer has not been implemented above and beyond the indicative development envelopes as this incorporates any additional land and represents a more conservative approach. As the proposed indicative tunnel corridor is below ground, it will not affect any PRoWs and therefore the tunnel corridor is scoped out.
- Regional - this will extend across Lancashire and acknowledges the fact that, for certain recreational activities, a wider catchment area exists (e.g. many people embark on long distance routes for recreational purposes, or facilities such as leisure centres and sports playing fields have wider catchments requiring people to travel from further afield).

471) The assessment of effects on public access will take account of the following.

- Changes in the accessibility of PRoWs, long distance routes and areas of open access land
- Changes in the amenity (attractiveness) experienced by public access route users.

472) The assessment of effects on recreational facilities will consider the following.

- Changes in the accessibility of the recreational facilities

⁴⁸ MAGIC Maps <https://magic.defra.gov.uk/MagicMap.aspx> Last Accessed 30th August

⁴⁹ Sustrans (<https://www.sustrans.org.uk/find-a-route-on-the-national-cycle-network/?location=null&routetype=null&distance=null>) Last Accessed 30th August

⁵⁰ Rowmaps <https://www.rowmaps.com/> Last Accessed 30th August

⁵¹ Long Distance Walkers Association <https://www.ldwa.org.uk/> Last Accessed 30th August

- Potential changes in the ongoing viability of the recreational facilities.

- 473) Baseline data will continue to be gathered from existing desk-based sources, and via consultation with appropriate statutory bodies, key stakeholders and other organisations. These may include where appropriate: local authority rights of way officers/countryside officers; Local Access Forums; local ramblers groups; the Ramblers Association (national); Sustrans, local cycling groups; local horse riding clubs; angling associations; sailing clubs; and other users of the local PRoW network and local sports and recreational facilities.
- 474) As the Proposed Bowland Section will not affect any National Trust Land, this will be scoped out of the assessment.
- 475) Additional public access routes or recreational facilities requiring consideration in the assessment will be identified through consultation, stakeholder engagement and further desk-based research.
- 476) A site walkover of affected PRoWs will be undertaken to inform the assessment of effects on public access. However, usage surveys for Public Rights of Way or recreational facilities will not be undertaken. This position will be agreed with the relevant local authority as part of continued consultation; for example, should the need arise for temporary PRoW closures or diversions.
- 477) Information relating to the proposed phasing of construction works and the availability of diversions will be assessed to determine the degree of impact on users of public access routes.
- 478) The level of detail presented in the Environmental Statement will be determined and agreed with the relevant local authority and key stakeholders, in conjunction with any requirements for mitigation.

13.3 Proposed Assessment Criteria

- 479) The assessment will take account of the principles contained within: the Institute for Environmental Management and Assessment (IEMA) Guidelines for Environmental Impact Assessment (2004); and Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 8 Pedestrians, Cyclists, Equestrians and Community Effects.
- 480) Professional judgement will inform the identification of impacts and evaluation of effect significance, which will use a matrix-based approach using criteria to define the relative importance/sensitivity of public access and recreation receptors and the magnitude of impact (as presented below).
- 481) Table 13.1 below explains the criteria used to determine the sensitivity of the Public Access and Recreation areas and Table 13.2 explains the magnitude. Professional judgement will be used to confirm the correct significance of potential effect.

Table 13.1: Criteria used to determine the importance/sensitivity of Public Access and Recreation Receptors

Sensitivity	Description
High (National)	Feature/receptor possessing key characteristics which contribute significantly to the distinctiveness and character of the site, (e.g. footpath of national significance), and receptor is identified as having a very low capacity to accommodate proposed form of change, (i.e. is very highly sensitive). Feature/receptor possesses very significant social/community value. Feature/receptor is extremely rare.
Medium (Regional)	Feature/receptor possesses key characteristics which contribute significantly to the distinctiveness and character of the site, (e.g. footpath of regional significance) and receptor is identified as having low capacity to accommodate proposed form of change, (i.e. is highly sensitive). Feature/receptor possesses significant social/community value. Feature/receptor is rare.

Sensitivity	Description
Low (local)	Feature/receptor only possesses characteristics which are locally significant (e.g. local PRoW network). Feature/receptor not designated or only designated at a local level. Feature/receptor identified as having some tolerance of the proposed change subject to design and mitigation (i.e. is of moderate sensitivity). Feature/receptor possesses moderate social/community value. Feature/receptor is relatively common.
Very Low/ Negligible	Feature/receptor characteristics do not make a significant contribution to the character or distinctiveness of the site and surroundings at a local scale. Feature/receptor not designated. Feature/receptor identified as being generally tolerant of the proposed change, i.e. of low sensitivity. Feature/receptor possesses low social/community value. Feature/receptor is common.

Table 13.2: Criteria used to determine the magnitude of impact on Public Access and Recreation Receptors

Magnitude	Description
High	Permanent loss or obstruction/irreversible changes to key characteristics, features or the function of amenity and recreation assets. Impact may occur over the whole asset. Significant effect certain to occur.
Medium	Obstruction or change of key characteristics, features or the function of amenity and recreation asset in the medium term. Impact may occur over the majority of the asset. Significant effect likely to occur.
Low	Noticeable but not substantial obstruction or change (temporary/potentially reversible), over part of the asset, to key characteristics, features or the function of amenity and recreation assets in the short term. Significant effect unlikely to occur.
Very Low/ Negligible	Barely noticeable obstruction or changes over a small area, to key characteristics, features or the function of amenity and recreation assets, which are infrequent or temporary. Impact very unlikely to occur.

13.4 Existing Conditions

482) This report summarises the Public Access and Recreation baseline for the assessment area and identifies receptors where there is potential for significant effects to arise. A brief description of the existing conditions is also included. This section only has a tunnelling option (with very limited open-cut connections) and as the tunnel corridor is below ground and will not affect above ground, only the indicative envelope around compound/laydown areas will be assessed. These areas will include above-ground temporary works to support the operation and maintenance of the TBMs.

13.4.1 Public Access

483) Construction area A is not crossed by a PRoW however there are two footpaths which surround the site (1-38-FP 21 and 1-38-FP 22). Construction area B is not crossed by a PRoW. The access to Construction area C is intersected by a footpath (1-38-FP 32a) with a further footpath (1-38-FP 32) located close to the access track. Construction area D is not crossed by a PRoW however a Bridleway (1-40-BW 1) runs along the eastern boundary of the compound/laydown area – indicative development envelope. Construction

area E is not crossed by a PRoW however a footpath (3-29-FP 15) runs along the northern boundary of the construction compound/laydown area – indicative development envelope. The discharge pipe indicative corridor is crossed by a footpath (3-29-FP 31). Figure 13.1 shows the location of these public rights of way.

- 484) No restricted byways and byway open to all traffic (BOAT) would be intersected by the Proposed Bowland Section.
- 485) There are no National Cycle Network routes that would be intersected by the Proposed Bowland Section, however routes within a 5 km radius that could potentially be affected by haulage routes include NCN 90 which is the North Lancashire Loop⁵² that follows a route east of the assessment area, approximately 1.2 km east of Construction Area A at its nearest point and NCN Route 69 which connects Morecombe with Grimsby.
- 486) An area of open access land is intersected by Construction Area B and adjacent to Construction Area D. While additional areas of open access land are present around the assessment area, therefore this receptor is scoped in.

13.4.2 Recreational

- 487) There are several informal recreational facilities located within the assessment area with the Proposed Bowland Section located within Forest of Bowland AONB.
- 488) There are many informal activities identified within the assessment area including walks, festivals, stargazing, arts, crafts, cycling, fishing, bird watching, photography and several more. There are several campsites (including Marl Barn campsite, Hartleys Farm and Bowland Fell Park) as well as caravan parks and cabins.
- 489) A number of lodges, hotels, B&Bs and local pubs have been identified within the assessment area. Shooting on the Bowland Fells is important for the local economy, with shooting parties staying at local B&Bs and hotels and using local facilities. As shooting centres on commercial enterprises these are considered further in the Communities and Health chapter.
- 490) The area has three main recreational rivers – The Wyre, Ribble and Lune with their associated tributaries - all attracting anglers. The Ribble Rivers Trust has volunteers who regularly check water samples for invertebrates which indicate how healthy the rivers and streams are.
- 491) High Bentham is located 5 km north east, Lancaster is located 15 km west and Clitheroe is located 10 km south east of the Proposed Bowland Section. There are many formal recreational activities identified within Clitheroe where locals could travel to including leisure centres, playing fields, sports clubs and grounds and swimming pools. Lancaster also has many formal recreational activities including sports centres, swimming pools and leisure centres. Lancaster Castle which is a popular tourist location as well Morecombe Beach and Bay located just past Lancaster.
- 492) A further detailed search will be required due to the number of recreation activities identified within the assessment area, therefore recreation has been scoped in.

13.5 Potential Effects

- 493) The process of scoping has highlighted the potential for likely effects to occur during the construction phase of the Proposed Bowland Section on the following resources and their respective user groups.
- **Public Access** – Effects on pedestrians, equestrians and cyclists using definitive Public Rights of Way (footpaths, bridleways), cycle routes and areas of open access land or common land
 - **Recreation** – There are several local informal recreational activities (e.g. angling, water sports, camping, wildlife watching, photography etc.) but there are no local formal recreational facilities within the indicative development envelope. There is some limited potential for regional effects in local towns where for example there are sports playing fields and leisure centres.
- 494) It is noted that journeys made using Public Rights of Way or cycle routes comprise either utility or recreational journeys. Utility journeys are those made for necessity, for instance commuting to work or to access public

⁵² National Cycle Network and Open Road Open Skies[Accessed August 2019] <https://www.openroadopenskies.co.uk/self-guided-cycling-holidays/route-90-north-lancashire-loop>

transport, shops or essential services such as schools or doctors. Recreational journeys are those made for pleasure and / or to access recreational facilities or activities.

495) In identifying potential effects, it has been assumed that most utility journeys use footways or cycleways on or adjacent to the highway network and, in some circumstances, PRoWs may be used. Most PRoWs are principally used for recreational journeys.

496) A preliminary review of potential construction effects identified the following.

- Construction of the proposed aqueduct routes will require temporary working areas including site compound and laydown areas. Construction access routes have the potential to temporarily adversely effect users of existing PRoWs, roads and access land/common land
- As identified above there are several recreational facilities in the assessment area. Construction could cause delays and severance on the local road network. There is potential for construction to cause disruption to recreational facilities, it has been scoped in the EIA.

497) Temporary closures and diversions may be required where a PRoW crosses the indicative development envelope.

498) A preliminary review of potential operational effects identified limited scope for other impacts due to the following.

- No permanent PRoW closures are likely to be required as part of the operation of the Proposed Bowland Section; therefore there should be no permanent access restrictions or effects on recreational interests
- Maintenance of new infrastructure will generally occur on an infrequent basis, with works being of small scale and for short durations therefore operational effects are scoped out.

13.6 Summary Scope for the EIA

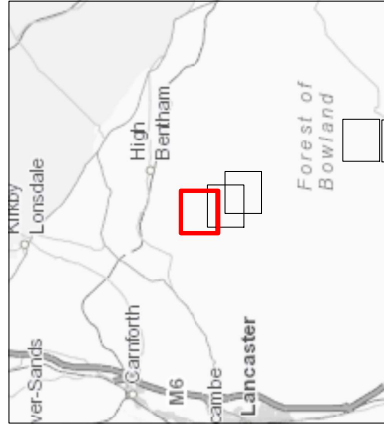
499) Table 13 3 below shows which matters are scoped in for this chapter.

Table 13 3: Scoping outcomes

Receptor group	Matter / potential effects	Location within assessment area	Comments
Public Access (Construction)	PRoWs (including footpaths, bridleways, restricted byway, byway open to all traffic) Access Land and National Cycle Network.	Proposed Bowland Section	Scoped in. A small number of footpaths, bridleways and open access land could be affected.
Recreation Facilities (Construction)	Formal and informal activities.	Proposed Bowland Section	Scoped in. Local and regional formal and informal recreational facilities are affected.
Public Access (Operational)	PRoWs (including footpaths, bridleways, restricted byway, byway open to all traffic) and National Cycle Network	Proposed Bowland Section	Scoped out
Recreation Facilities (Operational)	Formal and informal activities	Proposed Bowland Section	Scoped out

FIGURE 13.1

- Legend**
-  250m Assessment Area
 -  Proposed Construction Compound / Laydown Area - Indicative Development Envelope
 -  Area
 -  Proposed Indicative Construction Compound / Laydown Area
 -  CRoW Act 2000 - Access Land
- Constraints**
-  Footpath
 -  Bridleway
 -  Byway
 -  Restricted Byway
 -  Byway open to all traffic (BOAT)
 -  Regional Cycle Network
 -  CRoW Act 2000 - Access Land

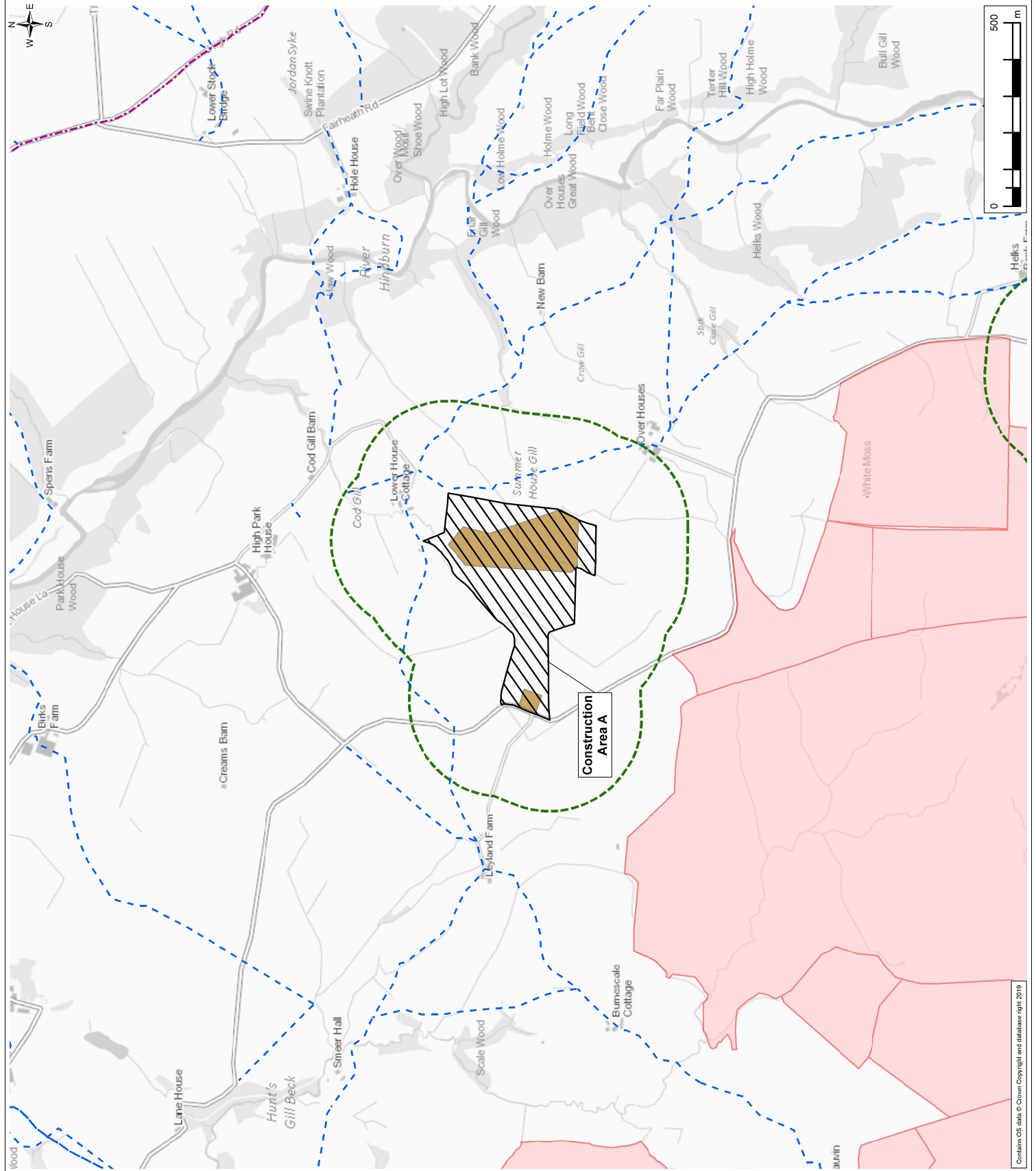


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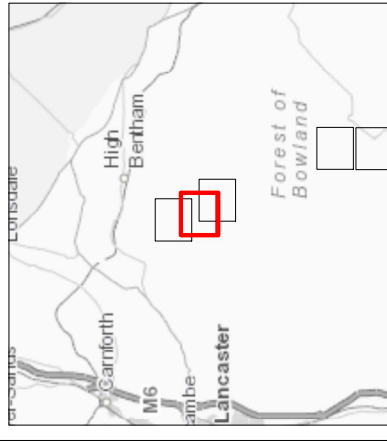
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Project	HAMSWATER AQUEDUCT RESILIENCE PROGRAMME			
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Drawing Status	FINAL			
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FIGURE 13.1

- Legend**
- 250m Assessment Area
 - Proposed Construction Compound / Laydown Area - Indicative Development Envelope
 - Proposed Construction Access - Indicative Area
 - Proposed Indicative Construction Compound / Laydown Area
 - CRoW Act 2000 - Access Land
- Constraints**
- Footpath
 - Bridleway
 - Byway
 - Restricted Byway
 - Byway open to all traffic (BOAT)
 - CRoW Act 2000 - Access Land



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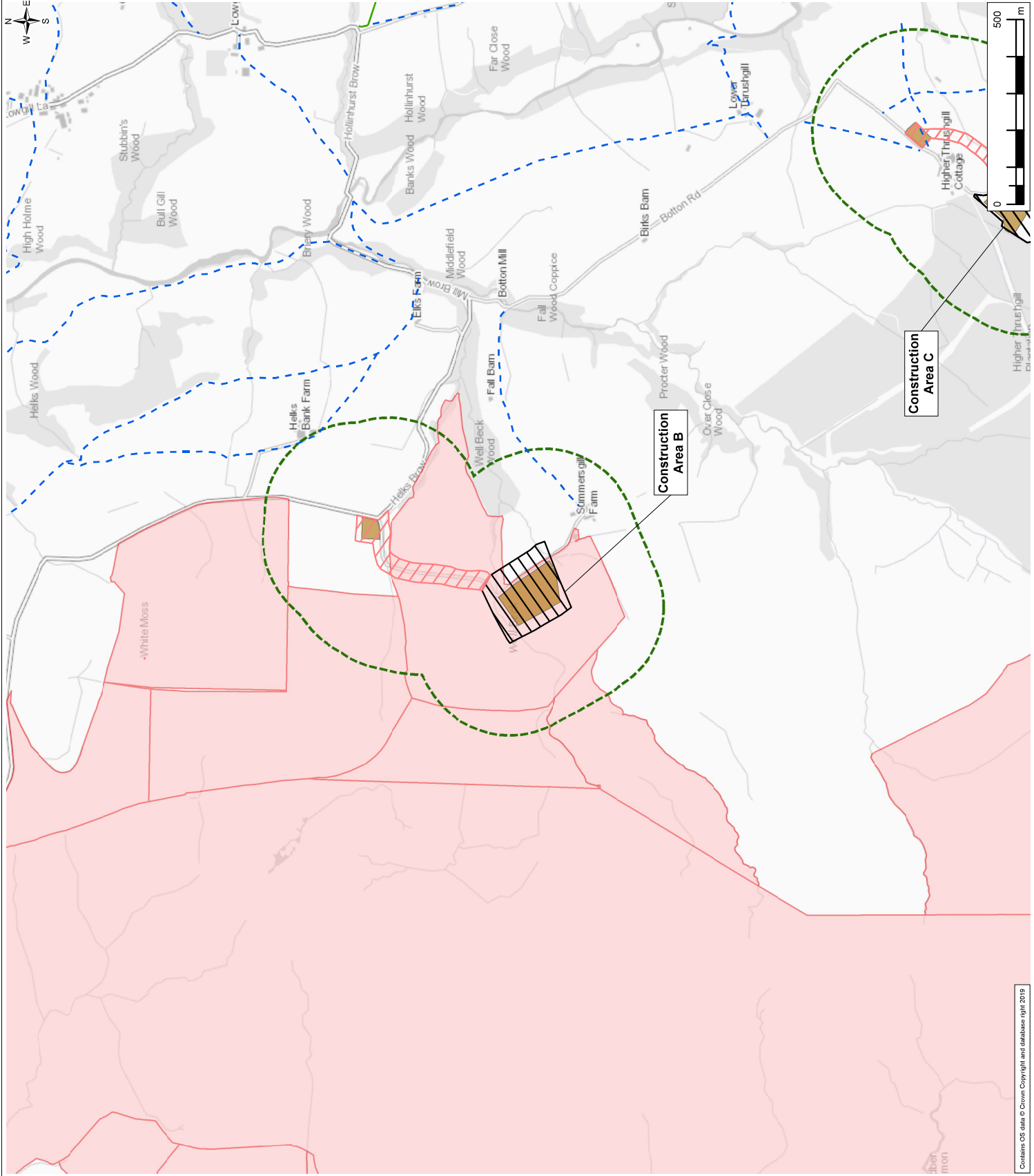
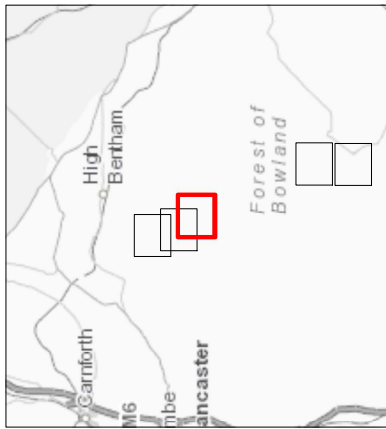


FIGURE 13.1

- Legend**
- 250m Assessment Area
 - Proposed Construction Compound / Laydown Area - Indicative Development Envelope
 - Proposed Construction Access - Indicative
 - Proposed Indicative Construction Compound / Laydown Area
 - CRoW Act 2000 - Access Land
- Constraints**
- Footpath
 - Bridleway
 - Byway
 - Restricted Byway
 - Byway open to all traffic (BOAT)
 - CRoW Act 2000 - Access Land



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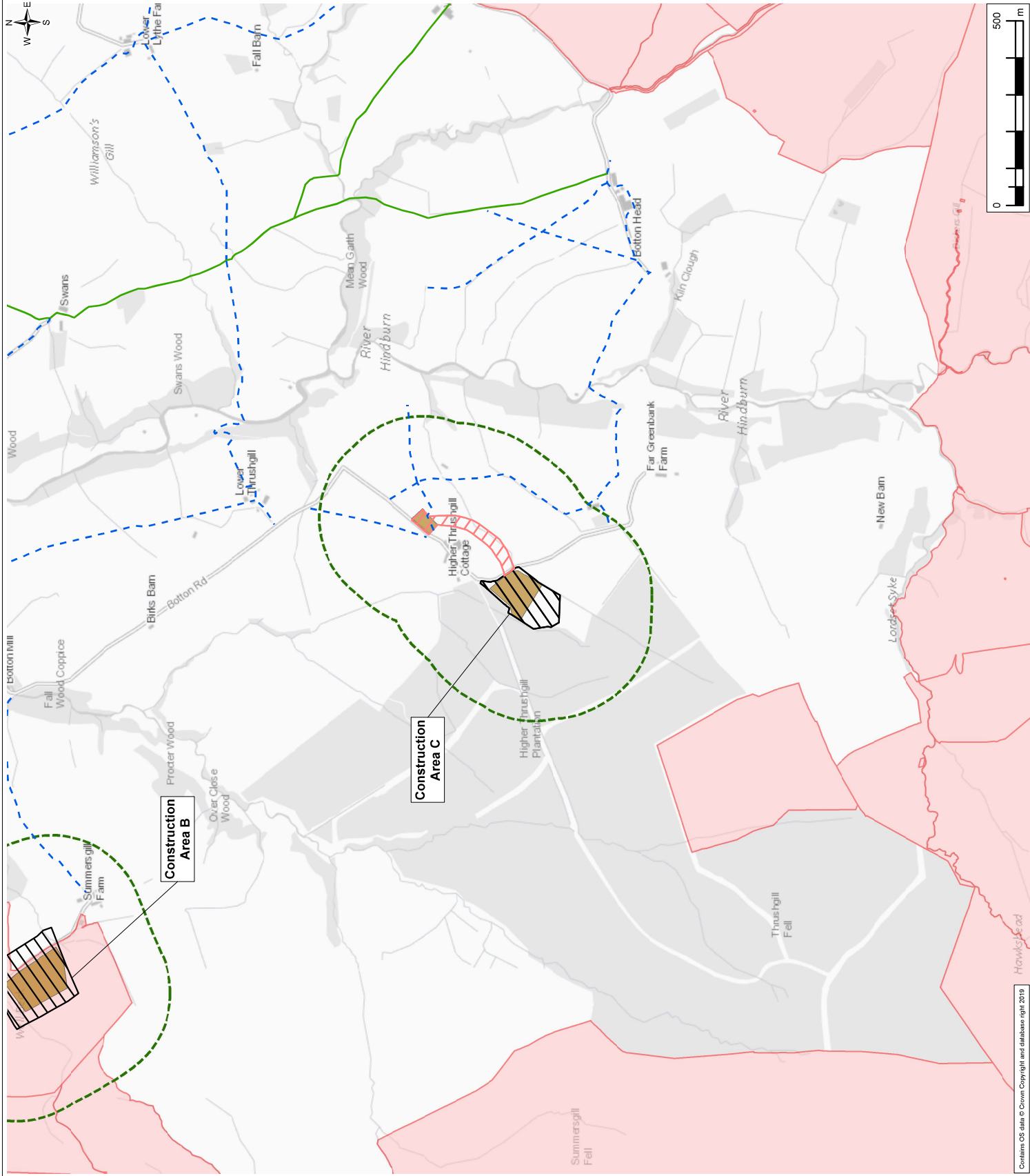
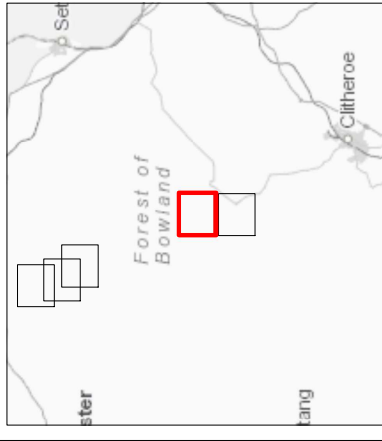


FIGURE 13.1

- Legend**
- 250m Assessment Area
 - Proposed Construction Compound / Laydown Area - Indicative Development Envelope
 - Proposed Indicative Construction Compound / Laydown Area
 - CRoW Act 2000 - Access Land
- Constraints**
- Footpath
 - Bridleway
 - Byway
 - Restricted Byway
 - Byway open to all traffic (BOAT)
 - CRoW Act 2000 - Access Land



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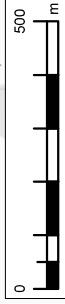
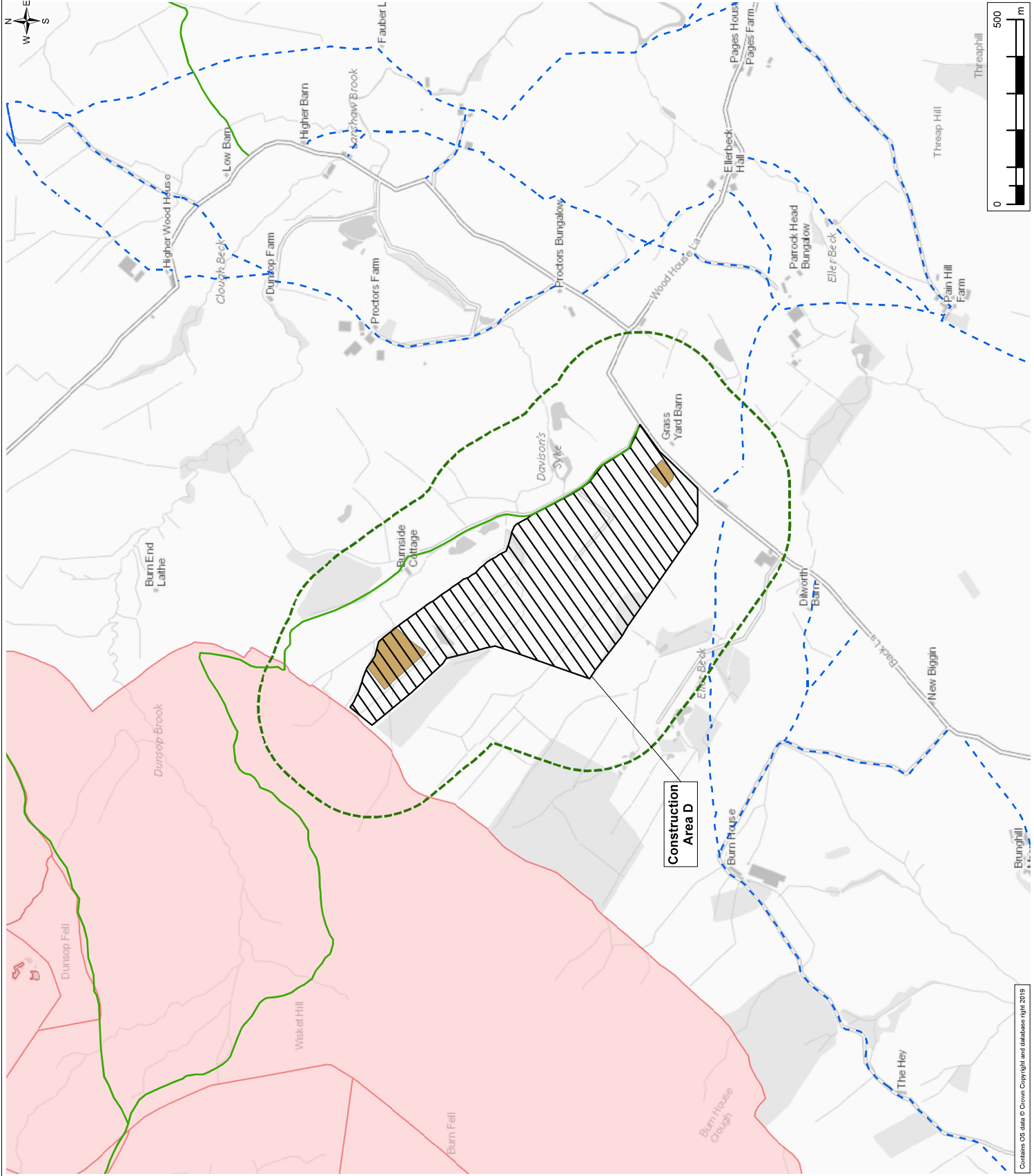
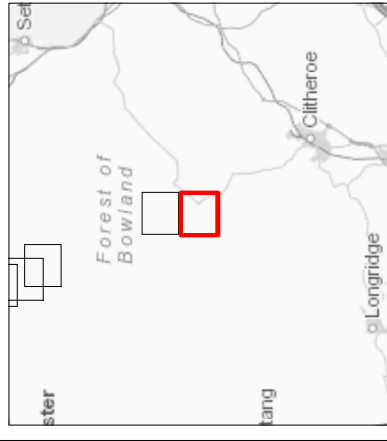


FIGURE 13.1

- Legend**
- 250m Assessment Area
 - Proposed Construction Compound / Laydown Area - Indicative Development Envelope
 - Proposed Indicative Construction Compound / Laydown Area
 - Proposed Discharge Pipe - Indicative Corridor
 - CRoW Act 2000 - Access Land
- Constraints**
- Footpath
 - Bridleway
 - Byway
 - Restricted Byway
 - Byway open to all traffic (BOAT)
 - CRoW Act 2000 - Access Land
 - Open Greenspace



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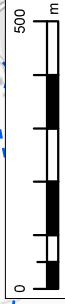
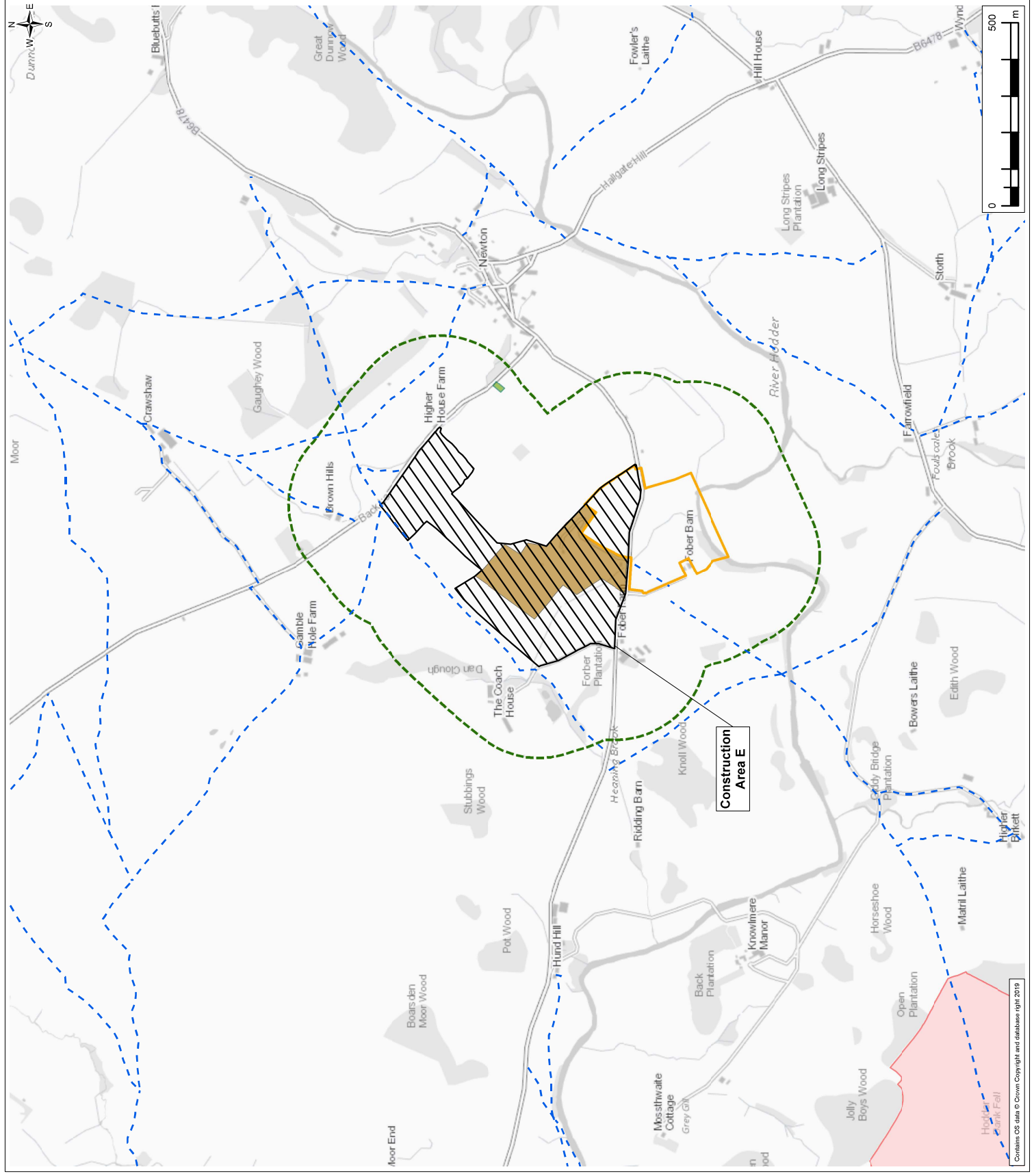


**HAMESWATER AQUEDUCT
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**PUBLIC ACCESS AND RECREATION
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 SHEET 5 OF 5**

Client	FINAL		
Project	HAMESWATER AQUEDUCT RESILIENCE PROGRAMME		
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14. Communities and Health

14.1 Overview

500) This chapter provides a high-level review of the potential for the Proposed Bowland Section to give rise to significant effects on communities, and the health and well-being of people who live and work in those communities. The scope of the review encompasses adverse and positive effects on social and economic (*socio-economic*) factors associated with the construction and operation phases. In this context, 'effects' refer to the potential social and economic consequences of the Proposed Bowland Section on local people, businesses and community resources. These effects are linked to the way in which people live, work, play, relate to one another, and organise to meet their needs.

501) The scope of the socio-economic topics considered in this chapter comprise:

- Employment
- Economy
- Tourism
- Effects on communities
- Agriculture
- Health.

502) The consideration of some of these disciplines will require contributions from other EIA topics, particularly those which may give rise to potential significant effects on communities – for example, air quality, noise and vibration, landscape and visual, and traffic and transport. The combination of these effects contribute to a broader picture of how local people, businesses and community resources may respond to the Proposed Bowland Section.

503) In this chapter, elements of the socio-economic baseline are summarised, and an initial view of the potentially significant socio-economic effects is provided. The proposed scope of the socio-economic assessment for the EIA and the technical methodology are described. In some instances, socio-economic effects may be scoped out of the EIA due to very low population densities or the absence of community resources. While it is concluded that a formal socio-economic assessment will not be necessary at these locations, it should be stressed that United Utilities will nevertheless consult local people during the EIA process and prior to submission of the planning applications to identify potential community concerns and develop practicable solutions.

504) The EIA Regulations also require consideration of the human health effects of a proposed development. This chapter provides a provisional methodology examining potential health effects, noting that other chapters in this Scoping Report also deal with human health matters such as air quality and noise.

14.2 Proposed Communities Methodology

505) Most of the data required to develop a socio-economic baseline are publicly available. A site visit with supplementary walk-over of specific locations along the route will take place before the detailed assessment is undertaken. This site visit will be used to verify information collated by the desktop study. Points of interest include the location of the route, construction compounds, local communities and sensitive community resources, as well as the location and nature of tourism attractions and tourist accommodation near the Proposed Bowland Section.

506) The assessment will be undertaken using available information, professional judgement and by way of reference to established thresholds and criteria set out in related assessment guidance and policy.

507) The socio-economic assessment area will be defined by local and regional communities:

- A local community will be defined by a 500 m boundary around the relevant elements of the Proposed Bowland Section, expanded or reduced as appropriate depending on the nature and significance of potential effects, and the relationship to centres of population

- The regional community will be defined by the relevant local authority boundaries and by smaller population definitions such as wards, where appropriate. Where appropriate, changes with the potential to affect a wider region will be considered at a county or metropolitan level.
- 508) The baseline for assessment will be established by drawing on existing published statistics and data held within the public domain, for aspects including: population and demographic characteristics; key social and economic characteristics; land uses; and infrastructure.
- 509) Key receptor types to be identified for consideration in the assessment comprise: social infrastructure (e.g. hospitals, GP surgeries, aged care facilities, places of worship, emergency services, schools, post offices, open space and recreation areas); residential and commercial properties; agricultural land / crops; and public roads.
- 510) Receptor value will be determined through consideration of its sensitivity towards change, using the following broad assumptions and criteria:
- The sensitivity of agricultural land will be assessed based on the quality of agricultural land, as defined by the Agricultural Land Classification (ALC) grading profile (no formal ALC surveys are proposed)
 - The sensitivity of agricultural businesses and other enterprises dependent on the land, such as country sports, will be considered through engagement with individually affected landowners and tenant farmers. This will be delivered through a questionnaire circulated among directly affected (i.e. construction land take) landowners and tenant farmers
 - Similarly, the sensitivity of non-agricultural land uses will be established through consultation with local authorities and affected landowners
 - Residential properties, and commercial premises providing local employment, are considered to be highly sensitive receptors
 - Residential and commercial land (i.e. within property boundaries but avoiding buildings) are considered to be of medium sensitivity
 - The sensitivity of local community facilities and tourism infrastructure (including accommodation such as hotels and bed and breakfasts) will be based upon the type and scale of the asset or attraction.
- 511) Baseline data will be reviewed as part of the assessment to establish the following relationships:
- Relevant socio-economic profiles, including the demographic, skills and employment characteristics of local and regional assessment areas
 - The current use of land within the assessment area (e.g. agriculture, open space and recreation, residential and commercial)
 - The distance from the Proposed Bowland Section to sensitive properties, vulnerable groups and community assets within the defined assessment area (e.g. houses, hospitals, aged care facilities, emergency services, education facilities, open space and recreation areas etc.)
 - The distance from the Proposed Bowland Section to the main centres and villages, and the likelihood of severance and social cohesion concerns arising.
- 512) GIS techniques will be employed in the assessment to digitally map and record information, drawing on data compiled for other related assessments such as public access and recreation.
- 513) Published guidelines and criteria contained in the following documents will be referenced to assist in the evaluation of effects on the socio-economic environment:
- Standard economic approaches, including the approach suggested by the 'Additionality Guide' with regards to indirect and induced employment effects
 - *The Good Practice Guide on Planning for Tourism* by the Department for Communities and Local Government, May 2006
 - *The Design Manual for Roads and Bridges* (Volume 11), 1993 - 2014 (DMRB).

14.3 Proposed Communities Assessment Criteria

514) A standard matrix approach will be adopted to determine the significance of effect, which will be determined by correlating the sensitivity (value) of particular interests with the magnitude of impact predicted to occur as a result of construction and operation of the Proposed Bowland Section, as shown below.

Table 14.1: Sensitivity and magnitude matrix for determining significance

		Magnitude			
		Negligible	Low	Medium	High
Sensitivity	Low	Negligible	Negligible / slight	Slight / moderate	Moderate
	Medium	Negligible / slight	Slight	Moderate	Moderate / major
	High	Slight	Slight / moderate	Moderate / major	Major

515) Specific significance criteria will be adopted in the assessment to determine the effects on agricultural land; these have been developed around the potential temporary (construction phase) loss of ALC graded land and are set out below.

Table 14.2: Significance of effect on agricultural land quality⁵³

Effect	Criteria
Major	Loss of 20 hectares or more of the best and most versatile agricultural land – that is land classified as grades 1, 2 or 3a under the MAFF (now DEFRA) originated ALC system. This follows the approach of Annex B15 of PPG7 as amended March 2001, which stipulated that MAFF (DEFRA) had a right to be consulted and hence object to schemes where a significant amount of such land was required for development. This has not been retained in the current guidance (NPPF) but nonetheless represents a measure of land loss that has been used in planning issues for 20 years or more.
Moderate	Loss of 10 to 19 hectares of best and most versatile agricultural land - grades 1, 2 or 3a – or 50 hectares or more of lower quality agricultural land - grades 3b, 4 and 5 under the MAFF (DEFRA) ALC system. This represents the mid-range between the upper and lower thresholds.
Minor	Loss of 5 to 9 hectares of best and most versatile agricultural land - grades 1, 2 or 3a - or 10 to 49 hectares of lower quality agricultural land - grades 3b, 4 and 5 under the MAFF (DEFRA) ALC system. A threshold of ten acres (approximately four hectares) or more follows the approach of paragraph 6 of the <i>Department of the Environment Circular 71/71 (Welsh Office Circular 152/71) 'Development of Agricultural Land'</i> .
Negligible	Loss of less than four hectares of best and most versatile agricultural land - grades 1, 2 or 3a - or less than ten hectares of lower quality agricultural land - grades 3b, 4 and 5 under the MAFF (DEFRA) ALC system. This is in line with the <i>Department of the Environment Circular</i> quoted above.

⁵³ Based upon guidance from: Department for Communities and Local Government, National Planning Policy Framework, Chapter 11 "Conserving and enhancing the natural environment", March 2012; and Department of the Environment, Transport and the Regions, Policy Planning Guidance 7 – The Countryside – Environmental Quality and Economic Social Development, February 1997, as amended March 2001.

516) Effects on private property (residential, commercial and community) will be determined using specific criteria set out below, which have been developed with regard to land take and any requirements for relocation or demolition.

Table 14.3: Indicative sensitivity Criteria

Sensitivity	Description
High	<ul style="list-style-type: none"> Residential property Commercial buildings / employment premises Buildings used by the community e.g. schools, community halls Land that attracts users internationally or nationally e.g. national parks Places of worship and cemeteries.
Medium	<ul style="list-style-type: none"> Residential or commercial land, but not buildings Land used by the community on a regional scale, e.g. country parks, forests and other land managed in such a way as to attract visitors from a regional catchment Local roads linking communities where alternative routes do not exist Locally-used community land e.g. local parks and playing fields where there are few if any practicable alternatives.
Low	<ul style="list-style-type: none"> Derelict or unoccupied buildings.

Table 14.4: Indicative Impact magnitude criteria

Magnitude	Description
High	<ul style="list-style-type: none"> Demolition of buildings, large loss of land and / or complete severance of access to community facilities or resources due to land take causing complete re-routing of access. Large, direct change to the economic profile of the community Large, direct change to the availability of tourist accommodation.
Medium	<ul style="list-style-type: none"> Medium loss of land and / or major severance of access to community facilities or resources due to land take causing large diversions Medium, direct or indirect change to the economic profile of the community Medium, direct change to the availability of tourist accommodation.
Low	<ul style="list-style-type: none"> Small land loss and / or partial severance of access to community facilities or resources due to land take causing small diversions Small, direct or indirect change to the economic profile of the community Small, direct change to the availability of tourist accommodation.
Negligible	<ul style="list-style-type: none"> Very slight change from the baseline condition. Change hardly discernible, approximating to a 'no change' in conditions.

517) During construction, vehicle movements could give rise to adverse effects on local community receptors, either actual or perceived. For example, potential effects on safety, amenity, perception of risks for pedestrians, and severance will be considered. The assessment of impact on community facilities or resources (over and above that considered above) will focus on temporary traffic related severance, and will be undertaken using adapted criteria based on that presented in DMRB Volume 11 which suggests 8,000 vehicles per day (Average Annual Daily Traffic (AADT)) as the minimum flows for which severance impacts may occur. Consideration will also be given to the potential for road closures and diversions to affect access to community facilities and resources, where appropriate. This assessment will be undertaken in close collaboration with the Public Access and Recreation assessment, ensuring that all relevant issues are covered without duplicating the reporting of effects.

518) Traffic data will also assist the evaluation of impacts associated with access and severance to tourist sites from traffic related disruption. Severance effects during operations are likely to be negligible.

- 519) Employment effects will be assessed through identifying the capacity of current public services and facilities and the needs that will result from the scale of the workforce, as well as current accommodation capacity in the area and the needs that will result from the scale of the workforce. Where employment is a consideration in the assessment, employment levels will be determined through the Proposed Bowland Section requirements, and the application of guidance in the Additionality Guide, that will allow for the determination of the construction employment, and the proportion of jobs that are likely to be sourced locally.
- 520) A quantitative assessment will be undertaken to identify effects on the local and regional economy, based on estimates of the proportion of the total spend on the Proposed Bowland Section that will be captured within the assessment area, and investigation into the potential for additional effects through the application of local spend multipliers, using the Additionality Guide and other data sources where appropriate. This will allow for an estimate of the overall economic benefit to the local area.

14.4 Proposed Health Methodology

14.4.1 Introduction

- 521) This part of the Communities and Health chapter addresses human health, which encompasses the environmental and social topic areas of health assessment, community profiling, stakeholder engagement and environmental assessment. At this early stage in the development of the Proposed Bowland Section, the focus of the scoping exercise has been to identify high level health determinants which will be considered during the next stage of the EIA process, but not necessarily taken through to full impact assessment. As such, the methodology is high level and has generally not been prepared to reflect section-specific conditions.
- 522) This approach is required because it is currently not practicable to either identify or quantify all potential health determinants that the Proposed Bowland Section could give rise to. Furthermore, it is not presently possible to understand potential health interactions between the Proposed Bowland Section and the overall Proposed Programme of Works. Further work is required and it is anticipated that Health and Well-being Boards will be consulted to establish whether human health as a topic may require further assessment over and above those health-related topics considered in other chapters of the ES. Additionally, consultations with the Health and Well-being Boards will address whether there are potential interactions between local Strategic Needs Assessments and the Proposed Programme of Works which require consideration in the EIA.

14.4.2 Scope

- 523) When considering the health effects of major development projects, health is viewed in a broad sense, encompassing both physical and mental wellbeing. Health effects are influenced by a wide range of environmental, social and economic factors that can impact both positively and negatively on health and wellbeing (known as health determinants). This broader understanding of health is defined by the World Health Organization (WHO) which states that *'health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity'*.
- 524) Direct effects on health can occur from sources of pollution such as noise (for example, sleep disturbance), and traffic (for example, driver stress in dealing with construction vehicle movements). Indirect effects on health can also arise. For example, disruption to communities from increased traffic can result in reduced community interaction (direct effect), which can have an adverse effect on well-being (indirect effect). Similarly, a change in levels of happiness or change in levels of stress (indirect effect) can result from, perceived or real, direct and prolonged environmental effects.
- 525) It should be recognised that at this stage, however, the Proposed Bowland Section will make a major positive contribution to public health in its own right, helping secure the supply of a secure, wholesome drinking water supply to over two million people. While not wishing to pre-judge the outcome of any future health-related studies associated with each proposed replacement section, any potential effects should be viewed against the backdrop of a regionally-significant investment in public health infrastructure, and that potential adverse effects are likely to be short-term and could be partly or fully mitigated should they occur.

14.4.3 Baseline

526) Baseline conditions will be compiled through a combination of desk study (for example, Public Health England and Joint Strategic Needs Assessment publications; local authority policies), consultation with statutory health providers and local communities, and ground-truthing of community facilities and sections of the population that could be more adversely affected (for example, schools, care homes, hospices and special educational needs centres).

14.5 Proposed Health Assessment Criteria

527) Health assessment is a multi-disciplinary activity that crosses the boundaries of health, public health, social sciences and environmental sciences. The potential health effects of the Proposed Bowland Section will be assessed alongside environmental and community effects through a holistic approach.

528) Health effects will be assessed at the population level, by considering the environmental and socio-economic impacts of the Proposed Bowland Section, and evaluation of the potential for these impacts to affect health. In addition, the assessment will highlight potential impacts on specific groups of people and local resources, such as users of community facilities that may be impacted by the Proposed Bowland Section, or vulnerable groups within the community. Where appropriate, clear links will be established between the social and economic assessment described elsewhere in this chapter.

529) The spatial extent of the assessment area will be tailored to reflect not only potential effects on communities located within or adjacent to the indicative development envelopes, but also those living more remotely from these locations, for example on haulage routes.

530) The human health aspects associated with a potential major accident arising from the Proposed Bowland Section are considered in Section 15 (Major Accidents and Disasters).

531) Steps will be taken to avoid 'double counting' adverse effects which may be reported in other chapters of the ES, for example, air quality, noise and community severance. However, it is anticipated that these and potentially other topics from the ES will contribute to the health assessment, according to the level of significance they may give rise to in their respective chapters (see 'Likely Significant Effects' below).

532) The objectives of the assessment will be to:

- Describe how the Proposed Bowland Section has the potential to impact (directly and indirectly) on the factors that influence health and wellbeing (termed 'health determinants')
- Identify the likely extent and intensity of exposure to impacts on health determinants
- Qualitatively or quantitatively assess the potential health effects arising from these impacts
- Identify those sections of the population likely to be most affected, either positively or negatively, by impacts on health determinants
- Identify measures to mitigate significant negative effects on community health and wellbeing.

14.5.1 Likely Significant Effects

533) Effects will be considered in relation to the baseline data that will be compiled during the initial stages of the EIA. The health assessment will additionally draw on the potential for significant effects identified within other chapters of the ES (for example, noise, air quality and severance) and will consider the likely overall extent of effects on health. However, where effects are concluded not to be significant at a topic level within the ES, these will generally not be taken into account when in the health assessment.

14.5.2 Consultation and engagement

534) Stakeholder feedback will be invited to further understand the specific characteristics, concerns and perceptions of local communities that may not be picked up through a review of publicly available data. This will enable the susceptibility of local communities to health and wellbeing effects to be more fully understood.

14.6 Existing Conditions

- 535) This section summarises the socio-economic baseline for the assessment area and identifies potentially significant effects on the local community. It also sets out the methodology that will be used to quantify, assess and mitigate these effects in the EIA.
- 536) The process of scoping commenced with the definition of a preliminary assessment area within which socio-economic receptors could be identified to assist in the identification of potential effects.

14.6.1 Assessment area

- 537) The assessment areas for potential socio-economic effects in the vicinity of the Proposed Bowland Section is defined by local and regional communities:
- The local community assessment area (LCAA) is defined by a 500 m boundary around all elements of the Proposed Bowland Section excluding the indicative corridor for the traffic routes
 - The regional community assessment area (RCAA) is defined as the combined Lancaster City Council and Ribble Valley Borough Council boundaries, incorporating indicative corridors for traffic routes.
- 538) The LCAA has been modified slightly to bring in all properties in Newton-in-Bowland to the south east of the Proposed Bowland Section. For the RCAA, given the scale of the work involved in the Proposed Bowland Section and the relatively large area covered by the combined Lancaster City Council and Ribble Valley Borough Council boundaries, there is no need to consider effects at a county level. The assessment area may be refined further through the EIA process, based upon desk-study data and field survey verification and through design development.

14.6.2 Information Sources

- 539) The following desk-based sources have been used to inform this scoping chapter:
- Office for National Statistics, including 'nomis'
 - Lancashire County Council publications
 - Lancaster City Council publications
 - Ribble Valley Borough Council publications
 - Information related to environmental constraints entered onto the project GIS database.

14.6.3 Socio-economic characteristics

- 540) As part of scoping, an initial desk study was undertaken to better understand the key socio-economic characteristics of the area. This desk study enabled an understanding of the potential receptors close to the Proposed Bowland Section, and identified where potential significant effects could arise. The LCAA is located within Lancaster City Council and Ribble Valley Borough Council and goes through Wray-with-Botton, Slaidburn, and Newton-in-Bowland Parish Councils, with a small section in Roeburndale. The LCAA contains a small number of residential and agricultural properties with a very low population density of approximately 0.2 people / ha. The main residential grouping is focused around Newton-in-Bowland, which also contains a church, village hall, car park and pub. Businesses in the LCAA are primarily agricultural- or tourism-related and are widely dispersed.
- 541) Land in the LCAA is dominated by agricultural uses. All land in the LCAA is Agricultural Land Classification Grade 4 (Poor) or 5 (Very Poor). United Utilities will work with potentially affected local landowners, farmers and tenant farmers to understand how farming operations could be affected, and how best to mitigate any adverse effects through engagement and agreement with the landowner (recognising that different landowners and farmers may have different business needs and priorities).
- 542) The indicative development envelope for the Proposed Bowland Section falls within the Forest of Bowland AONB. The area in and around the Forest of Bowland AONB is a popular tourist destination.
- 543) The City of Lancaster has a population of approximately 145,000 people, with Ribble Valley having a population of approximately 60,000. The primary population centres are Lancaster and Clitheroe respectively. Elsewhere in the RCAA the population density is generally low. Lancaster has a mixed

economy, with strengths in advanced manufacturing (especially aerospace, automotive and energy), education and tourism. Similarly, Ribble Valley has a mixed economy with a strong foundation in tourism, agriculture, manufacturing and mineral extraction.

14.6.4 Key socio-economic receptors

544) Key socio-economic receptors include:

- Agricultural and other businesses in the LCAA that may be directly or indirectly affected by construction activities
- Businesses and residents in the LCAA and on subsequent transport routes that may be affected by increased traffic associated with construction
- Tourism assets in the LCAA and wider RCAA, including hotels, bed and breakfast accommodation, recreational areas and the Forest of Bowland AONB. It is noted that parts of the AONB are important for country sports pursuits.

14.7 Potential Effects

545) Effects are most likely to arise on residential or commercial properties within the LCAA or on tourism facilities or areas in the LCAA or wider RCAA. Direct effects could arise where land is required for construction activities and to a much lesser extent for operational facilities. Direct effects could also arise as result of disturbance to normal community activities as a result of construction. These could arise as a result of increased traffic during construction or as a result of increased noise from traffic and / or construction activities. Further work will be undertaken as part of the EIA to understand community assets in the LCAA.

546) Effects could arise on tourist facilities and areas within the LCAA and wider RCAA, including the Forest of Bowland AONB. There is potential to have effects on the tourism economy that focuses on the AONB. Consideration needs to be given to the potential socio-economic effects associated with construction works.

547) There is potential for effects on the normal functioning of farms. United Utilities will work with potentially affected local landowners, farmers and tenant farmers to understand how farming operations could be affected, and how best to mitigate any adverse effects.

548) Indirect effects could arise as a result of increased traffic resulting in severance of communities. Construction traffic would have to make use of local roads which could have effects on communities and tourism in the area.

549) Given the low number of business properties in the LCAA (excluding those associated with tourism), and the poor quality of the agricultural land present, the likelihood of significant socio-economic effects upon these receptors is considered to be low.

550) Therefore, potential socio-economics effects on commercial properties (excluding tourism assets) and agricultural land are scoped out of the Environmental Statement for the Proposed Bowland Section. Potential socio-economic effects on communities, farms, tourism and country sports assets are scoped into the EIA and will be considered further.

14.8 Summary Scope for the EIA

551) Further consideration of socio-economic effects is being scoped in to the Bowland EIA. The key receptors are identified below along with the reasons for scoping them in or out.

Table 14.5: Scoping outcomes

Receptor group	Matter / potential effects	Location within assessment area	Comments
Employment and economy	<p>Employment opportunities for local workforce</p> <p>Economic opportunities for local suppliers</p> <p>Disturbance to normal functioning affecting commercial performance</p>	LCAA & RCAA	<p>Scoped out:</p> <p>Opportunities for employment for the local workforce, or opportunities for involvement from the local supply chain in construction is expected to be limited in scale.</p> <p>Commercial property density is very low in the LCAA. Potential commercial effects (excluding tourism) are expected to be low and would be mitigated via other assessments.</p>
Tourism	<p>Use of tourist accommodation by construction workforce</p> <p>Disturbance to normal functioning of tourist attractions or impact on attractiveness of the area to tourists</p>	LCAA & RCAA	<p>Scoped in:</p> <p>The LCAA is within the Forest of Bowland AONB which is an important tourism area. Some local businesses in or adjacent to the LCAA are supported by tourism (hotels, B&Bs etc.). Further assessment required to understand potential effects on tourism receptors.</p>
Social infrastructure (e.g. hospitals, doctors' surgeries, aged care facilities, places of worship, emergency services, schools, post offices, open space and recreation areas)	<p>Disturbance to normal functioning affecting community cohesion</p>	LCAA	<p>Scoped in:</p> <p>Social infrastructure receptors are present in the LCAA and may be affected, especially by increases in traffic on local roads.</p>
Population and residential properties	<p>Disturbance to normal functioning affecting quality of life</p> <p>Community severance from increased traffic</p>	LCAA & RCAA	<p>Scoped in:</p> <p>Potential effects on community severance from increased traffic will be considered further and reported in the ES.</p> <p>Scoped out:</p> <p>Residential density is very low in the LCAA with very few properties present. Any potential effects (such as dust or noise disturbance) would be mitigated via other</p>

Receptor group	Matter / potential effects	Location within assessment area	Comments
			assessments and appropriately recorded in the ES.
Agricultural land / crops and farms	<p>Temporary or permanent loss of agricultural land</p> <p>Disturbance to normal functioning of farms and landholdings</p>	LCAA	<p>Scoped in:</p> <p>Construction will be undertaken in a manner that minimises, as far as practicable, the potential effects on the normal functioning of farms and landholdings. Potential effects will be assessed and reported in the ES.</p> <p>Scoped out:</p> <p>Agricultural land in the area is either Poor (Grade 4) or Very Poor (Grade 5) indicating that any land lost to the Proposed Bowland Section will have limited agricultural value, while recognising the importance of agriculture to the local economy.</p> <p>Construction effects will be temporary and all land not occupied by above ground operational facilities will be restored.</p>

15. Major Accidents and Disasters

15.1 Introduction

552) This chapter considers the potential consequences, and risk control/mitigation measures, associated with Major Accident Events (MAEs) arising during the construction and operation of the Proposed Bowland Section. There is no specific guidance on the assessment of the potential for major accident hazards associated with cross country aqueducts carrying treated water. As a precautionary approach, techniques developed for installations which fall within the Control of Major Accident Hazard Regulations 2015 (COMAH) will be applied for the EIA, should it be determined with each respective planning authority and the Health and Safety Executive (HSE) that this area of work is required for one or more of the proposed line sections.

553) It is important to note that the Proposed Bowland Section does not fall within the COMAH regulations, nor is it classified as a Major Accident Hazard Pipeline (MAHP).⁵⁴ It is anticipated that major accidents as a topic could be discounted from the EIA following receipt of scoping opinions. Since consultations are ongoing with the HSE in relation to Construction Design and Management matters, however, and a desk study of potentially hazardous installations and infrastructure has not been undertaken at this stage, a precautionary approach has been adopted. This enables a general methodology to be presented for the purposes of scoping, which will either be discounted or further refined at a later stage.

554) Given the outline nature of the methodology, the following is a generic description of the proposed approach.

15.2 Regulatory Guidance

555) A Major Accident is defined within COMAH as *'an occurrence such as a major emission, fire, or explosion resulting from uncontrolled developments in the course of the operation of any establishment to which these Regulations apply, and leading to serious danger to human health or the environment (whether immediate or delayed) inside or outside the establishment, and involving one or more dangerous substances'*.

556) The term 'Major Accident to the Environment' (MATTE) is used in the UK by the competent authorities (the HSE and Environment Agency) and industry to indicate when a major accident has been caused or could cause serious harm to the environment. Because of the HSE's knowledge of major accident hazards, the Government has appointed the HSE as the statutory consultee to planning authorities for certain developments. With respect to this Proposed of Works, the HSE is a consultee for scoping regarding the adverse effects that could result from a major accident, while for planning-related matters the HSE has delegated some of its decision-making functions to local planning authorities.

557) Regulatory guidance for COMAH is provided by HSE Guidance Note L111. Specific guidance on defining and assessing major accidents is provided by the HSE in the form of Safety Report Assessment Manuals (SRAMs) and these will be drawn upon in the ES should they be required.

15.3 Scope of Major Accident Events Assessment

558) The requirement for major accident events (MAE) to be specifically considered in EIA was introduced in the 2017 EIA Regulations. The Regulations require the assessment to identify expected significant effects arising from the vulnerability of the proposed development to major accidents or disasters that are relevant to that development. Similarly, under the EIA Regulations, the risk of the Proposed Bowland Section giving rise to a major accident event – either to the built environment or natural environment – should also be considered.

559) The design and operation of the aqueduct will comply with the Construction Design and Management (CDM) Regulations and other relevant legislation. The CDM Regulations require the management of potential hazards to reduce the likelihood of accidents and disaster risk, and their consequences, to an acceptable level. Further assessment of accidents or disaster risk within the EIA process should largely be unnecessary but the EIA can serve to clarify the mechanisms and design measures included to reduce these risks to an acceptable level.

⁵⁴ Major Accident Hazard Pipeline as prescribed in the Pipelines Safety Regulations (1996), as amended.

- 560) While each of the proposed sections of replacement aqueduct individually, and the current Haweswater Aqueduct as a whole, are not MAHP or COMAH facilities, COMAH guidance will be adopted, if and where appropriate, in developing the methodologies for hazard identification and MAE assessment.
- 561) The ES will identify potential MAEs and describe how the risk has been assessed and managed. Consideration of vulnerability to disasters, including natural disasters, will not be separately covered, as such disasters would simply represent additional initiating events of incidents captured in consideration of MAEs. In the context of the Proposed Bowland Section, hypothetical construction and operation phase MAEs could arise from:
- Risks to construction workers, particularly below-ground activities in the tunnel sections
 - Accidental release of a large volume of a construction-related material or fuel, such as bentonite slurry or diesel, into the surface water environment
 - Ingress of non-potable water into the treated water supply
 - The potential loss of containment and significant release of treated water from the operational aqueduct – flood risk
 - Possible collapse of the redundant asset and subsequent groundwater ingress and egress.

15.4 Methodology

- 562) The impact assessment methodology for MATTEs will focus on identifying source-pathway-receptor linkages and considering the likelihood of a breach of water from the aqueduct, potential volumes and the sensitivity of possible downstream land uses and properties. Aqueduct failure could therefore be considered for MATTE assessment. The initial risk assessment would be carried out on the most vulnerable receptors. If this demonstrates that there would be no significant effects, then it can be inferred that lesser vulnerable receptors would not suffer significant effects either.
- 563) Should the separate flood risk assessment comprehensively address the concerns associated with a breach or failure of the aqueduct, then this may obviate the need for a MATTE analysis. This approach would be agreed with the competent authorities post-scoping, once more design and operation details are available to support the decision making.
- 564) In addition to examining the potential effects of an aqueduct failure, the assessment will also examine the public health consequences surrounding a 'do nothing' or 'do minimum' scenario, rather than implementing the Proposed Bowland Section. This will consider, for example, the consequences of an increased risk of water quality breaches and supply interruptions brought about by not investing in new infrastructure.
- 565) The ES will describe the regulatory regime governing water quality standards, the design and operational controls surrounding the maintenance of a wholesome water supply, and the steps to be taken in the unlikely event of water quality being compromised during the operational phase.

15.5 Assessment Criteria

- 566) Given the unique nature of the type of effects potentially being considered under MAE, the general approach to assigning significance criteria to potential outcomes reported elsewhere in the scoping report will not be used for this topic. By definition, the consequence of a MAE would be highly significant. Instead, emphasis will be placed on demonstrating the steps that will be taken to achieve compliance with regulatory and good practice requirements to avoid major accident events occurring in the first instance.

16. Transport Planning

16.1 Overview

567) This chapter presents the outcome of the scoping exercise in relation to potential transport and traffic impacts on the local highway network associated with the Proposed Bowland Section. Roads on the local highway network are controlled by local highway authorities (LHAs), while the strategic road network (SRN) is controlled by Highways England. Detailed information regarding construction will not be available in advance of the scoping submission. Therefore possible locations have been identified where traffic data may need to be acquired to assess potential construction impacts on the road network.

16.2 Proposed Methodology Overview

568) The proposed methodology has been discussed with Lancashire County Council Highways and Highways England in connection with, respectively, the local and strategic highway networks. Technical scope and baseline data have also been discussed with these authorities.

569) The traffic and transport assessment will be undertaken with reference to good practice guidance outlined within 'Guidance for the Environmental Assessment of Road Traffic' (IEMA, 1993) which will be used as a basis to develop appropriate thresholds. The guidance also explains that there is a requirement to consider '*particular groups or locations which may be sensitive to changes in traffic conditions*' and these are listed below. (The guidance also notes that other groups / interests can be added as appropriate):

- People at home
- People in work places
- Sensitive groups including children, elderly and disabled
- Sensitive locations, e.g. hospitals, churches, schools, historical buildings
- People walking
- People cycling
- Open spaces, recreational sites, shopping areas
- Sites of ecological/nature conservation value
- Sites of tourist/visitor attraction.

570) An indicative assessment area has been identified based on consultations with the highway authorities and this is presented in Figure 16.1.

16.2.1 Baseline Information Sources

571) The assessment will be conducted using baseline traffic counts obtained on the road network and from assumptions generated from first principles regarding vehicle trip generation and distribution. Based on an initial estimation of vehicle movement routes, traffic counts will be undertaken at key points on the local highway network which will determine the number and duration of daily/peak periods vehicle movements. These data may be supplemented by additional data collection once further detail on movement times and routes has been established.

572) These data will be used to inform the consideration of particular groups identified below and locations which may be sensitive to changes in traffic conditions, as identified in Section 16.2. The following information is required:

- Traffic count surveys will be collated using either Automatic Traffic Count (ATC) surveys or through Manual Classified Counts (MCCs) which video record traffic movements in which the data will be manually classified into the following groups:
 - Pedal Cycles
 - Motorcycles
 - Cars and taxis

- Light Goods Vehicles
- Other Goods Vehicles type 1
- Other Goods Vehicles type 2
- Public Service Vehicles
- Due to the assessment period varying, based on the location and when the peak impact is, it is anticipated that appropriate growth factors will be applied to the baseline traffic to uplift the background network traffic levels. Appropriate factors from the National Transport Model (NTM), locally adjusted using the most recent version of TEMPRO software will be used to identify the appropriate growth and applied accordingly
- Specific sensitive locations / affected parties, based on the groups listed above in the IEMA guidance
- Information provided by Early Contractor Involvement (ECI) such as:
 - Construction working hours
 - Programme
 - Estimated numbers of HGVs during the construction phase / quantities of materials
 - Compound locations
 - Method of construction
 - Traffic management arrangements including strategic routing and diversionary routes.
- The potential origin/destinations of material supplies/disposal points, consideration of traffic which may be diverted off key corridors and any cumulative impacts of the increase of HGV and employment traffic based on a model which will identify potential hourly impacts
- It is anticipated that committed development information will be incorporated into a spreadsheet-based traffic model. Where information is available from the local highway authority and Highways England, street works which will have a significant effect on vehicle movements will also be incorporated into the same spreadsheet model
- Road Safety Review analysing road collisions and safety statistics for the most recent five-year period available will be obtained from STATS19 system. The catchment area would include, and be limited to, the length of the envisaged construction traffic route.

16.2.2 Assessment Methodology: Lancashire Local Highway Network

573) Based on discussions with Lancashire County Council Highways the primary interest with regard to assessment of potential impacts are the practicalities of access arrangements and demonstrating that the indicative routes are safe and workable. Reference was made by Lancashire County Council Highways to requirements from some specific previous planning applications which were considered to generate construction traffic impacts.

574) It has been agreed that a detailed review of localised potential impacts that would require assessment will be undertaken on a route-by-route basis as the site access and waste disposal routes are developed. Notwithstanding this, with regard to the physical practicalities of access arrangements and demonstrating that the indicative routes are safe and workable, based on a review of the Lancashire County Council consultation response and Proofs of Evidence for the previous applications preferred to by Lancashire County Council the following principles of assessment have been established:

- Consideration of passing places
- Swept path analysis, accounting for potential agricultural movements, and the needs of non-motorised users
- Consideration of emergency vehicle access
- Consideration of vertical gradient, particularly during winter months
- Consideration of visibility and lighting conditions particularly during Autumn / Winter

- Placement of traffic management
- Consideration of flooding and drainage conditions in comparison to the estimation of movements through the programme
- Traffic Count Surveys to be undertaken during good weather conditions, during a peak period for agriculture and leisure movements
- Collection of data for non-motorised users (i.e. using video surveys) along the local road network
- Consideration of construction movements and deliveries operating hours to avoid school sensitive hours if route passes a school
- Consideration of local events affecting the highway
- Consideration of implications of parking behaviour on routes
- Consideration of on-site vehicle storage areas to be provided to reduce off-site travel distances
- Consideration of using local drivers and route training
- Consideration of car sharing and / or minibus use which will be covered within the Employee Travel Plan.

575) In light of the above, an accompanying Transport Assessment, to be appended to the Environment Statement, would present the following information:

- A summary of the local highway network, cycle and pedestrian infrastructure, and public transport services in the vicinity of the site
- A summary of baseline information:
 - Any restrictions on working within the highway e.g. seasonal, weekend and overnight
 - Vehicle routing and traffic management arrangements
 - Emergency diversion routes
 - Width / height restrictions (including sensitive locations)
 - Abnormal load routes
 - Advanced signage requirements
 - Programmed / historic maintenance and improvements
 - Personal Injury Accident (PIA) data
- Identification of development trip generation
- Identification of committed developments
- Identification of programmed major street works
- A summary of baseline traffic data as collected by traffic surveys
- Traffic forecasts based on background traffic growth + construction traffic for a representative construction year
- A Road Network Traffic Assessment for the construction year.

576) It has been acknowledged during discussions with Lancashire County Council Highway Authorities that the operational transport impact of the scheme (i.e. following the construction period) is likely to be negligible, although it is acknowledged that there may also be impacts during the decommissioning phase of the existing Haweswater Aqueduct. Therefore, the assessment will focus on potential construction/decommissioning-phase impacts only.

577) The assessment will include a mitigation strategy, including a Construction Traffic Management Plan and Interim Construction Travel Plan. This will detail the origin/destinations of material supplies/disposal points, consider traffic which may be diverted off key corridors and potential cumulative impacts of the increase of

HGV and employment traffic through the use of a bespoke spreadsheet model which will define potential hourly impacts.

578) Practical solutions to mitigate partial or full closures on the highway network and reduce the impact of additional vehicle movements will be developed in the form of a traffic management strategy, which may include the following types of measure:

- Identification of appropriate times for deliveries and/or material movements to minimise disruption
- Where appropriate and feasible within the public adopted highway, temporary highway improvements may be considered at specific locations identified as part of swept path analysis and site visits;
- Identification of traffic management measures to address partial road closures
- Identification of appropriate diversionary routes (if required) to address full road closures
- Where feasible within the programme requirements, appropriate phasing of construction to avoid the effects of concurrent works on strategic routes
- Routing Plan to direct HGVs via the most appropriate and suitable routes
- Signing Strategy to provide advance warning from beyond the immediate locality in consultation with Lancashire County Council Highways.
- Employee Travel Plan to mitigate potential impacts of individual car trips.

16.2.3 Assessment Methodology: Strategic Network

579) Highways England have indicated that potential impacts associated with the Proposed Bowland Section would unlikely be associated with car-based staff movements, and instead the focus of assessment would be on heavy vehicle movements, particularly abnormal load movements during peak periods.

580) Based on discussions with Highways England there is the possible requirement for capacity assessments, in relation to junction modelling and merge/diverge slip roads. This would be dependent on hourly flows during identified peaks on the network. If required, these assessments will need to be conducted as well as cumulatively for the whole programme of works.

581) Further to this, direct access from the SRN would be discouraged however could be considered if there are no other appropriate options with detailed discussion and design work for approval. Also, it is noted that accesses would be reviewed in the context of Department for Transport Circular 02/2013 '*Strategic road network and the delivery of sustainable development*' which states that:

- '*Where appropriate, proposals for the creation of new junctions or direct means of access may be identified and developed at the Plan-making stage in circumstances where it can be established that such new infrastructure is essential for the delivery of strategic planned growth.*
- '*Where the strategic growth test cannot be met there will be no additional junctions with, or direct means of access to, motorways and other routes of near motorway standard¹⁰ other than for the provision of signed roadside facilities for road users (see Annex B), maintenance compounds and, exceptionally, major transport interchanges.*'

582) Additionally, discussions with Highways England also highlighted that while 'standard' HGVs could be accommodated on the network, a detailed review of physical constraints needs to consider abnormal loads as part of the assessment.

16.3 Proposed Assessment Criteria

583) The significance of effect can be determined by way of additional vehicle movements as a proportion of the baseline traffic flow, using first principles methods to assess additional trip generation and distribution. Criteria to be adopted in this assessment will be guided by that outlined within the IEMA document '*Guidelines for the Environmental Assessment of Road Traffic*'. These guidelines suggest the following general 'rules of thumb' when considering the initial appraisal of potential environmental impacts and the identification of where more detailed analysis of specific environmental effects might be required:

- Rule 1: Include highway links where traffic flows will increase by more than 30% (or the number of heavy goods vehicles will increase by more than 30 %)
- Rule 2: Include any other specifically sensitive areas where traffic flows have increased by 10% or more.

584) The guidance lists ‘*accident blackspots, conservation areas, hospitals, links with high pedestrian flows*’ and areas with ‘*a large increase in the numbers of HGVs*’ as examples of especially sensitive areas.

585) The IEMA guidance notes that increases in traffic may be below the above environmental assessment thresholds but may nonetheless have a potential impact from an operational and capacity perspective. Furthermore, scoping discussions with the highways authorities have indicated that the percentage increase in flows is of less interest than the localised operational impact of any increases, regardless of percentage.

586) NPPF Chapter 9 ‘Promoting Sustainable Transport’ states that developments associated with significant movement should be supported by a Transport Assessment so that the potential impacts of the proposal can be assessed. Paragraph 108 states the below points when considering development proposals:

587) ‘*In assessing sites that may be allocated for development in plans, or specific applications for development, it should be ensured that:*

- *Appropriate opportunities to promote sustainable transport modes can be – or have been – taken up, given the type of development and its location*
- *Safe and suitable access to the site can be achieved for all users*
- *Any significant impacts from the development on the transport network (in terms of capacity and congestion), or on highway safety, can be cost effectively mitigated to an acceptable degree.’*

588) ‘*Travel Plans, Transport Assessments and Statements*’ was published by the Ministry of Housing, Communities & Local Government in March 2014 to provide further guidance on the principles guiding the requirement and content of accompanying transport documentation as part of the planning process. In doing so, the guidance makes reference to NPPF as follows:

- Paragraph 111 of the National Planning Policy Framework sets out that all developments that generate significant amounts of transport movement should be supported by a Transport Statement or Transport Assessment.
- Local planning authorities must make a judgement as to whether a development proposal would generate significant amounts of movement on a case by case basis (i.e. significance may be a lower threshold where road capacity is already stretched or a higher threshold for a development in an area of high public transport accessibility).
- In determining whether a Transport Assessment or Statement will be needed for a proposed development, local planning authorities should take into account the following considerations:
 - *The Transport Assessment and Statement policies (if any) of the Local Plan*
 - *The scale of the proposed development and its potential for additional trip generation (smaller applications with limited impacts may not need a Transport Assessment or Statement)*
 - *Existing intensity of transport use and the availability of public transport*
 - *Proximity to nearby environmental designations or sensitive areas*
 - *Impact on other priorities/strategies (such as promoting walking and cycling)*
 - *The cumulative impacts of multiple developments within a particular area*
 - *Whether there are particular types of impacts around which to focus the Transport Assessment or Statement (e.g. assessing traffic generated at peak times).*

589) In light of the above, a Transport Assessment will be produced, which will provide full technical detail across all aspects of the assessment. The outcomes of this work will be presented in summary within the ES Traffic and Transport chapter.

590) The NPPF also states that ‘*Development should only be prevented or refused on highways grounds if there would be an unacceptable impact on highway safety, or the residual cumulative impacts on the road network would be severe*’ (Paragraph 109).

591) Accordingly, the assessment with the Transport Assessment and summarised within the ES Transport chapter will extend beyond the IEMA “Rule 1” and “Rule 2” thresholds, and with regard to NPPF, will consider whether any traffic movements associated with the development would have an unacceptable impact on highway safety, or the potential residual cumulative impacts on the road network would be severe.

16.4 Existing Conditions

592) Desktop research has been conducted to understand the existing road network, indicative development envelopes and access points from the SRN. The road network which is anticipated to be used by vehicles during the construction period is composed of a hierarchy of roads, including:

- SRN – Managed by Highways England which comprises high standard / high capacity roads including motorways and some A roads
- A Roads
- B Roads
- Unclassified Roads / Single Lane Tracks with passing places and potential physical constraints.

16.4.1 Assessment area Overview

593) The potential impact on the road network will differ dependent on the hierarchy for instance, the potential impacts of vehicles on lower classification roads will be higher due to the potential physical constraints and sensitive groups and locations identified through IEMA guidance.

594) For instance, the access points cover a number of A roads, B roads and minor roads between Junction 34 – 31 of the M6 which is located to the west of this section of aqueduct. There are also populated areas close to this section of aqueduct and therefore there are numerous locations which could include local communities, schools, hospitals, open spaces and other sensitive locations if subject to an increase in HGV activity. These settlements include but are not restricted to:

- Caton
- Wray
- Wennington
- Low Bentham
- Clitheroe
- Waddington
- West Bradford
- Slaidburn
- Newton-in-Bowland.

595) This section will take into consideration the below elements:

- Proximity to locations at which the aqueduct construction would cross the highway network
- The points of access to proposed construction areas.

596) It is anticipated that there will be an increase in HGV activity associated with the construction phase for the Proposed Bowland Section. The subsequent paragraphs explain the indicative development envelopes which are shown in Figure 16.1. It should be noted that these indicative routes will be reviewed once detailed information is provided. Further, haulage routes are anticipated to use the SRN, however, details of where materials may originate from is not determined at this stage. A reasonable worst-case scenario will however be assumed, namely that the SRN should be utilised to transport surplus material from site to its final destination(s).

16.4.2 Bowland Access – A683 and B6480 (North East of Lancaster) Construction Areas A, B and C

597) A route which could be used to access Construction Areas A, B and C includes the use of part of the SRN, the M6, exiting at Junction 34 onto the A683 which runs through the local community of Caton. As such, this route could impact on pedestrians, cyclists and equestrians as well as sensitive amenities for example, residential properties. This indicative route continues onto the B6480 which passes through local communities such as Wray, Low Bentham and Wennington which encompasses residential properties and a church. It is also noted that sections of this route do not provide pavements, which could result in conflict between pedestrians and HGVs.

16.4.3 Bowland Access – B6478 (North of Clitheroe) Construction Areas D and E

598) An initial assessment of potential routes to access Construction Areas D and E, include the use of part of the SRN, M6, exiting at Junction 31 onto the A59. This route continues onto Whalley Road and Queensway which runs through the local community of Clitheroe. As such, this route could impact on non-motorised users as well as sensitive amenities, for example residential properties and work places. The route progresses onto the B6478 through the local communities of Waddington, West Bradford, Slaidburn and Newton-in-Bowland. As such, it is possible that the indicative route would impact on pedestrians, cyclists and equestrians as well as sensitive amenities for example churches, residential properties and schools.

16.5 Potential Effects

599) Scoping has identified that the implementation of the proposed development will potentially alter the traffic conditions associated with the strategic and local road network in terms of increased vehicle journeys and changes in traffic composition which, as identified within the IEMA guidance can give rise to the potential *;perception of changes in traffic by humans, and the impact of traffic changes on various ecological systems will also vary according to factors such as:*

- *Existing traffic levels*
- *The location of traffic movements*
- *The time of day*
- *Temporal and seasonal variation of traffic*
- *Design and layout of the road*
- *Land-use activities adjacent to the route*
- *Ambient conditions of adjacent land-uses.*

600) The process identified that the following changes are likely to arise primarily during construction, and to a lesser extent during operation of the Proposed Bowland Section:

- Increased HGV activity within and in proximity to sensitive locations (e.g. people at home, people at work places, hospitals, churches schools and tourist/visitor attractions) where low background traffic will increase the level of perceived impact to local users
- Increased perception of severance to non-motorised users (e.g. pedestrians, cyclists and equestrians) associated with increased HGV activity through populated areas
- Reduced accessibility for users where traffic management may be introduced (e.g. temporary traffic signals, temporary road closures and temporary lane closures).

601) The process also recorded potential for related impacts on Noise and Air Quality arising from increased vehicular activity within sensitive areas. Noise and Air Impacts are considered separately within Chapters 17 and 18. Additionally, consideration of impacts for non-motorised users not on the Public Highway Network is considered separately in the Public Access and Recreation chapter.





16.6 Summary Scope for the ES

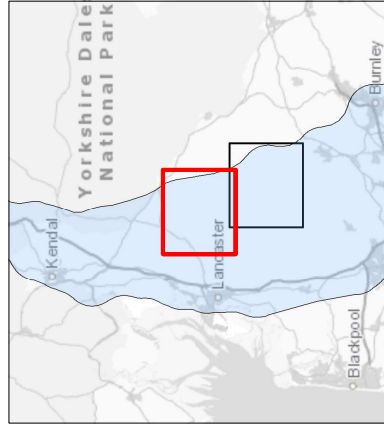
602) As part of the scoping phase of the Environmental Impact Assessment (EIA), a proposed approach to the EIA in respect of the proposed aqueduct and the identification of assessment methods for each EIA topics to be assessed has been developed. This scope is identified within Table 16.1.

Table 16.1: Scope of EIA – Traffic and Transportation

Scope of EIA – Traffic and Transportation	
1	As the aqueduct will route through various populated areas, there are likely to be several locations which could contain sensitive locations / affected parties if subject to an increase in HGV activity.
2	Scoping identified that potential alterations of traffic conditions such as increased journey times and changes in vehicle composition will occur on the road network.
3	Provisional mitigation measures have been identified which could be employed such as temporary signing, traffic management plan, temporary parking restrictions and temporary traffic lights. However, it is noted that further mitigation measures may also arise in later stages.
4	No likely significant effects have been identified during the operational phase.
5	The assessment of environmental impacts will use the 'Guidance for the Environmental Assessment of Road Traffic' (IEMA, 1993) as a basis for inclusion as a chapter within the Environmental Statement.

FIGURE 16.1

- Legend**
-  Transport Assessment Area
 -  Proposed Construction Access - Indicative Route
 -  Proposed Construction Compound / Laydown Area - Indicative Development Envelope
 -  Proposed Indicative Construction Compound / Laydown Area



Rev	Date	Initial Issue	LT	IM	SH	CS
0	OCT19	Purpose of revision	Drawn	Checked	Rev'd	Appl'd

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Client: United Utilities

Project: HAWESWATER AQUEDUCT RESILIENCE PROGRAMME

Drawing Title: TRAFFIC AND TRANSPORT ASSESSMENT AREA EXTENT PROPOSED BOWLAND SECTION SHEET 1 OF 2

Drawing Status:	FINAL
Scale:	1:50,000
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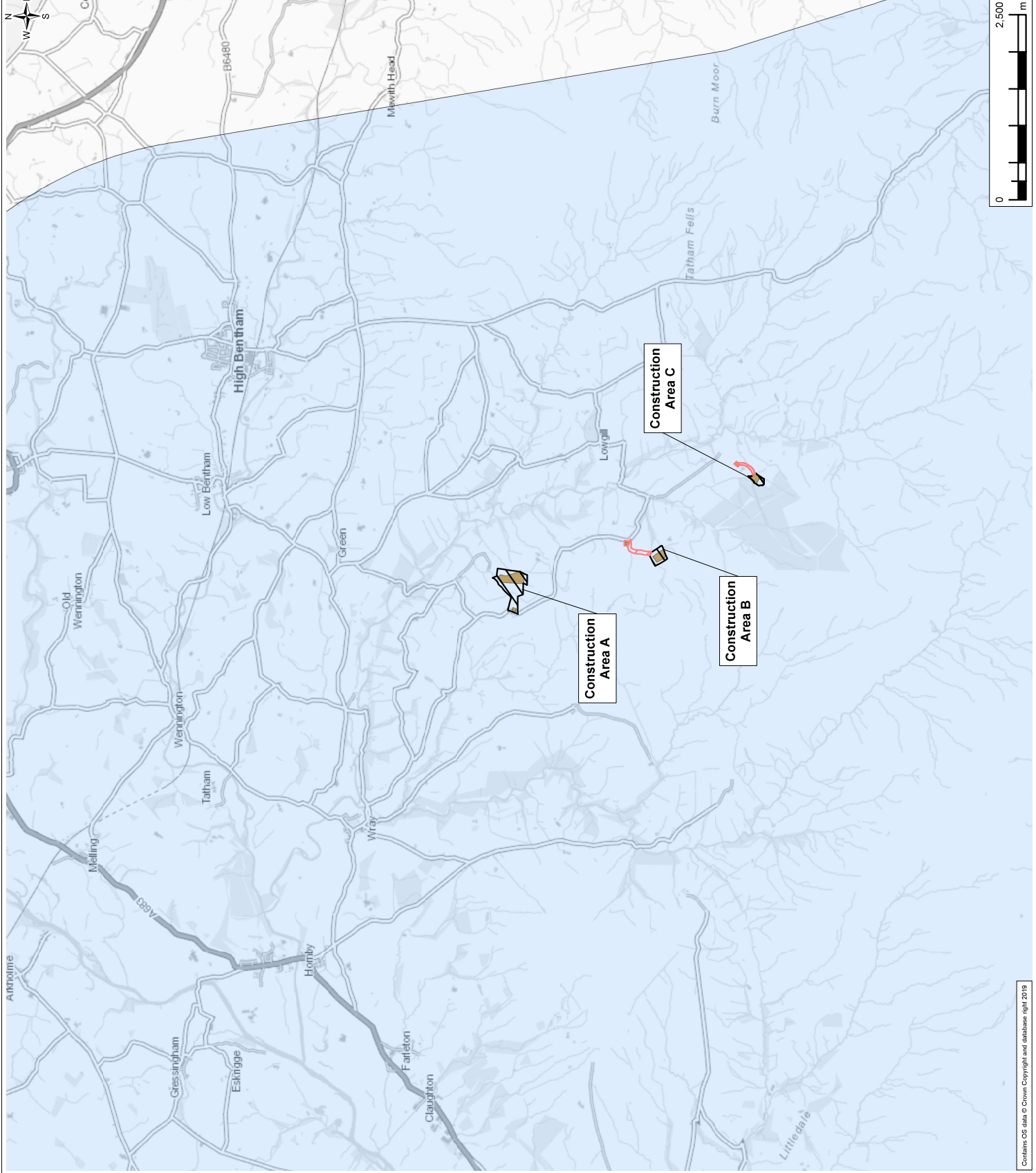




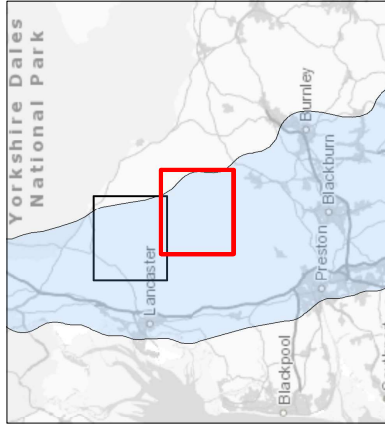
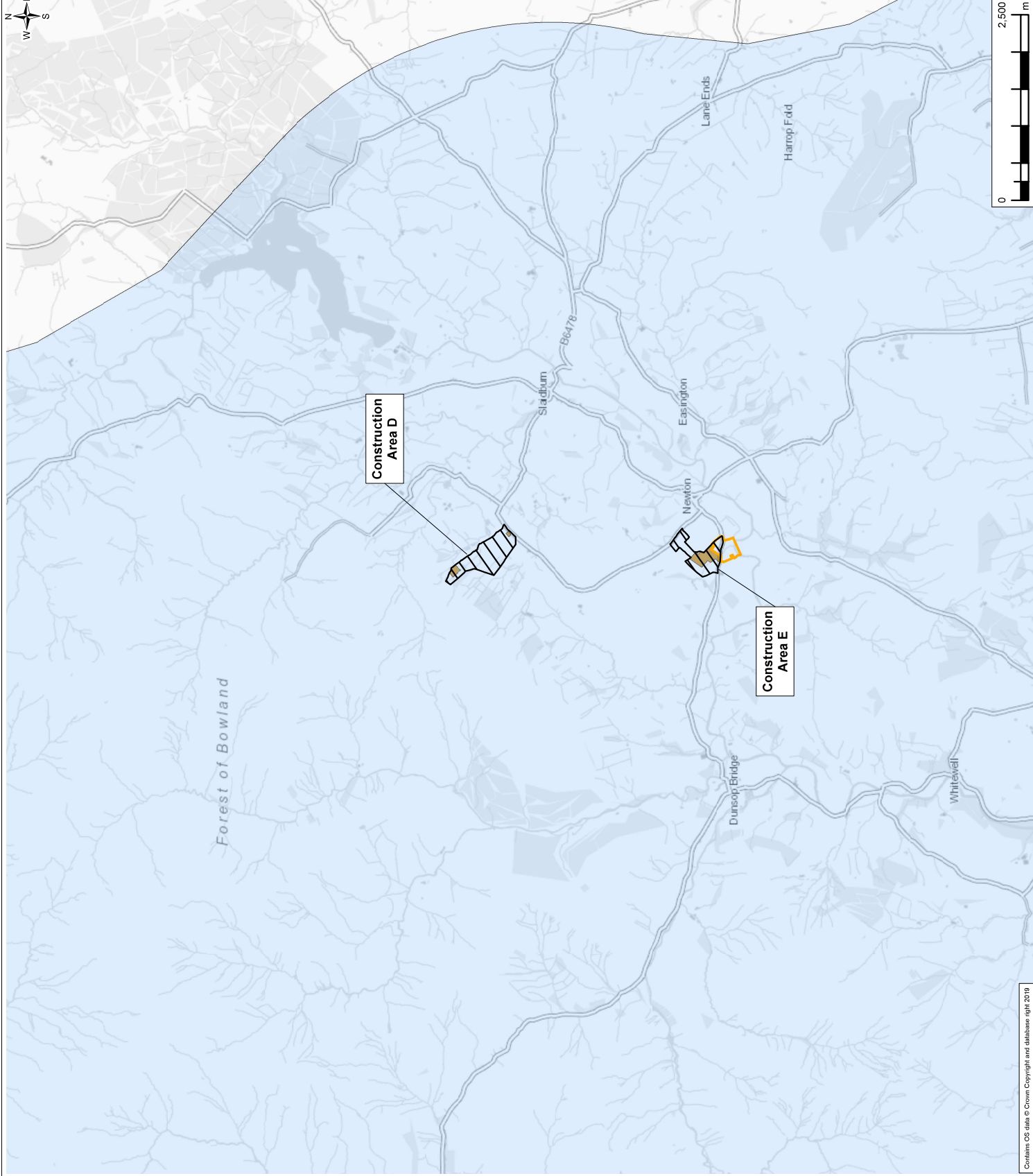


FIGURE 16.1

Legend

-  Transport Assessment Area
-  Proposed Construction Compound / Laydown Area - Indicative Development Envelope
-  Proposed Indicative Construction Compound / Laydown Area
-  Proposed Discharge Pipe - Indicative Corridor



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Client: United Utilities

Project: HAMESWATER AQUEDUCT RESILIENCE PROGRAMME

Drawing Title: TRAFFIC AND TRANSPORT ASSESSMENT AREA EXTENT PROPOSED BOWLAND SECTION SHEET 2 OF 2

Drawing Status: FINAL

Scale: @ A3 1:50,000
Jacobs No.: B27070CG
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17. Noise and Vibration

17.1 Overview

603) This chapter presents the outcome of the scoping exercise in relation to potential noise & vibration effects arising from the Proposed Bowland Section. Noise and vibration effects during construction of the Proposed Bowland Section are anticipated. However, no significant noise and vibration effects are anticipated during the operational phase of the aqueduct.

604) In this chapter, the noise and vibration baseline condition for the assessment are summarised, and an initial indication of the potentially significant noise and vibration effects is provided. The scope of the noise and vibration assessment for the Environmental Statement (ES) and the technical methodology are described.

17.2 Proposed Methodology

605) The assessment would be undertaken in accordance with the relevant Government policies and British Standards, and would draw on previous experience of similar projects, professional judgement and knowledge of the proposed construction activities.

606) The following key guidance and Standards would be considered in undertaking the assessment:

- Environmental Protection Act 1990⁵⁵
- National Planning Policy Framework (NPPF), 2019⁵⁶
- Noise Policy Statement for England (NPSE), 2010⁵⁷
- Planning Practice Guidance-Noise (2019)⁵⁸
- BS 5228-1: 2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites' - Part 1 (Noise)⁵⁹
- BS 5228-2: 2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites' - Part 2 (Vibration)⁶⁰
- World Health Organisation 'Environmental Noise Guidelines for the European Region', 2018⁶¹.

607) The construction noise and vibration assessment area would initially be limited to a 300 m buffer from the extent of the indicative working areas but would be kept under review during the assessment and expanded if necessary. The 300 m assessment area is based on BS 5228-1:2009+A1:2014, section F.2.2.2.2, which states that '*At distances over 300 m noise predictions have to be treated with caution, especially where a soft ground correction factor has been applied, because of the increasing importance of meteorological effects*'.

608) Road traffic noise impacts may occur beyond 300 m of the surface works, with the location of such impacts influenced by the location of the haul routes selected. Data related to traffic movements would be presented within Chapter 16: Transport Planning and shall be used in the assessment of potential noise and vibration impacts. Detailed road traffic noise predictions through 3D computer modelling would not be undertaken, rather Basic Noise Level (BNL) emissions (as per the Calculation of Road Traffic Noise, CRTN, 1988) from roads would be considered through a simplified spreadsheet assessment approach.

609) The identification of likely significant effects would draw on an understanding of the methods of construction and previous experience. Noise impact shall be calculated using the prediction method presented within Annex F of BS 5228-1:2009+A1:2014, using manufacturer published noise emission levels or library source data (Annex C of BS 5228-1:2009+A1:2014), where manufacturer data are unavailable.

⁵⁵ HMSO, 1990. Environmental Protection Act, London: Her Majesty's Stationery Office.

⁵⁶ MHCLG, 2019. National Planning Policy Framework, London: Ministry of Housing, Communities and Local Government.

⁵⁷ DEFRA, 2010. Noise Policy Statement for England, London: Department for Environment, Food and Rural Affairs.

⁵⁸ MHCLG, 2019. National Planning Practice Guidance: Noise: Ministry of Housing, Communities & Local Government.

⁵⁹ BSI, 2014. BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites. Noise', London: British Standards Institution.

⁶⁰ BSI, 2014. BS 5228-2:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites. Vibration', London: British Standards Institution.

⁶¹ WHO, 2018. Environmental Noise Guidelines for the European Region, Copenhagen: World Health Organisation.

- 610) Potential groundborne noise and vibration effects shall initially be predicted using the empirical calculation methods presented in Table E.1 in BS 52282:2009+A1:2014. Detailed predictions of groundborne noise and vibration transmission from the TBM to sensitive receptors would be undertaken where the initial assessment demonstrates that there is a potential for significant effects.
- 611) The assessment of likely significant effects would take account of mitigation proposals developed as an integral part of the overall scheme design.
- 612) Temporary mitigation measures would be considered to address potential short-term impacts associated with construction of the new pipeline and works associated with the tunnelling, with consideration also given to the smaller scale operations (e.g. set up of construction compound).
- 613) Pressure release valves could be located within valve house buildings along the Proposed Bowland Section. It is anticipated that the valve house buildings would provide a level of noise mitigation that would result in negligible noise emission to atmosphere from the pressure release valves and washout valves. As such, the assessment of operational noise and vibration impacts have been scoped out of the ES.

17.3 Proposed Assessment Criteria

- 614) The NPSE, PPG-Noise and the EIA Regulations (2017)⁶² would be considered when identifying potential significant effects of noise and vibration effects arising from the Proposed Bowland Section. In order to determine whether a significant effect has occurred, it is first necessary to determine the sensitivity of receptors impacted by noise and vibration, and then determine the magnitude of any impacts.

17.3.1 Receptor sensitivity

- 615) The noise and vibration assessment shall consider the following sensitive receptors in the vicinity of the Proposed Bowland Section and associated transportation routes:
- Human receptors – when present at dwellings, schools, hospitals, places of worship, recreational areas, public rights of way or other noise-sensitive locations
 - Infrastructure receptors – buildings, both contemporary and historic (e.g. Listed Buildings) and statutory or other underground services.
- 616) No formal guidance is available on the value of noise sensitive resources. IEMA Guidelines for Environmental Noise Impact Assessment⁶³ include as noise sensitive areas houses, schools, hospitals and commercial premises. However, it should be noted that the degree of sensitivity may not be the same for all of them. For instance, since residential property is intended to be used as a permanent living and resting place, its value is considered to be 'High'.
- 617) Non-residential premises, such as schools, hospitals and commercial buildings, are not places of permanent residence. Given that their degree of noise sensitivity may vary depending on the use of the receptor, this has not been considered when classifying the magnitude of the noise impact. Table 17.1 provides the outline in determining the sensitivity of a receptor for noise.
- 618) A receptor may be placed into a different category for vibration. For example, a workshop using precision equipment may not necessarily be sensitive to noise, but it could be to vibration. There are no noted examples of this within this assessment.

⁶² HMSO, 2017. The Town and Country Planning (Environmental Impact Assessment) Regulations, London: Her Majesty's Stationery Office.

⁶³ IEMA, 2014. Guidelines on Environmental Noise Impact Assessment, Lincoln: Institute of Environmental Management & Assessment.

Table 17.1: Sensitivity of receptors

Sensitivity of receptor	Description
Very High	Internationally designated areas such as World Heritage Sites, Special cases for noise or vibration sensitivity. Particular vibration sensitivity for receptors making use of highly vibration sensitive equipment, e.g. microscopy, nanotechnology laboratories.
High	Dwellings, hospitals and residential healthcare facilities, schools and TV/music recording studios/ recital rooms.
Medium	Places of worship, cemeteries, open-air amenities used for recreation and offices.
Low	Farms, retail and commercial premises, sports facilities.
Negligible	Industrial installations.

619) An initial review of potential noise and vibration sensitive receptors has not identified any highly vibration sensitive locations. However, should such receptors be identified then an assessment would be undertaken that shall be based on information currently available (from the operator and building owner where possible) for the relevant equipment and / or process.

17.3.2 Significance of effect

620) The significance of effect for noise and vibration is determined from the combination of the value of the resource (Table 17.1) and the magnitude of impact and is described in Table 17.2. These are used to determine the significance of environmental impacts. The approach to assigning values to the effect level in relation to government policy is then described.

Table 17.2: Environmental Significance of Effect for Noise or Vibration

		Magnitude of Impact				
		No change	Negligible	Minor	Moderate	Major
Sensitivity of receptor	Negligible	Neutral	Neutral	Neutral	Neutral	Slight
	Low	Neutral	Neutral	Neutral	Slight	Moderate
	Medium	Neutral	Neutral	Slight	Moderate	Large
	High	Neutral	Slight	Slight	Moderate	Large
	Very High	Neutral	Slight	Moderate	Large	Very Large

621) The magnitude of change differs depending on the noise or vibration source under assessment. The scale of magnitude used for each noise or vibration source is presented in the following paragraphs. The value of magnitude relates to a magnitude of change for noise assessment whereas for vibration and ground-borne noise the magnitude relates to absolute levels and not to change.

622) For the purpose of this assessment effects of Moderate or greater significance are considered to be significant in the context of the EIA Regulations.

623) Professional judgement will be applied when considering noise and vibration effects, with factors including duration of exposure and cumulative impact (for example) having the potential to influence assessment outcomes.

17.3.3 Magnitude of impact

624) As required by the NPSE and PPG-Noise, noise thresholds for the lowest observable adverse effect level (LOAEL) and the significant observable adverse effect level (SOAEL) would be defined. Additionally, NPSE

defines a level at which no adverse effect would be experienced (the No Observed Effect Level, NOEL). These effect levels, and the change in noise levels predicted to occur due to the Proposed Bowland Section, would be considered when classifying the magnitude of impacts at receptors.

- 625) PPG-Noise states that a noise level at a LOAEL would typically be noticeable and intrusive, with examples of possible behavioural changes likely to include:
- Turning up the volume of a television
 - Speaking more loudly
 - Where there is no alternative ventilation, having to close windows for some of the time because of the noise
 - Potential for some reported sleep disturbance.
- 626) PPG-Noise states that a noise level at a SOAEL would typically be noticeable and disruptive, with examples of possible behavioural changes likely to include:
- Avoiding certain activities during periods of intrusion
 - Where there is no alternative ventilation, having to keep windows closed most of the time because of the noise
 - Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep
 - Quality of life diminished due to change in acoustic character of the area.
- 627) There is no equivalent guidance in terms of vibration, and as such, the guidance above shall be considered to apply for vibration impacts.
- 628) The criteria that shall be adopted for noise and vibration are presented below in Table 17.3 to Table 17.12 and presented in the methodology, assumptions and assessment technical appendix (unless stated otherwise).
- 629) It should be noted that the noise and vibration levels presented below may be amended for certain locations once the baseline conditions are known and subject to more detailed review of receptor sensitivity.

Airborne Noise

- 630) Noise impact thresholds for construction activities at residential premises, and other noise sensitive receptors, as presented in Table 17.3, have been classified using the assessment approach set out in Annex E.3 of BS5228-1:2009 + A1:2014.
- 631) In relation to construction noise, day is 07:00 to 19:00, evening is 19:00 to 23:00 and night is 23:00 to 07:00. The level provided for the daytime is for the entire period, whereas that for evening and night is applicable to any single hour within the respective period.
- 632) The threshold values presented in Table 17.3 relate to the site noise level, which is the noise from construction activities alone.

Table 17.3: Construction noise impact thresholds at residential receptors (construction noise only)

Construction Airborne Noise Effect Level	Threshold Value ($L_{Aeq,T}$) 1m in front of the relevant façade	Source
Lowest Observed Adverse Effect Level (LOAEL)	Exceeds existing $L_{Aeq,T}$ noise level for day, evening or night	LOAEL is set at a level where construction noise becomes the dominant source.
Significant Observed Adverse Effect Level (SOAEL)	Day 65 dB $L_{Aeq,daytime}$ Evening 55 dB $L_{Aeq,1h}$ Night 45 dB $L_{Aeq,1h}$	Lower cut off value BS 5228-1:2009+A1:2014 Annex E.3.3.

633) In order to determine the significance of effects (see Table 17.2), the magnitude of airborne noise change due to construction needs to be defined using the criteria presented in Table 17.4.

Table 17.4: Construction airborne noise effect levels

Magnitude of change	Criteria
Major	Total construction noise level exceeds the pre-construction ambient noise level by 10 dB or more and exceeds SOAEL
Moderate	Total construction noise level exceeds the pre-construction ambient noise level by 5 dB or more and exceeds SOAEL
Minor	Total construction noise level exceeds the pre-construction ambient noise level by less than 5 dB and exceeds SOAEL
Negligible	Total construction noise level exceeds the pre-construction ambient noise level, but remains below SOAEL
No Change	Site construction noise remains below the pre-construction ambient noise level.

Vibration – human response

634) The effect of building vibration on people inside buildings is often assessed using the Vibration Dose Value (VDV) index, as described in BS 6472-1:2008. However, a simpler approach is often initially taken to establish if there is potential for perceptible effects from construction activities, and this is possible with the PPV index. This approach is described by BS 5228-2, which states in para B.2:

- *'BS 6472, as stated, provides guidance on human response to vibration in buildings. Whilst the assessment of the response to vibration in BS 6472 is based on the VDV and weighted acceleration, for construction it is considered more appropriate to provide guidance in terms of the PPV, since this parameter is likely to be more routinely measured based upon the more usual concern over potential building damage. Furthermore, since many of the empirical vibration predictors yield a result in terms of PPV, it is necessary to understand what the consequences might be of any predicted levels in terms of human perception and disturbance.'*

635) Further, BS 5228-2 states (para B.2) that:

- *'Human beings are known to be very sensitive to vibration, the threshold of perception being typically in the PPV range of 0.14 mm/s to 0.3 mm/s. Vibrations above these values can disturb, startle, cause annoyance or interfere with work activities. At higher levels they can be described as unpleasant or even painful. In residential accommodation, vibrations can promote anxiety lest some structural mishap might occur.'*

636) Based on this, the LOAEL shall be set at 0.3 mm/s and the SOAEL at 1.0 mm/s. A table of guidance levels is provided in BS 5228-2, and is reproduced in Table 17.5.

Table 17.5: Construction vibration guidance and effect levels

Impact Classification	Vibration level, PPV mm/s	Effect
Major	10	Vibration is likely to be intolerable for any more than a very brief exposure to this level.
Moderate	1.0	It is likely that vibration of this level in residential environments would cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
Minor	0.3	Vibration might just be perceptible in residential environments.
Negligible	0.14	Vibration might just be perceptible on the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
No change	<0.14	Vibration is below levels of perception.

637) If the predicted levels for a single event for construction are above the SOAEL then mitigation measures and the duration of the construction activity would be considered first to determine if further investigation is required using the VDV index.

Vibration – buildings

638) For building structure response BS 5228-2 reproduces the advice provided in BS 7385-2: 1993 – *Evaluation and Measurement for Vibration in Buildings: Guide to Damage Levels from Groundborne Vibration*. The response of a building to ground-borne vibration is affected by the type of foundation, underlying ground conditions, the building construction and the state of repair of the building. The vibration velocity levels (mm/s) values given in Table 17.6 below represent levels above which cosmetic damage may occur and are separated out based on building type and frequency range. For continuous vibration where there is a potential for dynamic magnification, it is recommended that these guide values be reduced by up to 50 %.

Table 17.6: Transient vibration guide values as peak particle velocity (PPV) for cosmetic damage (reproduced from BS 5228-2)

Type of Building	Peak particle velocity (PPV) in frequency range of predominant pulse	
	4Hz to 15Hz	15Hz and above
Reinforced or framed structures	50 mm/s	50 mm/s
Industrial and heavy commercial buildings		
Un-reinforced or light framed structures ⁽¹⁾	at 4Hz increasing to 20 mm/s at 15Hz	20 mm/s at 15Hz increasing to 50 mm/s at 40Hz and above
Residential or light commercial buildings ⁽²⁾		
Note 1: Values referred to are at the base of the building.		
Note 2: At frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded.		

639) Minor damage is possible at vibration magnitudes that are greater than twice those given in Table 17.6, with major damage at values greater than four times the values in the table.

640) BS 7385-2 also states that the probability of damage tends towards zero at 12.5 mm/s peak component particle velocity, which can be halved for a conservative level for continuous vibration. Although now superseded, BS 5228-4:1992 suggested a threshold for cosmetic damage at peak particle velocities of 10 mm/s for intermittent vibration and 5 mm/s for continuous vibrations. This lower level of 5 mm/s has been used to assign the level for no change and is adopted for this scheme assessment as a threshold for cosmetic

damage to standard buildings. The thresholds within BS 5228-4:1992 have not been updated within the more recent version but it is assumed that they are still valid.

641) Table 17.7 presents the magnitude of impact for building damage from vibration. These are based on a building that is structurally sound. If a building is structurally unsound, then these values may be reduced. It should be noted that BS 7385-2 states (para 7.5.2) "A building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive". As the receptor is a building and not a human receptor, no values for the effect level can be assigned.

Table 17.7: Magnitude of impact for potential vibration damage to buildings

Magnitude of Impact	Damage risk	PPV mm/s ⁽¹⁾
Major	Major	30
Moderate	Minor	15
Minor	Cosmetic (intermittent vibration)	10
Negligible	Cosmetic (continuous vibration)	5
No change	None	<5

Note 1 Peak Particle Velocity (PPV) is defined as the maximum instantaneous positive or negative peak of the vibration signal. It is specified in millimetres per second (mm/s). It is important to note that the PPV refers to the movement within the ground of molecular particles and not surface movement.

Groundborne noise and vibration

642) The impact classification criteria presented in Table 17.8, Table 17.9 and Table 17.10 shall be used in the assessment of groundborne noise and vibration impacts at residential receptors and buildings during construction.

Table 17.8: Groundborne noise impact criteria for residential receptors

Impact Classification	Groundborne sound level dB L_{pASmax} , (measured indoors, near the centre of any dwelling room on the ground floor)
Negligible	35 - 39
Minor	40 - 44
Moderate	45 - 49
Major	>49

643) The groundborne noise LOAEL and SOAEL values at residential receptors are 35 and 45 dB L_{pASmax} , respectively.

Table 17.9: Groundborne vibration impact criteria for occupants and building users

Impact Classification	In the absence of appreciable existing levels of vibration	
	VDV m/s ^{1.75} Daytime (0700-2300)	VDV m/s ^{1.75} Night time (2300 – 0700)
Negligible	≤ 0.2	≤ 0.1
Minor	> 0.2 - 0.4	> 0.1 - 0.2
Moderate	> 0.4 - 0.8	> 0.2 - 0.4
Major	> 0.8	> 0.4
Highest impact category used, daytime or night-time. Determined at the worst location on a normally loaded floor (usually the centre of the floor).		

644) The groundborne vibration LOAEL and SOAEL values for occupants and building users are 0.2 and 0.8 VDV m/s^{1.75}, respectively, for the daytime period, and 0.1 to 0.4 VDV m/s^{1.75}, respectively, for the night-time period.

Table 17.10: Vibration impact criteria for buildings (criteria below which there is no risk of cosmetic damage)

Category of building	Impact criterion: (Peak Particle Velocity - PPV - at building foundation)	
	Transient vibration (e.g. percussive piling)	Continuous vibration (e.g. vibrating rollers)
Potentially vulnerable buildings	≥ 6 mm/s	≥ 3 mm/s
Structurally sound buildings	≥ 12 mm/s	≥ 6 mm/s

645) The values presented in Table 17.10 are considered to represent the NOELs for ground-borne vibration with regard to risk of building damage.

Construction traffic

646) The effect levels assigned for road traffic noise are shown in Table 17.11 with an explanation of how they have been derived provided below.

Table 17.11: Road Traffic Noise Effect Level for Residential Receptors

Effect Level	Period	Noise Level
LOAEL	Day	55 dB LA _{10,18h} at 1m from façade
	Night	40 dB LA _{eq,6h} free-field
SOAEL	Day	68 dB LA _{10,18h} at 1m from façade
	Night	55 dB L _{night} free-field

647) The value adopted for daytime LOAEL is 50 dB LA_{eq,16h} and is based on the information provided in the WHO Guidelines for Community Noise. In that document it states that 50 to 55 dB LA_{eq} represent 'day-time levels below which the majority of the adult population would be protected from becoming moderately or seriously annoyed'. The level of 50 dB LA_{eq,16h} for moderately annoyed has therefore been chosen and corrections applied to give an equivalent LA_{10,18h} façade threshold for comparison against calculations of road traffic noise in line with CRTN.

- 648) For night-time the LOAEL is set at 40 dB $L_{Aeq,8h}$ which is explicitly defined as the LOAEL in the WHO Night Noise Guidelines for Europe.
- 649) For daytime, the SOAEL is set at 68 dB $L_{A10,18h}$ (façade), which is consistent with the daytime trigger level in the Noise Insulation (Amendment) Regulations 1988 (NIR). For night-time, the SOAEL is set at 55 dB L_{night} (free field) for residential properties. This aligns with the interim night-time outdoor target level provided in the WHO Night Noise Guidelines for Europe.
- 650) A classification for the magnitude of changes in road traffic noise is provided in HD213/11. A change in road traffic noise of 1 dB(A) in the short term (Do-Minimum to Do-Something in the same year) is the smallest change that is considered perceptible to people. For road traffic noise the classification of magnitude of change is reproduced from HD213/11 in Table 17.12.

Table 17.12: Scale of magnitude of road traffic noise change

Magnitude of Impact	Change dB $L_{A10,18h}$
No Change	0
Negligible	0.1 - 0.9
Minor	1 - 2.9
Moderate	3 - 4.9
Major	5 or more

- 651) For vibration from road traffic HD 213/11 advises that a Peak Particle Velocity (PPV) of 0.3 mm/s measured in the vertical direction is considered to be perceptible, and structural damage to buildings can occur when levels are above 10 mm/s.
- 652) Where PPV from road traffic would rise above a level of 0.3 mm/s, or existing levels above 0.3 mm/s are predicted to increase are predicted, then this should be considered as an adverse impact from vibration.
- 653) HD 213/11, paragraph A5.26 states:
- *“Significant ground-borne vibrations may be generated by irregularities in the road surface. Such vibrations are unlikely to be important when considering disturbance from new roads and the assessment would only be necessary in exceptional circumstances.”*

17.4 Existing Conditions

- 654) This section considers the potential noise and vibration impacts in the Proposed Bowland Section. Based on an initial desktop study, it would provide a brief description of the existing baseline conditions, nearby potential noise and vibration sensitive receptors, the potential for local mitigation and the scope of the assessment required.
- 655) The process of scoping commenced with the definition of a preliminary assessment area within which the noise and vibration impacts could be evaluated to assist in the identification of potential effects. The local noise climate is likely to be dominated by local road traffic.

17.4.1 Assessment area

- 656) A detailed description of the Proposed Bowland Section is presented in Chapter 3, Section 3.1.
- 657) The assessment area would cover an area 300 m around the proposed construction works. However, this shall be kept under review during the assessment. It is also acknowledged that significant effects during tunnelling may occur at receptors located along the proposed route of the tunnel, with the depth of the tunnel likely to be a significant factor in impacts experienced at properties at surface level. These properties shall be considered on a case-by-case basis during the assessment.
- 658) Construction traffic impacts would also be considered, with the extend of the assessment area for this element of the assessment being determined by the outputs from the traffic model, which shall be developed to support chapter 16: Transport Planning.

17.4.2 Information Sources

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

- BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites - Part 1 (Noise)'
- BS 5228-2:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites - Part 2 (Vibration)'
- Information related to environmental constraints entered onto the project GIS database⁶⁴
- Extrium online noise map viewer⁶⁵.

17.4.3 Baseline noise and vibration conditions

660) The baseline conditions discussed below are based on initial desktop study only. A baseline noise monitoring programme is scheduled for late 2019 and proposed baseline noise monitoring locations are shown in Figure 17.1. Review of the noise maps for England via the online Extrium noise map viewer suggests that there are no major transport noise sources in the area of the proposed works. This would suggest that local noise sources are likely to dominate the acoustic climate in the vicinity of the assessment area.

661) From review of the GIS database it would appear that there are no significant vibration generating activities in the area likely to be affecting residential receptors presently.

662) A baseline survey would be undertaken to support the noise and vibration assessment that shall be reported in the ES. The survey shall be undertaken with due regard for relevant Standards and guidance and shall be discussed and agreed with the Environmental Health Department at the local planning authorities (Lancaster City Council and Ribble Valley Borough Council) prior to commencement. Based on the initial review of baseline conditions, it is not considered that a baseline vibration survey would be required.

17.4.4 Key receptors

663) Key noise and vibration sensitive receptors that have been identified through the initial desktop study include the following residential properties and other sensitive receptors in the vicinity of the proposed works:

- Lower House Cottage, Low Gill
- Botton Hall/ Over Houses, Low Gill
- Leyland Farm
- Helks Bank Farm
- Wellbeck House
- Higher Thrushgill Cottage
- Burnside Cottage
- Property on Eller Beck
- Lathams Farm
- Higher House Farm
- Valve House
- Fober Farm.

64 United Utilities ProjectMapper. 2019. Projectmapper.com. [Online]. [accessed 10 July 2019]. Available from: <https://projectmapper.com/map.aspx?cid=78>

65 Extrium Noise Map Viewer. 2019. Extrium.co.uk. [Online]. [accessed 10 July 2019]. Available from: <http://www.extrium.co.uk/noiseviewer.html>

17.5 Potential Effects

664) Construction would take place through tunnelling, which would involve the use of a TBM, within the Proposed Bowland Section. Tunnelling would involve the creation of two shaft access points (one drive and one reception shaft), which lie approximately 16.4 km apart, along with up to three compound/ laydown areas for intermediate shafts along the route of the proposed. Surface works would be limited to these shaft access and intermediate shaft locations and would involve the setting up of the sites, delivery of material to be used in the construction, surface treatment of materials via separation plant and the removal of the construction waste materials via the local road network.

665) Potential noise and vibration impacts during tunnelling would be most significant at receptors in the vicinity of the drive shaft (and to a lesser extent the reception shaft), at intermediate shafts and along the construction traffic route on the local road network.

17.5.1 Construction

666) The scoping assessment makes several assumptions, based on previous relevant project experience, to allow an initial assessment of potential noise and vibration effects during construction to be made.

667) In terms of airborne noise impacts, it has been assumed that receptors within the assessment area (300 m) may potentially be exposed to significant adverse effects during construction, subject to the context of noise exposure (e.g. duration, time). For groundborne noise and vibration impacts, based on the upper threshold for distance typically used within the empirical calculations of groundborne noise and vibration (BS 5228-2, Annex E, Table E.1), it has been assumed that receptors within 100 m of the works activities may potentially be exposed to significant adverse effects during construction.

668) The following construction activities shall be undertaken:

- Preconstruction enabling works (fencing, top soil strip)
- Tunnelling
- Some open-cut pipeline laying activities for pipe tie-in at either end and potentially at the discharge pipe
- Site reinstatement.

669) At this time, it is not possible to scope out the potential for significant adverse airborne noise or groundborne noise and vibration effects during the construction phase of the Proposed Bowland Section, based on the location of receptors in and around the development envelope and the assessment areas defined above.

17.6 Design and Mitigation

670) An optimised design will be developed that includes mitigation to help reduce likely significant noise and vibration effects. This could include:

- Careful design of major structures such as the tunnel entry point to minimise impacts on residential receptors.

671) Additional mitigation that could be adopted where reasonably practicable will be included in the Construction Code of Practice. This may include some of the following mitigation solutions;

- All construction activities (where practicable, e.g. excluding tunnelling) would be programmed to take place during core working hours, to be agreed with the local planning authority. No construction works would be undertaken outside of the core working hours, on Sundays or Public Holidays, unless prior approval is obtained from the local authority
- Careful consideration of surface level plant and equipment to maximise offset distances between construction plant and sensitive receptors
- Careful selection of plant and equipment at tunnel drive shaft to minimise the impacts at nearby residential receptors given that the operations could be 24 hours a day
- Erection of temporary barriers between construction activities and closest receptors to mitigate noise levels from noise sources which may be elevated

- All plant, equipment and noise control measures applied to plant and equipment shall be maintained in good and efficient working order and operated such that noise emissions are minimised as far as reasonably practicable
- As far as reasonably practicable, any plant, equipment or items fitted with noise control equipment found to be defective would not be operated until repaired
- Where reasonably practicable, other fixed items of construction plant should be electrically powered in preference to diesel or petrol driven
- As far as is reasonably practicable the location and orientation of semi-static equipment would be chosen to minimise the noise impact on sensitive receptors
- All personnel on site would undergo site specific inductions and briefings, to include noise and vibration control measures
- Noise from reversing alarms from delivery vehicles would be controlled and limited as far as possible through the following means:
 - Designing the site layout to limit the need for reversing vehicles
 - The use of banksmen for traffic management at site entrance gates and within site footprint
 - Reversing alarms incorporating directional sounders, broadband signals self-adjusting output sounders or flashing warning lights
 - Setting reversing alarms to the minimum output noise level required for health and safety compliance
- At the induction stage and through daily briefings, all site personnel to be made aware of the location of sensitive properties
- Parking shall only be permitted on site and not near/ next to sensitive properties
- Works to be planned appropriately to accommodate the anticipated timescales
- Construction traffic route should be carefully planned to minimise disturbance. Construction routes should be advertised in advance and the construction contractor should liaise with local authorities regarding construction traffic route to ensure they don't coincide with planned maintenance works, for example. Consideration should also be given to alteration of timings of signal-controlled junctions to avoid queuing construction traffic
- A programme of community liaison would be carried out, including notification of works and details of the complaints process.

17.7 Summary Scope for the EIA

672) The findings of the scoping assessment for the proposed Bowland Section show that the following elements would be scoped out during the next stage of the EIA noise and vibration assessment:

- **Airborne noise and groundborne noise and vibration during operation:** the aqueduct, being gravity fed and with above ground infrastructure limited to pressure release valves within valve house buildings, is not anticipated to generate any significant adverse impacts during operation, and as such no further assessment is proposed.

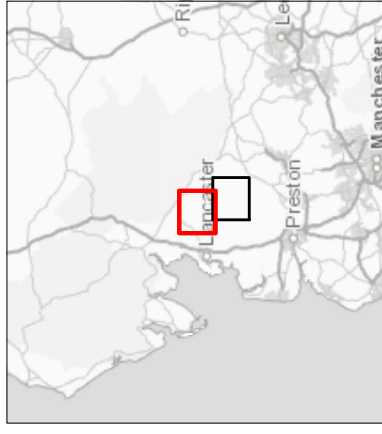
673) The scope of the noise and vibration assessment at ES stage is detailed in Table 17.13.

Table 17.13: Matters of significance for noise and vibration effects

Receptor group	Matter / potential effects	Comments
Residential Receptors	Airborne noise effects during enabling activities, pipeline laying via open-cut, tunnelling and site reinstatement activities.	Scoped in Representative baseline noise levels would be determined at the next stage of assessment. At this time, the likelihood of potentially significant airborne noise and groundborne noise and vibration effects at residential receptors cannot be discounted, and as such, detailed noise and vibration predictions of potential noise and vibration emissions during construction are proposed.
	Groundborne noise and vibration effects during enabling activities, pipeline laying via open-cut or tunnelling and site reinstatement activities.	
	Airborne noise effects Due to construction traffic.	Scoped in At this time, construction traffic volumes and routes are not known and as such it is not possible to discount the possibility of significant airborne noise and groundborne noise and vibration effects at sensitive receptors.
	Groundborne noise and vibration effects due to construction traffic.	

FIGURE 17.1

- Legend**
-  Proposed Tunnel Route - Indicative
 -  Proposed Construction Access - Indicative
 -  Proposed Construction Compound / Laydown Area - Indicative Development Envelope
 -  Proposed Indicative Construction Compound / Laydown Area
- Constraints**
-  Proposed Baseline Noise Monitoring Location



Rev	Date	Initial Issue	LT	IM	SH	CS
0	OCT19					

Purpose of revision
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Client: **United Utilities**
 Project: **HAMESWATER AQUEDUCT RESILIENCE PROGRAMME**

Drawing Title: **PROPOSED BASELINE NOISE MONITORING LOCATION PROPOSED BOWLAND SECTION SHEET 1 OF 2**

Drawing Status	FINAL
Scale @ A3	1:50,000
Jacobs No.	B27070CG
Client No.	B27070CG_ESR_17_01

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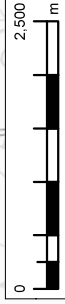
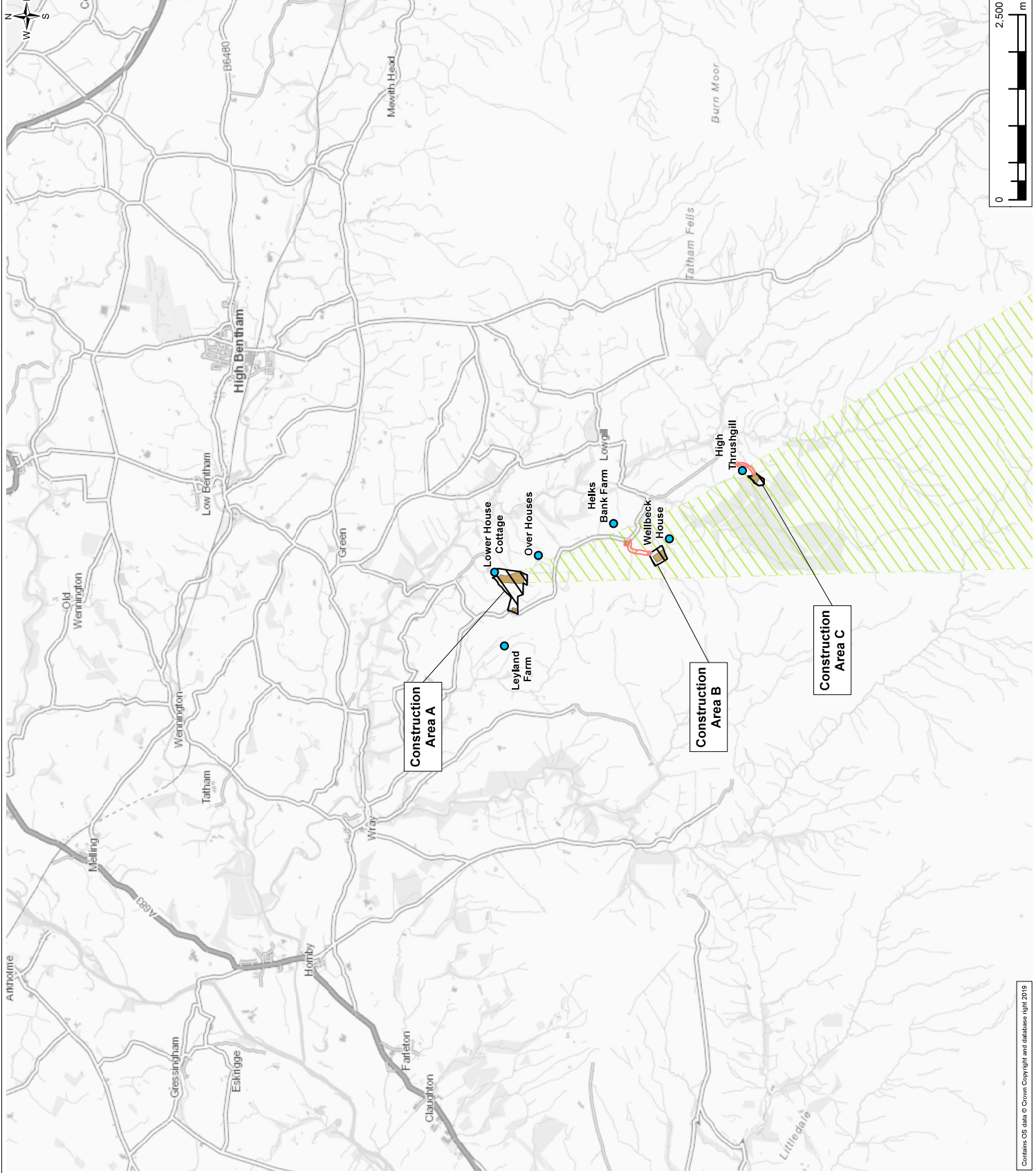





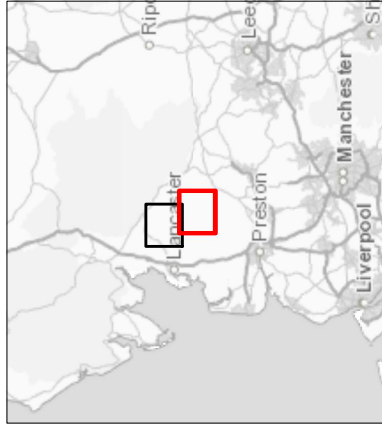
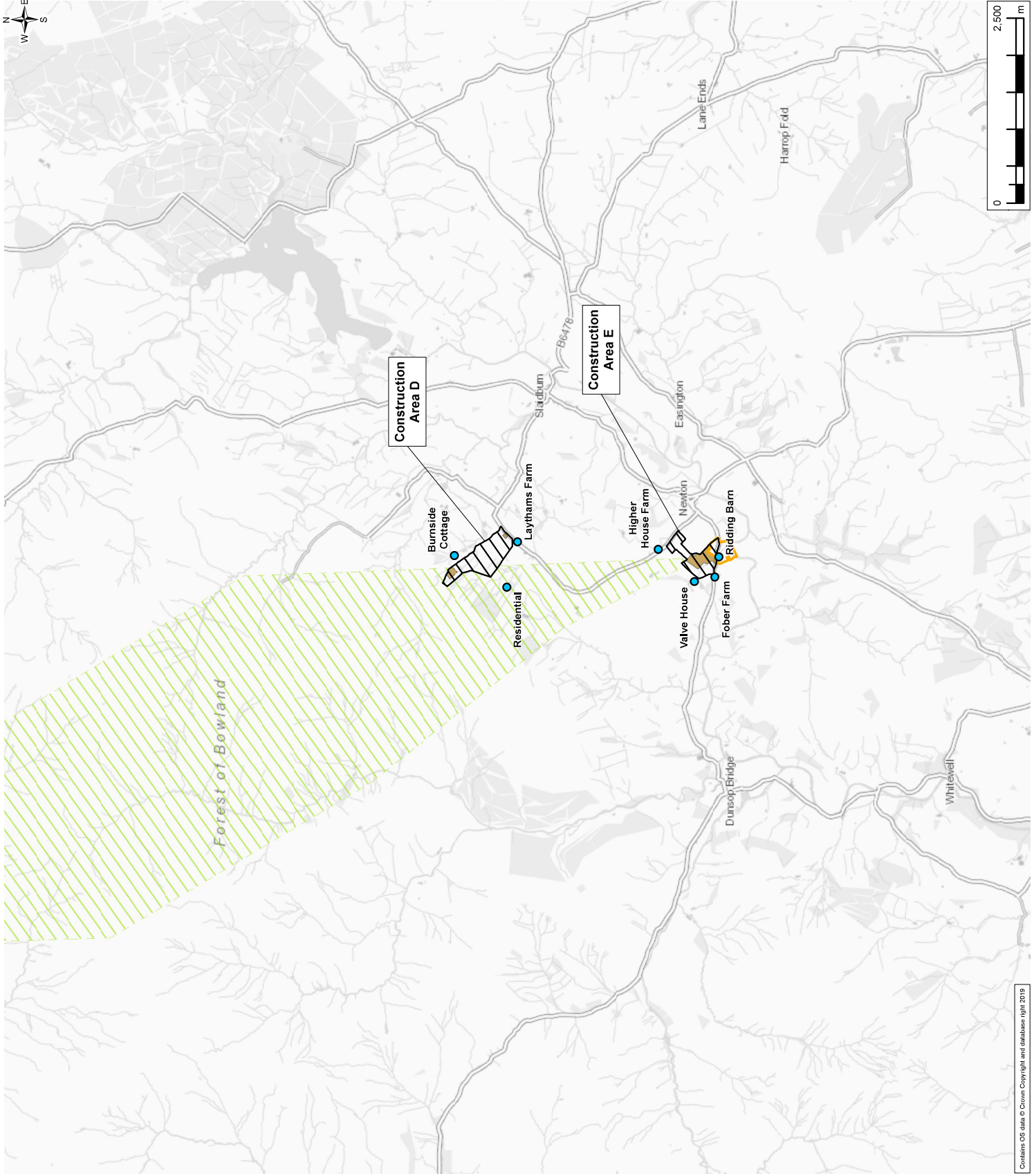


FIGURE 17.1

Legend

-  Proposed Tunnel Route - Indicative
 -  Proposed Construction Compound / Laydown Area - Indicative Development Envelope
 -  Proposed Indicative Construction Compound / Laydown Area
 -  Proposed Discharge Pipe - Indicative
- Constraints**
-  Proposed Baseline Noise Monitoring Location



Rev	Date	Initial Issue	LT	IM	SH	CS
0	OCT 19	Purpose of revision	Drawn	Checked	Rev'd	Approved

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Client: United Utilities
Project: HAMSWATER AQUEDUCT RESILIENCE PROGRAMME

Drawing Title: PROPOSED BASELINE NOISE MONITORING LOCATION PROPOSED BOWLAND SECTION SHEET 2 OF 2

Drawing Status:	FINAL
Scale:	1:50,000
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Client No.:	B27070CG_ESR_17_01

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18. Air Quality and Climate Change

18.1 Overview

- 674) This chapter presents the outcome of the scoping exercise in relation to the likely significant air quality effects of the Proposed Bowland Section. Air quality is a term relating to pollutant levels in ambient air and their potential effects on human health and wildlife habitats. The main pollutants of concern in the United Kingdom (UK) are associated with combustion emissions typically arising from vehicle traffic and industry, and are primarily oxides of nitrogen (NO_x), nitrogen dioxide (NO₂) and particulate matter (PM₁₀ and PM_{2.5}). In addition, air quality can be affected during construction by dust-generating activities.
- 675) In addition, the chapter considers the potential climate change effects of the Proposed Bowland Section, specifically in relation to greenhouse gas emissions, and also the resilience of the proposed infrastructure to climate change.
- 676) As part of the scoping exercise, a data review and desk study of the Proposed Bowland Section has been undertaken to establish existing air quality and scope the methodology within the indicative development envelopes.
- 677) The Proposed Bowland Section passes through the jurisdiction of: Lancaster City Council and Ribble Valley Borough Council, the competent authorities for air ambient air pollution management and control.
- 678) A review of publicly-available Local Air Quality Management (LAQM) reports from the relevant local authorities, along with GIS information provided by the Department for Environment, Food and Rural Affairs (Defra) for these locations, indicates that no Air Quality Management Areas (AQMAs) have been declared within or adjacent to the development envelopes of the Proposed Bowland Section.
- 679) This chapter provides a review of published Defra air quality data⁶⁶ in and around the Proposed Bowland Section and how these comply with Air Quality Strategy (AQS) Objectives for combustion related pollutants (NO_x, NO₂ and PM₁₀ and PM_{2.5}) (Table 18.1). Similarly, a review of Defra Pollution Climate Mapping data has been undertaken to establish whether there are any highways where predicted air pollutant levels will exceed European Union (EU) Limit Values in proximity to the indicative development envelopes.
- 680) The Objectives for other AQS pollutants are therefore unlikely likely to be exceeded along the alignment of the Proposed Bowland Section, with the exception of the more southern areas covered by Rossendale Borough Council and Bury Metropolitan Borough Council.

18.2 Proposed Methodology

- 681) The following section describes the proposed approaches for assessing air quality impacts arising from fugitive dust emissions and road traffic exhaust emissions. It also considers the resilience of the Proposed Bowland Section to climate change, and to greenhouse gas emissions.

18.2.1 Fugitive Dust from Construction Areas

- 682) A dust assessment is often undertaken using the Institute of Air Quality Management (IAQM) 'Guidance for the assessment of dust from demolition and construction' (IAQM, 2016), the outcome of which sets the level of mitigation needed (from high risk to low risk). It is expected that, in the absence of mitigation measures, fugitive dust could be generated through normal construction operations, and by the tracking of vehicles along unsealed haulage routes and on entering or leaving the public highway.
- 683) A dust assessment will not be undertaken, however, since it is assumed that any mitigation measures proposed in the ES will be sufficient to deal with high risk scenarios. Appropriate mitigation for fugitive dust emissions will however be considered in the CCoP to be presented in the ES.

18.2.2 Exhaust Emissions from Construction Vehicles

- 684) There is no directly relevant air quality assessment guidance for the water industry. Therefore, the assessment area and methodology for road traffic related emissions for both construction and operation will be defined based on guidance from DMRB, Volume 11, Section 3, Part 1 'Air Quality' (HA 207/07) (Highways

⁶⁶ <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html> accessed September 2019

Agency *et al.*, 2007) and associated Interim Advice Notes (IAN). DMRB criteria will be used to determine the extent of the air quality Affected Road Network (ARN) based on where:

- Road alignment will change by 5 m or more (this can include temporary haul routes)
- Daily traffic flows will change by 1,000 Annual Average Daily Traffic (AADT) or more
- Heavy Duty Vehicle (HDV) flows will change by 200 AADT or more
- Daily average speeds will change by 10 km/hour or more
- Peak hour speed will change by 20 km/hour or more.

685) The air quality assessment for road traffic will consider key receptors within 200 m of the ARN, the same ARN will be used to define the assessment area for both local air quality and regional air quality. The ARN is not defined in this Scoping Report, because traffic data was unavailable at the time of writing. Receptor results will be compared with Air Quality Objectives (AQOs) to assess any potential exceedances, their associated impact and whether the overall effect is significant. Where practicable, mitigation will be proposed.

686) The air quality assessment for road traffic will use the most recent version of the Defra Emissions Factor Toolkit and associated tools available at the start of the assessment. Where the existing baseline data indicates the potential for exceedances of the AQOs, then detailed dispersion modelling using ADMS-Roads will be undertaken for worst-case receptors. Where there is a low risk of exceedance of AQOs (e.g. the more rural areas such as the Proposed Bowland Section) then the DMRB drop off equation and a simple assessment (as detailed in HA 207/07) will be used for the dispersion modelling for worst case receptors. Dispersion modelled results will be added to the relevant years Defra background values to derive total concentrations. NO_x concentrations will be converted to NO₂ using the Defra NO_x to NO₂ tool.⁶⁷

18.2.3 Greenhouse Gas Emissions and Climate Change Resilience

687) Schedule 4 (5) of the EIA Regulations require that ESs should consider the impact of a proposed project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change.

688) Construction of the Proposed Bowland Section will require construction vehicle movements over a period of 12 months or more. The construction compounds may use diesel generating sets to provide power to plant and machinery at ground level and, potentially, the TBM below ground level. While the construction vehicles and generating sets would unavoidably release carbon dioxide in their exhaust emissions, the use of modern vehicles and generating sets, coupled with haulage strategies which aim to minimise the length of haulage routes on the road network, would minimise greenhouse gas emissions to the lowest practicable levels. It is therefore proposed to de-scope greenhouse gas emissions from construction-phase plant and haulage vehicles.

689) Embedded carbon in construction materials, especially the tunnel lining and pre-fabricated shaft linings, would be an unavoidable element of the carbon balance for the Proposed Bowland Section. The selection of the materials for the tunnel lining would be driven in the first instance by the resilience of the operational aqueduct and security of water supply. It is unlikely that embedded carbon could be used to differentiate significantly between the narrow range of materials which could be used to construct the tunnel and shafts. It is therefore proposed that the carbon performance of construction materials is de-scoped from the EIA.

690) The Proposed Bowland Section, forming part of the Proposed Programme of Works, would be gravity-fed during its operational phase. There would be no energy-consuming plant or machinery required to pump water along the operational aqueduct. Greenhouse gas emissions would be limited to inconsequential transport movements and materials usage during routine operations and maintenance activities, such as inspections of the valve houses. For this reason, the consideration of operational greenhouse gas emissions will be de-scoped from the EIA.

691) The Proposed Bowland Section will be designed to be resilient to future climate scenarios, particularly extreme weather events which could potentially damage key infrastructure. Climate change risks could pose threats to the aqueduct itself, or to local communities and environmental resources should the asset itself be

⁶⁷ <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html> accessed September 2019

breached by, for example, an extreme flood event. The ES will therefore provide details of how the proposed design will mitigate these risks over the lifetime of the asset.

18.3 Proposed Assessment Criteria

692) Highways England's IAN 174/13 (Highways Agency, 2013b) defines how the significance of air quality concentrations from road traffic can be reported. The approach identifies and assesses sensitive 'receptors' near roads where air quality might be adversely affected. Consequently, areas where AQOs are already exceeded, or are close to being breached (such as AQMAs), are considered.

693) Air quality assessment results will be used to identify locations exceeding the relevant AQOs, defined in Table 18.1 below, under 'do minimum' and 'do something' scenarios for the construction phase (where relevant). Only the sensitive receptors identified under IAN 174/13 would be considered in the assessment of significance. The change in predicted concentrations would be calculated as the difference between the 'do minimum' and 'do something' model results at these locations.

Table 18.1: Air Quality Objectives (AQOs)

Pollutant	Threshold Concentration ($\mu\text{g}/\text{m}^3$)	Averaging Period
Nitrogen dioxide (NO_2) (for human health)	40	Annual Mean
	200	1-hour mean, not to be exceeded more than 18 times per year (equivalent to the 99.79 th percentile of hourly mean)
Particulate Matter (PM_{10}) (for human health)	40	Annual Mean
	50	24-hour mean, not to be exceeded more than 35 times per year (equivalent to the 90.4 th percentile of the 24-hour means)
Nitrogen oxides (NO_x) (for vegetation and ecosystems)	30	Annual Mean
Particulate Matter ($\text{PM}_{2.5}$) (for human health)	25	Annual Mean (exposure reduction target)

694) Where the difference in concentrations are less than or equal to 1 % of the AQO (e.g. less than or equal to $0.4 \mu\text{g}/\text{m}^3$ for annual average NO_2) then the change at these receptors is considered to be imperceptible and can be scoped out of the judgement on significance. Note that for NO_x , the difference is considered to be insignificant where the difference in concentrations are less than or equal to $0.4 \mu\text{g}/\text{m}^3$ for an annual average.

695) Highways England has developed a framework to provide guidance on the number of receptors for each of the magnitude of change categories that might result in a significant effect. These are guideline values only and are to be used to inform professional judgement on the significant effects of the Proposed Bowland Section.

696) A receptor with a predicted change in concentration greater than 'imperceptible' (i.e. greater than a magnitude of $0.4 \mu\text{g}/\text{m}^3$) is assigned to one of six categories (large, medium and small for either worsening or improvement) where there is a predicted AQO exceedance. If any exceedances are predicted, the number of receptors in each category are compared to guideline ranges provided in IAN 174/13⁶⁸. Where the number of receptors falls below, or is equal to, the lower value of the range in a given category, it is considered that the Proposed Bowland Section is unlikely to have a 'significant' effect. Where values are equal to or greater than the upper limit of the range for a given category, the Proposed Bowland Section is likely to cause a 'significant' effect. Where values lie between the guideline ranges for a given category, further consideration

⁶⁸ Interim Advice Note 174/13 Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 'Air Quality (HA207/07), Highways Agency 2013.

based on a balanced judgement of the overall impacts across the whole assessment area has been undertaken. This includes consideration of both worsening and improvement.

18.4 Existing Conditions

18.4.1 Assessment area

697) The process of scoping commenced with the definition of a preliminary assessment area within which existing air quality could be evaluated to assist in the identification of potential effects. The preliminary area for the scoping extends to all areas within 2 km of the indicative development envelope as shown on Figure 3.2. It is acknowledged however that road haulage routes for the Proposed Programme of Works in general could extend well beyond the immediate vicinity of the indicative development envelope. This will need to be considered further once the tunnelling strategy and surplus material haulage strategy have both been further developed.

698) The Proposed Bowland Section falls within the jurisdiction of Lancaster City Council and Ribble Valley Borough Council. Local Authorities have a responsibility to fulfil the requirements for compliance with the air quality legislation and to meet the Air Quality Objectives (AQO). These are concentration levels set for the protection of human health and sensitive vegetation and ecosystems and are depicted in Table 18.1.

18.4.2 Information Sources

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

- Lancaster City Council 2018 Air Quality Annual Status Report, October 2018 (Lancashire County Council, 2018)
- Ribble Valley Borough Council 2018 Air Quality Annual Status Report, April 2018 (RVBC, 2018)
- Defra AQMA maps (Defra, July 2019) (<https://uk-air.defra.gov.uk/aqma/maps>)
- Background concentration data (base year 2017) published by Defra (<http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html>)
- Designated sites from:
 - Special Areas of Conservation (<https://data.gov.uk/dataset/a85e64d9-d0f1-4500-9080-b0e29b81fbc8/special-areas-of-conservation-england>)
 - Special Protection Areas (<https://data.gov.uk/dataset/174f4e23-acb6-4305-9365-1e33c8d0e455/special-protection-areas-england>)
 - Sites of Special Scientific Interest (<https://data.gov.uk/dataset/5b632bd7-9838-4ef2-9101-ea9384421b0d/sites-of-special-scientific-interest-england>)
 - Ramsar (<https://data.gov.uk/dataset/67b4ef48-d0b2-4b6f-b659-4efa33469889/ramsar-england>)
- Defra Pollution Climate Mapping data (<https://uk-air.defra.gov.uk/library/no2ten/2019-no2-pm-projections-from-2017-data>).

18.4.3 Local Authority monitoring and AQMAs

Lancaster City Council

700) The Lancaster City Council district comprises of varied land use including agriculture, industrial, urban and residential sectors, which contribute to the pollutant concentrations across the district.

701) Lancaster City Council has declared three Air Quality Management Area (AQMAs); City of Lancaster AQMA, Carnforth AQMA and Galgate AQMA, approximately 15 km west, 14 km north-west and 17 km south-west respectfully, from the Proposed Bowland Section. Carnforth and Galgate are declared for annual mean exceedances in NO₂, whereas Lancaster AQMA is declared for annual and hourly exceedances in NO₂. These breaches are a result of traffic emissions. Due to the large distances to the Proposed Bowland Section they are unlikely to be affected. NO₂ concentrations have reduced in recent years within AQMAs for Lancaster City Council. Monitoring will continue and if the concentrations continue to decline then the local

authority may consider revoking the AQMA. In terms of the diffusion tube NO₂ monitoring data, Lancaster City Council reported nine exceedances at tubes; L, J, LC2, LC20, LC1, LC32, LC11, LC19 and LC10 for 2017. All of these diffusion tubes are located in the City of Lancaster AQMA approximately 15 km from the Proposed Bowland Section. The highest NO₂ concentration for 2017 was reported at LC10 with a concentration of 62 µg/m³.

- 702) Continuous and non-automatic monitoring is undertaken across Lancaster City Council district. The annual mean and one hour mean NO₂ concentrations measured at continuous monitors (located at Cable Street, Lancaster (AN1) and Dalton Square, Lancaster (AN2)) are below AQOs and there has been a decreasing trend in concentrations in recent years. Lancaster City Council are also responsible for a diffusion tube monitoring programme across the district. Diffusion tubes are located where concerns relating to air quality have been raised or new initiatives have been set up. It is understood that there is no air quality monitoring in close proximity to the Proposed Bowland Section, with the nearest tube over 14 km away.
- 703) Particulates (PM₁₀) is monitored at Cable Street, Lancaster (APM1)). This is a roadside site in character with reported concentrations well below the annual mean and daily mean AQOs. The site is approximately 15 km east from the Proposed Bowland Section.

Ribble Valley Borough Council (RVBC)

- 704) The RVBC district comprises of varied land use including agriculture, industrial, urban and residential sectors, which contribute to the pollutant concentrations across the district.
- 705) RVBC currently has one declared AQMA, Whalley Road Clitheroe AQMA which is approximately 10 km south south-east to the Proposed Bowland Section. Whalley Road Clitheroe AQMA is declared for annual mean exceedances in NO₂. NO₂ concentrations have reduced in recent years within the AQMA. Monitoring will continue and if the concentrations continue to decline then the local authority may consider revoking the AQMA. In terms of the diffusion tube NO₂ monitoring data, there are no NO₂ exceedances reported at diffusion tubes within the AQMA for 2017. The highest reported NO₂ concentration is 37.6 µg/m³ located approximately 10.2 km south-east of the scheme.
- 706) There is currently only non-automatic monitoring undertaken by RVBC across the district. RVBC are responsible for a diffusion tube monitoring programme across the district. Diffusion tubes are located where concerns relating to air quality have been raised or new initiatives have been set up. It is understood that there is no air quality monitoring in close proximity to the Proposed Bowland Section.

18.4.4 Pollution Climate Mapping (PCM)

- 707) The Pollution Climate Mapping (PCM) model is run by Ricardo-AEA on behalf of DEFRA and is designed to fulfil part of the UK's EU Directive (2008/50/EC) requirements to report on the concentrations of pollutants in the atmosphere. Modelled PCM NO₂ concentrations are provided for a 2017 base year and projected to future years at representative roads throughout the UK.
- 708) The ARN for the Proposed Bowland Section is not yet defined. However, the closest PCM links to the scheme in the DEFRA PCM model are A683, approximately 14.3 km east of the proposed scheme and A671 approximately 8.5 km south-south east. These roads have a value of 28.3 µg/m³ and 17.9 µg/m³ respectively in 2019.

18.4.5 Designated Biodiversity Sites

- 709) Designated sites are published by Natural England and GIS data was used to identify any sites within 2 km of the scheme that may be affected. Identified designated sites and their distances from the Proposed Bowland Section are shown in Table 18.2.

Table 18.2: Designated Biodiversity Sites

Site Name	Designation	Approximate distance from the Proposed Site (km)
Bell Sykes Meadows	SSSI	2.2
Bowland Fells	SSSI / SPA / SPA	1

Site Name	Designation	Approximate distance from the Proposed Site (km)
Myttons Meadows	SSSI	0.7
Roeburndale Woods	SSSI	2.0
Far Holme Meadow	SSSI	0.8
North Pennine Dales Meadows	SAC	0.7

18.4.6 Background mapping

710) DEFRA mapped 1 km x 1 km grid background pollutant concentrations encompassing the Proposed Bowland Section and surrounding area presented in Table 18.3 for 2019 to show the range of estimated concentrations including and surrounding the Proposed Bowland Section. All pollutant concentrations are well within AQOs.

Table 18.3: Mapped background annual mean pollutant concentrations

Pollutant	Background concentration ($\mu\text{g}/\text{m}^3$)
NO ₂	3.9 to 4.8
NO _x	5.0 to 6.1
PM ₁₀	7.5 to 8.2
PM _{2.5}	5.2 to 5.6

18.5 Potential Effects

711) Scoping has identified that potentially significant air quality effects could occur during the construction phase. These would derive from pollutants associated with the operation of construction vehicles, plant and machinery. Emissions of NO_x, NO₂, PM₁₀ and PM_{2.5} from construction vehicles could lead to local air quality impacts on main haulage routes both within the indicative development envelopes and on local roads. At this stage of the design process, the haulage routes along local roads to the strategic road network have not been identified. Therefore the spatial scope of the air quality assessment is confined to 200 m beyond ARNs in proximity to the indicative envelopes. As further information on the road haulage strategy becomes available, the extent of the assessment area will be revised to reflect this.

712) Dust deposition can occur when particulate matter is generated and/or dispersed from construction areas, and can lead to loss of amenity and nuisance. Dust deposition associated with construction may lead to nuisance (soiling of surfaces) at sensitive properties, or impacting vegetation at sensitive ecological sites.

713) Although dust can cause significant air quality effects, it can also be effectively mitigated at source through the adoption of dust suppression practices within the construction site. The CCoP in the ES will make a commitment to the control of fugitive dust emissions to acceptable levels during the construction phase. Fugitive dust emissions have therefore been descoped from the later stages of the EIA.

714) While operational impacts could be associated with combustion emissions, should generators or other relevant plant be installed, these are likely to be inconsequential and will therefore also be discounted from the EIA. Although vehicles would be used to access points on the Proposed Bowland Section during its operation phase, these would be very few in number and would relate to routine operations and maintenance activities. The effects of exhaust emissions from operational phase vehicles would be insignificant.

18.6 Summary Scope for the EIA

715) Table 18.4 below summarises the outcome of the scoping exercise and indicates which potential air quality effects have been scoped into and out of the EIA.

Table 18.4: Summary of scoping exercise

Receptor group	Matter / potential effects	Location within assessment area	Comments
Residential receptors within 200 m of ARN	Road traffic during construction.	Not known at this stage but could extend a considerable distance beyond the immediate extent of the indicative development envelopes.	Scoped in, will depend on changes in traffic data on the local road network.
Ecological receptors within 200 m of ARN	Road traffic during construction.	Not known at this stage.	Scoped in, will depend on changes in traffic data on the local road network.
Residential receptors within 200 m of ARN	Road traffic during operation.	Routine operation and maintenance activities at points along the aqueduct.	Scoped out, very low traffic flows associated with operations and maintenance.
Ecological receptors within 200 m of ARN	Road traffic during operation.	Not known at this stage.	Scoped in, will depend on changes in traffic data on the local road network – will probably be scoped out based on road traffic.
Human receptors	Demolition, construction, earthworks.	Within 350 m from construction boundary.	Scoped out as effective standard mitigation measures are available to avoid adverse significant effects.
Ecological receptors	Demolition, construction, earthworks.	Within 50 m from construction boundary.	Scoped out as effective standard mitigation measures are available to avoid adverse significant effects.
Ecological receptors	Trackout.	Up to 50 m away from trackout routes (with trackout routes extending up to 500 m from the construction boundary).	Scoped out as effective standard mitigation measures are available to avoid adverse significant effects.