

# A1 in Northumberland: Morpeth to Ellingham

**Scheme Number: TR010059**

## **7.9.1.1 Culvert Mitigation Strategy**

Rule 8(1)(c)

Planning Act 2008

Infrastructure Planning (Examination Procedure) Rules 2010

Infrastructure Planning

Planning Act 2008

**The Infrastructure Planning  
(Examination Procedure) Rules  
2010**

**The A1 in Northumberland: Morpeth to  
Ellingham**

Development Consent Order 20[xx]

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**Culvert Mitigation Strategy**

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# 1 CULVERT MITIGATION STRATEGY

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## 1.1 REVISION HISTORY

- 1.1.1. Initial Submission (Rev 0) Deadline 1 [REP1-066] – Prepared to aid the Environment Agency in their review of the Water Framework Directive Assessments – Part A [APP-255] and Part B [APP-312] and the Road Drainage and Water Environment ES Chapters – Part A [APP-050] and Part B [APP-051].
- 1.1.2. Revision 1 (Rev 1) Deadline 5 [REP5-022] – Revised to incorporated information on natural beds proposed within the culverts and removal of marginal planting as a mitigation measure. The terminology was changed in relation to riparian woodland (from wet woodland) with the associated proposed extents changed from being reported as m<sup>2</sup> to m. This was to enable refined discussions with the Environment Agency.
- 1.1.3. Revision 2 (Rev 2) Deadline 8 [REP8-023] – Revised to reflect the outcomes from the discussions with the Environment Agency. The updates incorporated:
- Refinements to the lengths of the riparian woodland planting, incorporating the latest Scheme design parameters;
  - Removal of the justification for the provision of the depth of natural beds within the culverts, as agreement has been reached, (this information remains detailed in the Water Framework Directive Assessments – Part A [APP-255] and Part B [APP-312]);
  - Updates to the depth of the natural bed at two culverts (Earsdon Burn and the River Lyne), to reflect the agreement reached with the Environment Agency; and
- 1.1.4. Inclusion of a watercourse specific mitigation and compensation plan to demonstrate the spatial location of the measures committed to within the Culvert Mitigation Strategy.

## 1.2 INTRODUCTION

- 1.2.1. The Culvert Mitigation Strategy has been updated and enhanced at Deadline 11 (Rev 3), to reflect the discussions with the Environment Agency on the depth of the natural bed proposed within the culverts on the River Lyne and the Earsdon Burn and to ensure the measures fully align with those within the Outline Construction Environmental Management Plan [REP10-025 and 026] (as updated at Deadline 11).



Key	Not included in biodiversity assessment	Included in biodiversity assessment	No changes to the baseline scenario	Baffles to installed as part of the scheme
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Watercourse	Watercourse Characteristics					Existing Structures				Proposed Structures					Commentary	Proposed Bed Depth	
	WFD Waterbody	WFD Monitored Waterbody	Upstream Catchment Size (km <sup>2</sup> )	Low Flow Q95 (m <sup>3</sup> /s)	1 in 2 Year Flow (m <sup>3</sup> /s)	Watercourse Description	Structure	Length (m)	Dia. (m)	Features	Structure (Ref no.)	Length (m)	Dia. (m)	New culvert or extension			Features
Part A																	
Cotting Burn (Section 4 in WFD Assessment Part A (APP-255))	Wansbeck from Font to Bothal Burn	Y	0.75	0.001	0.51	- Ordinary watercourse. - River bed comprises clay and silt material. - Aquatic ecology survey identified watercourse as unsuitable habitat for fish. - No evidence of otter was identified during baseline mammal surveys. - Septic tank outfalling into watercourse.	Circular culvert	28	0.3	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Circular culvert	28	0.3	Unchanged	No changes to baseline.	✓ Total length of culverts are reduced by 0.4m. ✓ Gravel bed introduced in all culvert replacements. ✓ Approx. 15m length of riparian woodland will be planted along Cotting Burn.  Highly unlikely that Cotting Burn would be a suitable habitat for fish so no baffles or low flow channel provided.  No changes proposed to existing culverts beneath A1.  Mammal passage has not been provided in the replacement culverts beneath the private access road due to the likely low risk of mammal casualty and with low road usage.	250mm
							Circular culvert	41	0.9	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Circular culvert	41	0.9	Unchanged	No changes to baseline.		
							Circular culvert	7	0.35	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Box culvert (Ref 1.4)	12.8	H - 1.25 W - 2.7	Replacement culvert	Natural gravel bed - Y Baffles - N Low flow channel - N Mammal ledge - N		
							Circular culvert	4	0.35	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Box culvert (Ref 1.5)	12.8	H - 1.2 W - 3.0	Replacement culvert	Natural gravel bed - Y Baffles - N Low flow channel - N Mammal ledge - N		
							Circular culvert	15	0.45	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N Culvert blocked and assessed to be in poor condition during site visit.							
Shieldhill Burn (Section 5 in WFD Assessment Part A (APP-255))	N	0.94	0.001	0.24	- Ordinary watercourse. - Aquatic ecology survey identified watercourse as unsuitable habitat for fish. - No evidence of otter was identified during baseline mammal surveys. - Heavily modified with various piped and culverted sections. - Realigned along field boundaries in straight and trapezoidal channel. - Flow directed to 300mm dia pipe immediately downstream of culvert and conveyed below ground for c.210m.	Arch culvert	30	H - 1.0 W - 1.2	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Circular culvert (Ref 1A)	43.4	1.2	Replacement culvert	Natural gravel bed - Y Baffles - N Low flow channel - N Mammal ledge - N	✓ Gravel bed introduced in replacement culvert. ✗ Total length of culvert is increased by 13.4m.  Highly unlikely that Shieldhill Burn would be a suitable habitat for fish so no baffles or low flow channel provided.  Wildlife culvert provides free passage to mammals except when in times of flood.	150 mm	
										Wildlife culvert (Ref 1B)	48.5	0.6	New wildlife culvert	Provision of a separate 600mm diameter wildlife culvert.			
												Wansbeck from Font to Bothal Burn - WFD Waterbody Summary:	✗ Total length of culvert within the WFD waterbody is increased by 13m. ✓ Gravel bed introduced in all replacement culverts. ✓ Approximately 15m of new riparian woodland will be planted along the banks of Cotting Burn.				

Watercourse	Watercourse Characteristics					Existing Structures				Proposed Structures				Commentary	Proposed Bed Depth		
	WFD Waterbody	WFD Monitored Waterbody	Upstream Catchment Size (km <sup>2</sup> )	Low Flow Q95 (m <sup>3</sup> /s)	1 in 2 Year Flow (m <sup>3</sup> /s)	Watercourse Description	Structure	Length (m)	Dia. (m)	Features	Structure (Ref no.)	Length (m)	Dia. (m)			New culvert or extension	Features
Floodgate Burn (Section 6 in WFD Assessment Part A [APP-255])  In Biodiversity Net Loss Assessment	N	2	0.001	1.25	- Ordinary watercourse. - River bed comprises clay and silt material. - Aquatic ecology survey identified 3-spined stickleback. - No evidence of otter was identified during baseline mammal surveys. - Realigned along field boundaries in predominantly straightened trapezoidal channel, although evidence of natural adjustment.	Arch culvert	26	H - 1.0 W - 1.9	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Circular culvert (Ref 3)	32.7	1.8	Replacement culvert	Natural gravel bed - Y Baffles - N Low flow channel - N Mammal ledge - Y	<ul style="list-style-type: none"> <li>✓ Gravel bed introduced in replacement culvert.</li> <li>✓ Mammal ledge introduced in replacement culvert.</li> <li>✓ Approx. 240 m length of new riparian woodland planted along Floodgate Burn.</li> <li>✱ Total length of culverts is increased by 6.7m.</li> </ul>	150mm	
						Circular culvert	7	0.9	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Circular culvert	7	0.9	Unchanged	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N		Low flow channel and baffles not feasible due to design constraints for the culvert.	
River Lyne (Section 7 in WFD Assessment Part A [APP-255])  In Biodiversity Net Loss Assessment	Y	8.27	0.006	4.72	- Ordinary watercourse. - River bed comprises gravels and sands. - Aquatic ecology survey identified 3-spined stickleback and bullhead species. - No evidence of otter was identified during baseline mammal surveys.					Box culvert (Ref 4)	53	H - 3.75 W - 4.0	New culvert	Natural gravel bed - Y Baffles - N Low flow channel - Y Mammal ledge - Y	<ul style="list-style-type: none"> <li>✓ Gravel bed, low flow channel and mammal ledge included in new culvert.</li> <li>✓ Improvement to fish passage through existing culvert by inclusion of baffles.</li> <li>✓ Approx. 90m length of new riparian woodland planted along River Lyne.</li> <li>✱ Total length of culverts is increased by 53m.</li> </ul> <p>The culvert will be designed to include a minimum natural bed depth of 200mm, with the low flow channel provided in a notch or via the provision of a deeper / wider section of natural bed to create the low flow channel (minimum 300mm) should a culvert without a notch be chosen.</p>	200mm (minimum in low flow channel, otherwise 300mm).	
						Circular culvert inlet and arch culvert outlet	34	H - 2.66 W - 1.95	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Circular culvert inlet and arch culvert outlet	34	H - 2.66 W - 1.95	Unchanged, but with addition of baffles	Natural gravel bed - N Baffles - Y Low flow channel - N Mammal ledge - N			
Tributary of Fenrother Burn (Section 8 in WFD Assessment Part A [APP-255])	N	3	0.001	2.06	- Ordinary watercourse. - River bed comprises clay. - Aquatic ecology survey identified watercourse as unsuitable habitat for fish. - No evidence of otter was identified during baseline mammal surveys. - Realigned along field boundaries, with long, straight, over deepened sections and trapezoidal channel.	Circular culvert	120	0.5	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Culvert to be infilled							
										Twin box culvert (Ref 5.2)	33.1	H - 1.25 W - 2x1.5	New culvert	Natural gravel bed - Y Baffles - N Low flow channel - N Mammal ledge - N	<ul style="list-style-type: none"> <li>✓ Total length of culverts is reduced by 34.2m.</li> <li>✓ 429m of new improved watercourse channel being created to avoid further culverting.</li> <li>✓ Gravel bed introduced in all culverts.</li> </ul> <p>Low flow channel and baffles not feasible due to design constraints for the culverts.</p> <p>Wildlife culvert provides free passage to mammals.</p>	250mm	
										Box culvert (Ref 5.3)	52.7	H - 1.75 W - 3.0	New culvert	Natural gravel bed - Y Baffles - N Low flow channel - N Mammal ledge - N		250mm	
										Realigned watercourse channel	429	Similar channel width to existing	Realignment of watercourse	Design of new channel would maintain similar channel width to existing to mimic baseline conditions, but with boulders placed in new channel to provide improved varied substrate features and flow dynamics and assist movement of aquatic species. Channel planted with aquatic vegetation consistent with existing floral community of the watercourse/catchment.			
				Wildlife culvert (Ref 5.4)	55	0.6	New wildlife culvert	Provision of a separate 600mm diameter wildlife culvert.									

Watercourse	Watercourse Characteristics					Existing Structures				Proposed Structures				Commentary	Proposed Bed Depth		
	WFD Waterbody	WFD Monitored Waterbody	Upstream Catchment Size (km <sup>2</sup> )	Low Flow Q95 (m <sup>3</sup> /s)	1 in 2 Year Flow (m <sup>3</sup> /s)	Watercourse Description	Structure	Length (m)	Dia. (m)	Features	Structure (Ref no.)	Length (m)	Dia. (m)			New culvert or extension	Features
Earsdon Burn (Section 9 in WFD Assessment Part A [APP-255])  In Biodiversity Net Loss Assessment	Lyne from Source to Tidal Limit	N	4.2	0.003	2.87	- Ordinary watercourse. - River bed comprises gravels. - Aquatic ecology survey identified watercourse as unsuitable for fish. - Mammal survey identified the presence of otters. - Upstream sections have more natural planform although downstream in vicinity of A1 has reduced sinuosity and straightened channel.	Triple circular pipes	10	3x 0.45, 0.65, 0.65	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Triple circular pipes	10	3x 0.45, 0.65, 0.65	Unchanged	No changes to baseline.	✓ Gravel bed included in new culverts. ✓ Mammal ledge included in new culverts. ✗ Total length of culverts is increased by 47.2m.  Within the new culvert a low flow channel with a natural bed of 150mm will be provided and if a low flow channel is not possible, then the depth of the natural bed needs to be a minimum of 300mm.	150mm (minimum in low flow channel, otherwise 300mm).
							Bridge	29	W - 5.8	Natural gravel bed - Y Baffles - N Low flow channel - N Mammal ledge - N	Bridge	29	W - 5.8	Unchanged	No changes to baseline.		150mm (minimum in low flow channel, otherwise 300mm).
							Box culvert	32	W - 3.0	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Box culvert	32	W - 3.0 H - 2.1	Unchanged	No changes to baseline.		150mm (minimum in low flow channel, otherwise 300mm).
							Box culvert (Ref 6.2)	36.2	H - 2.1 W - 3.0	New culvert	Natural gravel bed - Y Baffles - N Low flow channel - N Mammal ledge - Y	Box culvert (Ref 6.3)	11	H - 2.1 W - 3.0	New culvert		Natural gravel bed - Y Baffles - N Low flow channel - N Mammal ledge - Y
Tributary of Earsdon Burn (Section 9 in WFD Assessment Part A [APP-255])	N	Not calculated	Not calculated	Not calculated	- Minor ordinary watercourse. - Catchment <0.5km <sup>2</sup> . Likely to be ephemeral. - Aquatic ecology survey identified watercourse as unsuitable habitat for fish. - Realigned along field boundaries.					Circular culvert (Ref 7.1)	148	1.6	New culvert	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	0		
										Circular culvert (Ref 7.2)	9	1.6	New culvert	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	0		
										Realigned watercourse channel	240	Similar channel profile to existing	Realignment of watercourse	Design of new channel would maintain similar channel dimensions to mimic baseline conditions, but with boulders placed in new channel to provide improved varied substrate features and flow dynamics. Channel planted with aquatic vegetation consistent with existing floral community of the watercourse/catchment.	✓ Realignment and improvement of 240m of the unnamed tributary to avoid further culverting. ✗ Total length of culverts is increased by 157m.  Insufficient baseflow to support fish so no gravel bed, baffles or low flow channel provided.  Culvert does not pass beneath A1 and only passes beneath private access track. Risk of casualty low so no mammal ledge provided.		
Lyne from Source to Tidal Limit - WFD Waterbody Summary:															✗ Total length of culvert within the WFD waterbody is increased by 231.5m. ✓ Gravel bed introduced in all replacement and new culverts (with exception of minor tributary). ✓ Mammal ledge provided in new Earsdon Burn culverts (only watercourse identified to support otter). ✓ Approximately 670m of watercourse created to avoid excessive culverting, and design of watercourse will offer improvement to the baseline flow dynamics and planting. ✓ Approximately 330m of new riparian woodland will be planted along River Lyne, tributary of Fenrother Burn and Floodgate Burn.		



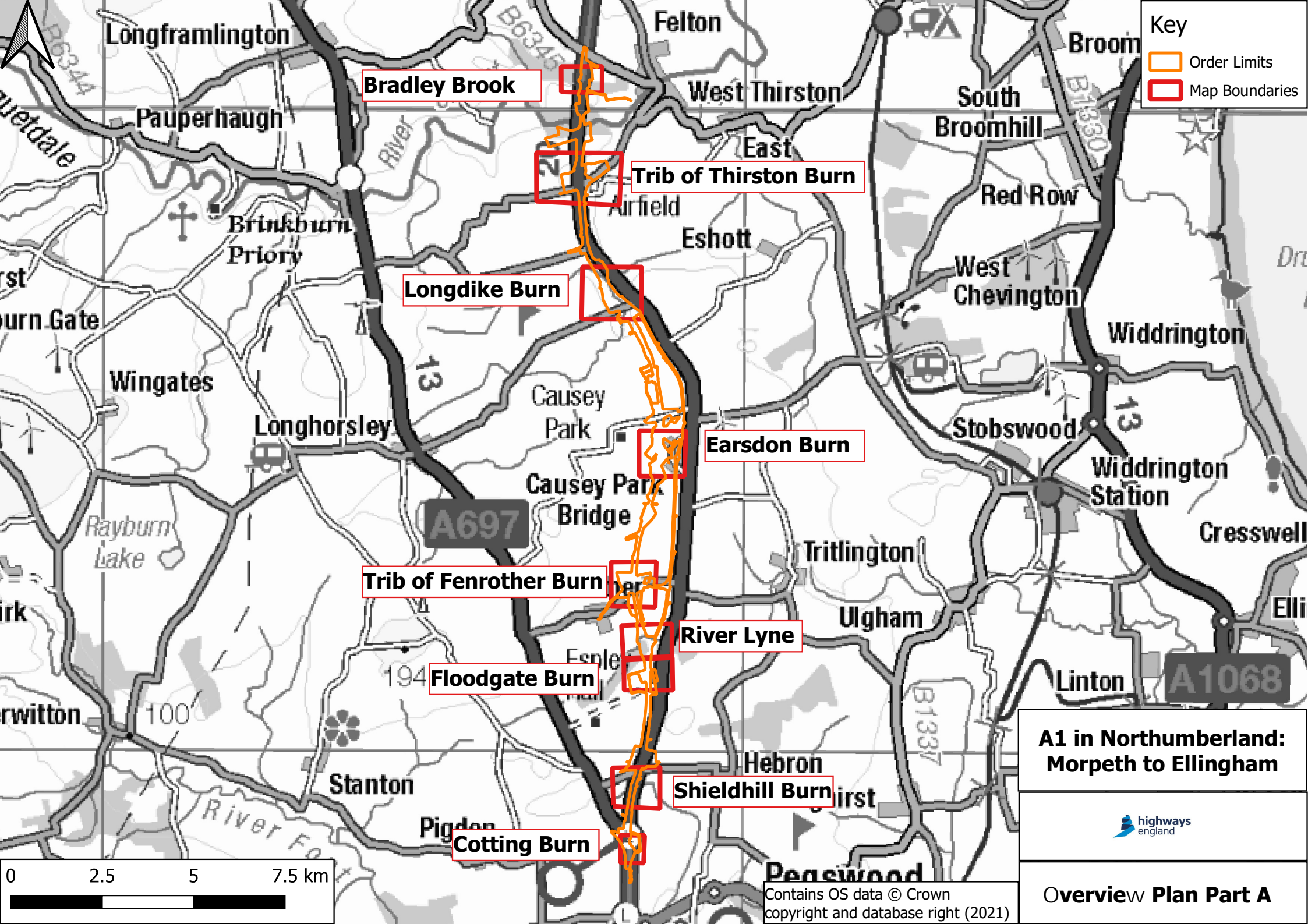
Watercourse	Watercourse Characteristics					Existing Structures				Proposed Structures				Commentary	Proposed Bed Depth		
	WFD Waterbody	WFD Monitored Waterbody	Upstream Catchment Size (km <sup>2</sup> )	Low Flow Q95 (m <sup>3</sup> /s)	1 in 2 Year Flow (m <sup>3</sup> /s)	Watercourse Description	Structure	Length (m)	Dia. (m)	Features	Structure (Ref no.)	Length (m)	Dia. (m)			New culvert or extension	Features
Wildlife passage (Measure EM027, Table 9-23 of Chapter 9: Biodiversity Part A [APP-048])		N	n/a	n/a	n/a	No watercourse					Wildlife culvert (Ref 8A)	51	1.5	New wildlife culvert	Mammal and bat passage.	✓ Wildlife culvert to provide free mammal passage beneath A1.	
Longdike Burn (Section 10 in WFD Assessment Part A [APP-255]) In Biodiversity Net Loss Assessment	Longdike Burn Catchment (trib of Coquet)	Y	23.4	0.014	11.36	- Main river. - River bed comprises silts and gravels. - Brown trout, lamprey and European eel were identified during the fish surveys. - Mammal survey identified the presence of otter along Longdike Burn. - Predominantly sinuous planform. - Outlet of Burgham culvert (Ref 10.1) perched above bed level.	Arch culvert	30	H - 4.8 W - 3.4	Natural gravel bed - N Baffles - Y Low flow channel - N Mammal ledge - N	Arch culvert (Ref 10.1)	30	H - 4.8 W - 3.4	Unchanged	Natural gravel bed - N Baffles - Y (Existing timber baffles replaced) Low flow channel - N Mammal ledge - Y	✓ Improvements to existing baffles to facilitate fish passage and provide a longer term solution / more robust arrangement. ✓ Improvements to mammal passage. ✓ Approx. 650m length of improvements along Longdike Burn. ✗ Total length of bridge is increased by 34.2m.	
Unnamed ditch of Longdike Burn (Section 10 in WFD Assessment Part A [APP-255])		N	Not calculated	Not calculated	Not calculated	- Minor ordinary watercourse. - Catchment <0.5km <sup>2</sup> . Likely to be ephemeral. - Watercourse unsuitable habitat for fish. - Aligned along field boundaries.					Triple circular culvert (Ref 13.1)	56	3 x 0.45	New culvert	Culvert conveys small ephemeral ditch that discharges into the Longdike Burn. No mitigation proposed.	✗ Total length of culvert along unnamed ditch of Longdike Burn is increased by 56m although this is a small ephemeral watercourse.	0
Tributary of Thirston Burn (Section 11 in WFD Assessment Part A [APP-255])		N	0.7	0.002	0.02	- Ordinary watercourse. - Aquatic ecology survey identified watercourse as unsuitable habitat for fish. - No evidence of otter was identified during baseline mammal surveys. - Modified channel in straight, over deepened and trapezoidal channel.	Circular culvert	24.3	1.2	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Circular culvert (Ref 14)	47.6	1.35	Culvert extension	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	✗ Total length of culvert is increased by 23.2m. Low flow channel and natural bed not feasible due to the existing culvert constraints.	0
																<ul style="list-style-type: none"> <li>✗ Total length of culvert within the WFD waterbody is increased by 79.2m.</li> <li>✗ Total length of bridge within the WFD waterbody is increased by 34.2m.</li> <li>✓ Improvements to existing baffles on Longdike Burn to facilitate fish passage.</li> <li>✓ Mammal ledge provided in Longdike Burn culverts (only watercourse identified to support otter).</li> <li>✓ Approximately 650m length of Longdike Burn will be improved to include:                             <ul style="list-style-type: none"> <li>•Riparian woodland planting (subject to detailed design this could include native tree species)</li> <li>•Enhancements to an existing berm with suitable planting particularly wetland tolerant / amphibious vegetation.</li> <li>•Aquatic macrophyte planting to compliment the riparian planting and enhancements to the berm feature.</li> <li>•Understorey planting (this may be beneficial along other parts of the reach) this could include amphibious or reeds or rushes.</li> </ul> </li> </ul>	
Bradley Brook (Section 13 in WFD Assessment Part A [APP-255]) In Biodiversity Net Loss Assessment	Coquet from Forest Burn to Tidal Limit	N	0.5	0.001	0.04	- Ordinary watercourse. - River bed comprises silt gravels. - No fish identified during aquatic ecology survey. - No evidence of otter was identified during baseline mammal surveys.	Circular culvert	125	1.2 to 0.9	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Circular culvert (Ref 16)	145	0.9	Culvert extension	Natural gravel bed - Y Baffles - N Low flow channel - N Mammal ledge - N	✓ Gravel bed included in new culvert extension. ✗ Total length of culvert is increased by 20m. Highly unlikely that Bradley Brook would be a suitable habitat for fish so no baffles or low flow channel provided.	150mm
																<ul style="list-style-type: none"> <li>✗ Total length of culvert within the WFD waterbody is increased by 20m.</li> <li>✓ Gravel bed included in new culvert extension.</li> </ul>	

Watercourse	Watercourse Characteristics					Existing Structures				Proposed Structures				Commentary	Proposed Bed Depth	
	WFD Waterbody	WFD Monitored Waterbody	Upstream Catchment Size (km <sup>2</sup> )	Low Flow Q95 (m <sup>3</sup> /s)	1 in 2 Year Flow (m <sup>3</sup> /s)	Watercourse Description	Structure	Length (m)	Dia. (m)	Features	Structure (Ref no.)	Length (m)	Dia. (m)			New culvert or extension
Part B																
Denwick Burn (Section 4 in WFD Assessment Part B [APP-312])  In Biodiversity Net Loss Assessment	N	3.8	0.003	2.08	- Ordinary watercourse. - River bed comprises silts and gravels. - Fish surveys not undertaken as watercourses not considered to have potential to support any notable aquatic species. - No evidence of otter was identified during mammal surveys. - Partially realigned along field boundaries.	Circular culvert	36	0.3	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Circular culvert (Ref 22.1)	43.75	0.3	Culvert extension	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	✓ Approx. 340m length of new riparian woodland planted along Denwick Burn. ✖ Total length of culvert is increased by 45.75m.  Low flow channel, natural bed and baffles not feasible due to existing culvert constraints.  Mammal ledges unable to be included/retrofitted due to culvert size.	
						Circular culvert	72.3	1.2	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Circular culvert (Ref 21.1)	110.3	1.2	Culvert extension	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N		
						Bridge	4.5	H - 0.895 W - 0.7	Natural gravel bed - Y Baffles - N Low flow channel - N Mammal ledge - N	Bridge	4.5	H - 0.895 W - 0.7	Unchanged	No changes to baseline.		
						Circular culvert	10	0.6	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Circular culvert	10	0.6	Unchanged	No changes to baseline.		
						Circular culvert	61.17	0.6	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Circular culvert	61.17	0.6	Unchanged	No changes to baseline.		
Tributaries of Denwick Burn (Section 4 in WFD Assessment Part B [APP-312])	Aln from Edlingham Burn to Tidal Limit  N	Not calculated	Not calculated	Not calculated	- Minor ordinary watercourses. - Catchments <0.5km <sup>2</sup> . Likely to be ephemeral. - Watercourses unsuitable habitat for fish. - Aligned along field boundaries.	Circular culvert	21.25	0.6	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Circular culvert (Ref 19.1)	37.75	0.6	Culvert extension	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	✖ Total length of culvert is increased by 16.5m although this is a small ephemeral watercourse.  Culvert extension provides free passage to mammals except when in times of flood.	
						Twin circular pipes	20	2 x 0.15	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Twin circular pipes	20	2 x 0.15	Unchanged	No changes to baseline.		
						Circular culvert (trib)	89	0.3	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Circular culvert (Ref 18.1)	89	0.3	Unchanged	No changes to baseline.		
						Circular culvert	49.95	0.5	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Circular culvert (Ref 17.1)	49.95	0.5	Unchanged	No changes to baseline.		
White House Burn (Section 5 in WFD Assessment Part B [APP-312])  In Biodiversity Net Loss Assessment	N	1.22	0.002	1.73	- Ordinary watercourse. - River bed comprises silts and gravels. - Fish surveys not undertaken as watercourses not considered to have potential to support any notable aquatic species. - No evidence of otter was identified during mammal surveys. - Realigned along field boundaries.	Box culvert	21.7	H - 3.44 W - 3.23	Natural gravel bed - Y Baffles - N Low flow channel - N Cattle creep within culvert. Mammal ledge - N	Box culvert (Ref 23.1)	37.3	H - 3.44 W - 3.23	Culvert extension	Natural gravel bed - Y Baffles - N Low flow channel - N Cattle creep within culvert. Mammal ledge - N	✓ Gravel bed continued through culvert extension. ✖ Total length of culvert is increased by 15.6m.  Low flow channel and baffles not feasible due to the existing culvert constraints.  Mammal ledge not required as cattle creep present.	150 mm
						Circular culvert	5.3	1.5	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Circular culvert	5.3	1.5	Unchanged	No changes to baseline.		
						Box culvert	Unknown		Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Box culvert	Unknown		Unchanged	No changes to baseline.		
												Aln from Edlingham Burn to Tidal Limit - WFD Waterbody Summary:	✖ Total length of culvert within the WFD waterbody is increased by 77.85 m. ✓ Approximately 340m of new riparian woodland will be planted along Denwick Burn.			

Watercourse	Watercourse Characteristics					Existing Structures				Proposed Structures				Commentary	Proposed Bed Depth		
	WFD Waterbody	WFD Monitored Waterbody	Upstream Catchment Size (km <sup>2</sup> )	Low Flow Q95 (m <sup>3</sup> /s)	1 in 2 Year Flow (m <sup>3</sup> /s)	Watercourse Description	Structure	Length (m)	Dia. (m)	Features	Structure (Ref no.)	Length (m)	Dia. (m)			New culvert or extension	Features
Tributaries of Kittycarter Burn (Section 6 in WFD Assessment Part B [APP-312]) Western tributary of Kittycarter Burn included in Biodiversity Net Loss Assessment	Embleton Burn from Source to North Sea	Y	3.98	0.003 (combined down-stream)	1.35 (combined down-stream)	- Ordinary watercourses. - River beds comprise silt and gravels. - Fish surveys not undertaken as watercourses not considered to have potential to support any notable aquatic species. - No evidence of otter identified during the mammal surveys. - Realigned along field boundaries.	Circular culvert (southern trib)	21.2	0.45	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Circular culvert (southern trib)	21.2	0.45	Unchanged	No changes to baseline.	✓ Gravel bed introduced in new culvert and maintained through box culvert extension. ✓ Southern tributary of Kittycarter Burn realigned to avoid further culverting. 225m of riparian woodland along realigned watercourse. ✓ Approx 20m length of new riparian woodland planted along the tributaries of Kittycarter Burn. ✗ Total length of culvert is increased by 75.3m.  Low flow channel and baffles not feasible due to design constraints.  Mammal ledges unable to be included/retrofitted due to culvert size.	150
							Circular culvert (southern trib)	25.5	0.6	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Circular culvert (Ref 24.2)	50	0.6	Culvert extension	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N		
							Circular culvert (southern trib)	17	0.6	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Circular culvert (Ref 25.1)	17	0.6	Replacement culvert	Natural gravel bed - Y Baffles - N Low flow channel - N Mammal ledge - N		
							Box culvert (western trib)	20.1	H - 2.25 W - 1.88	Natural gravel bed - Y Baffles - N Low flow channel - N Cattle creep within culvert. Mammal ledge - N	Box culvert (Ref 26.1)	70.9	H - 2.25 W - 1.88	Culvert extension	Natural gravel bed - Y Baffles - N Low flow channel - N Cattle creep within culvert. Mammal ledge - N		
Tributary of Embleton Burn (Section 7 in WFD Assessment Part B [APP-312])	N	0.58	Not calculated	Not calculated	0.44	- Ordinary watercourse. - Fish surveys not undertaken as watercourses not considered to have potential to support any notable aquatic species. - No evidence of otter was identified during the mammal surveys. - Realigned along field boundaries.	Box culvert	5.7	H - 0.31 W - 0.45	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Box culvert	5.7	H - 0.31 W - 0.45	Unchanged	No changes to baseline.	✓ Gravel bed included in new culvert. ✗ Total length of culvert is increased by 17m.  Low flow channel and baffles not feasible due to design constraints.  Mammal ledges unable to be included/retrofitted due to culvert size.	N/A
Embleton Burn from Source to North Sea - WFD Waterbody Summary:															✗ Total length of culvert within the WFD waterbody is increased by 92.3m. ✓ Approximately 165m of watercourse realigned to avoid excessive culverting, and design of watercourse will offer improvement to the baseline flow dynamics and planting. ✓ Approximately 245m of new riparian woodland will be planted along the tributaries of Kittycarter Burn.		



Watercourse	Watercourse Characteristics					Existing Structures				Proposed Structures				Commentary	Proposed Bed Depth		
	WFD Waterbody	WFD Monitored Waterbody	Upstream Catchment Size (km <sup>2</sup> )	Low Flow Q95 (m <sup>3</sup> /s)	1 in 2 Year Flow (m <sup>3</sup> /s)	Watercourse Description	Structure	Length (m)	Dia. (m)	Features	Structure (Ref no.)	Length (m)	Dia. (m)			New culvert or extension	Features
<b>Shipperton Burn</b> (Section 8 in WFD Assessment Part B [APP-312])  <b>In Biodiversity Net Loss Assessment</b>	Brunton Burn from Source to North Sea	N	3.09	Not calculated	1.54	- Ordinary watercourse. - Brown trout were identified during fish surveys. - No evidence of otter was identified during the mammal surveys. - Existing step-weir located immediately downstream of each culvert. - Realigned along field boundaries.	Box culvert	19.1	H - 1.28 W - 2.05	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Rectangular culvert (Ref 27.1)	46.75	H - 1.25 W - 2.0	Culvert extension	Natural gravel bed - Y Baffles - N Low flow channel - N Mammal ledge - N	✓ Existing step-weir located at outlet of culvert extension will be removed. ✓ Gravel bed included in culvert extension. ✗ Total length of culvert is increased by 27.65m.  Low flow channel and baffles not feasible due to the existing culvert constraints.  Mammal ledges unable to be included/retrofitted due to culvert size.	150mm
							Box culvert	21	H - 1.1 W - 1.9	Natural gravel bed - N Baffles - N Low flow channel - N Mammal ledge - N	Box culvert	21	H - 1.1 W - 1.9	Unchanged	No changes to baseline.		
														Brunton Burn from Source to North Sea - WFD Waterbody Summary:  ✗ Total length of culvert within the WFD waterbody is increased by 27.65m. ✓ Existing step-weir located at outlet of culvert extension will be removed. ✓ Gravel bed included in culvert extension.			



**Key**

- Order Limits
- Map Boundaries

**Bradley Brook**

**Trib of Thirston Burn**

**Longdike Burn**

**Earsdon Burn**

**Trib of Fenrother Burn**

**River Lyne**

**Floodgate Burn**

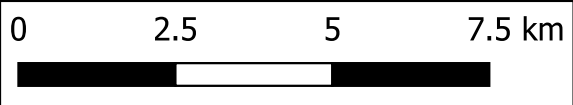
**Shieldhill Burn**

**Cotting Burn**

**A1 in Northumberland:  
Morpeth to Ellingham**

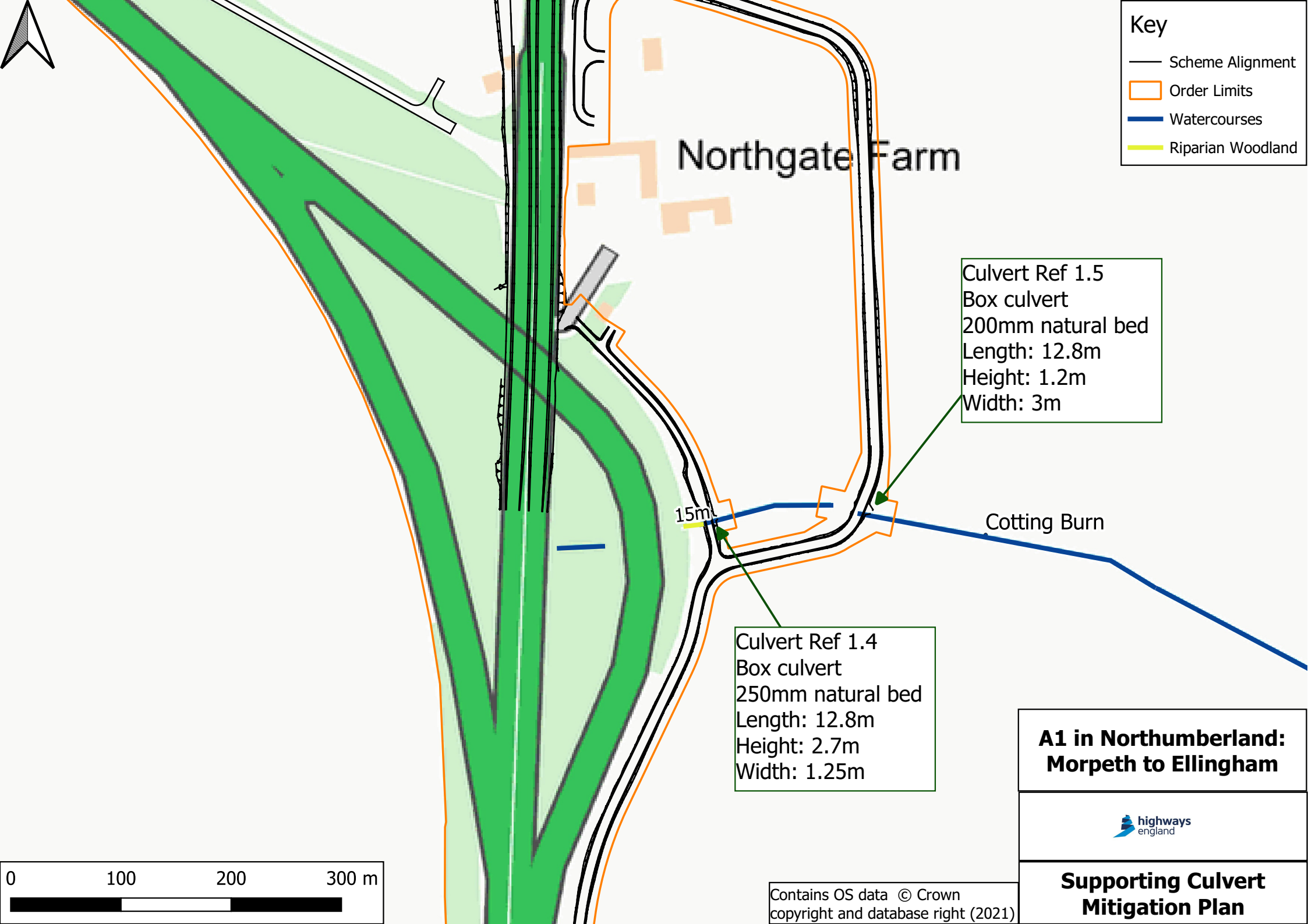


**Overview Plan Part A**



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**Key**

- Scheme Alignment
- Order Limits
- Watercourses
- Riparian Woodland

Northgate Farm

Culvert Ref 1.5  
Box culvert  
200mm natural bed  
Length: 12.8m  
Height: 1.2m  
Width: 3m

15m

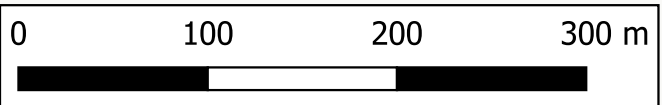
Cotting Burn

Culvert Ref 1.4  
Box culvert  
250mm natural bed  
Length: 12.8m  
Height: 2.7m  
Width: 1.25m

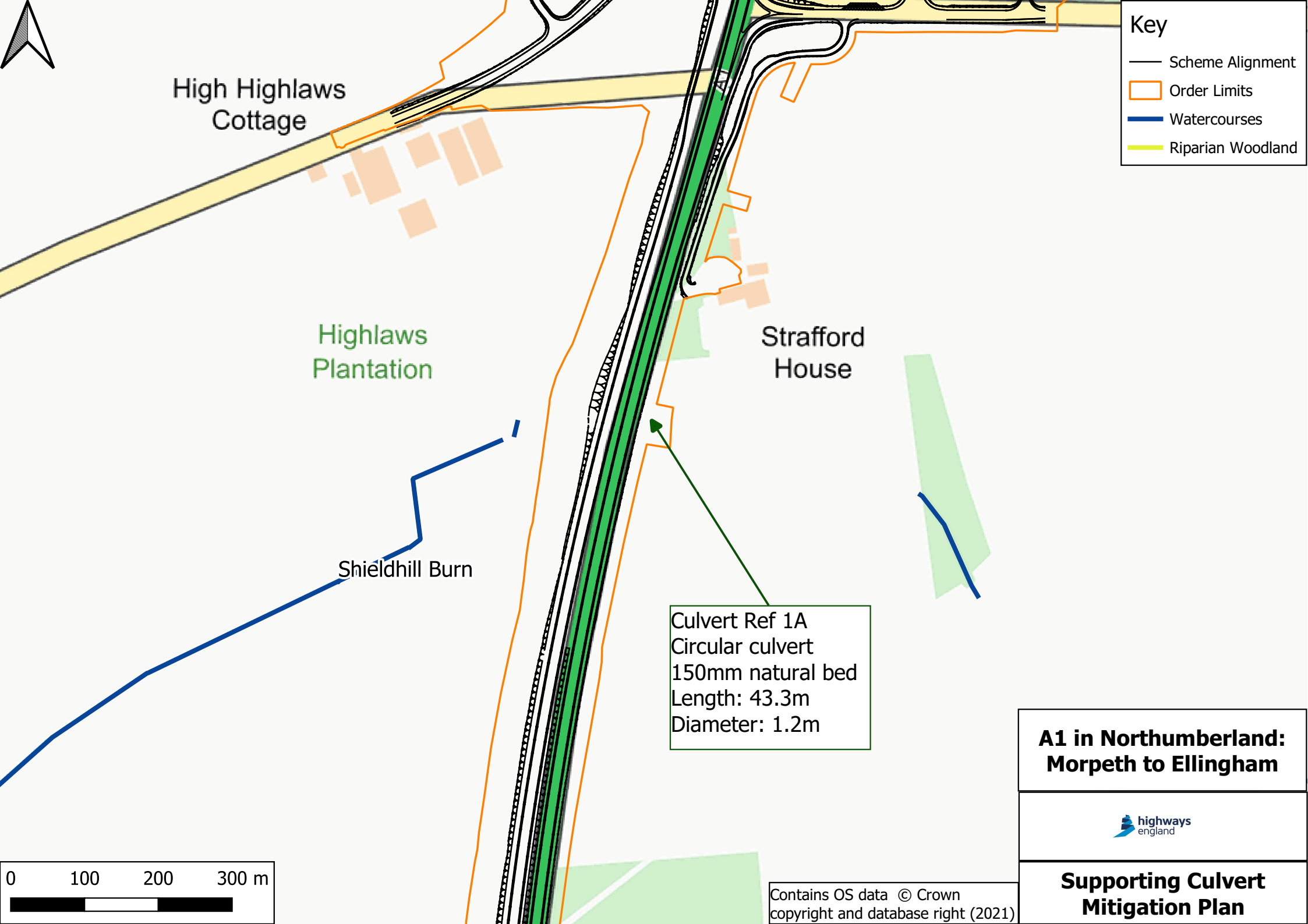
**A1 in Northumberland:  
Morpeth to Ellingham**

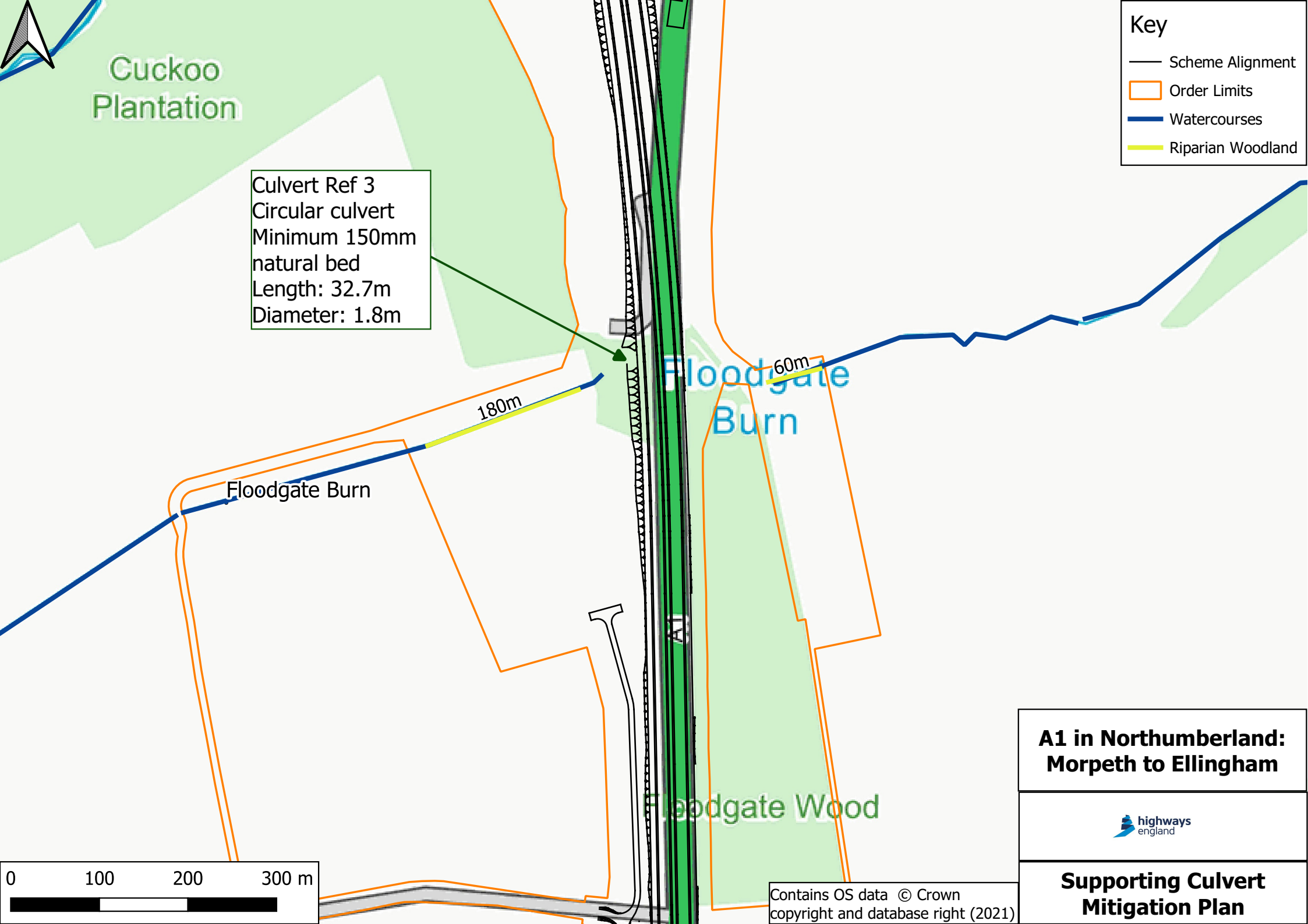


**Supporting Culvert  
Mitigation Plan**



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**Key**

- Scheme Alignment
- Order Limits
- Watercourses
- Riparian Woodland

Culvert Ref 3  
 Circular culvert  
 Minimum 150mm  
 natural bed  
 Length: 32.7m  
 Diameter: 1.8m

Floodgate Burn

Floodgate Burn

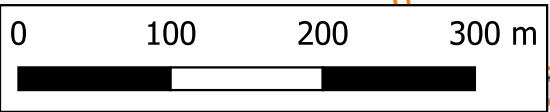
Floodgate Wood

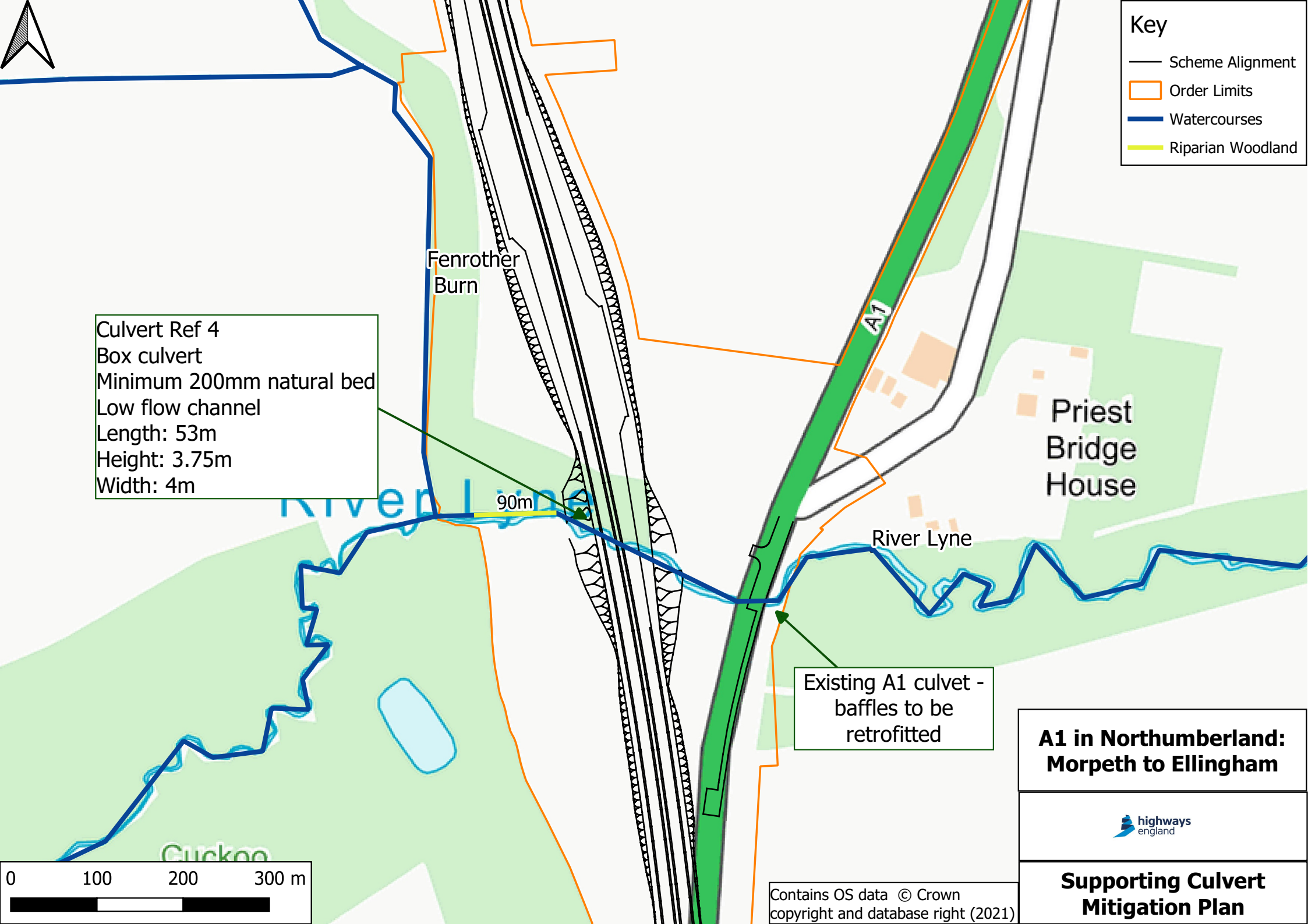
**A1 in Northumberland:  
 Morpeth to Ellingham**



**Supporting Culvert  
 Mitigation Plan**

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**Key**

- Scheme Alignment
- Order Limits
- Watercourses
- ▬ Riparian Woodland

Culvert Ref 4  
 Box culvert  
 Minimum 200mm natural bed  
 Low flow channel  
 Length: 53m  
 Height: 3.75m  
 Width: 4m

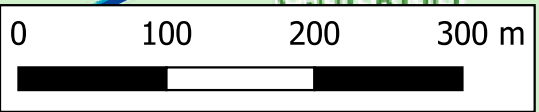
Existing A1 culvet -  
 baffles to be  
 retrofitted

**A1 in Northumberland:  
 Morpeth to Ellingham**

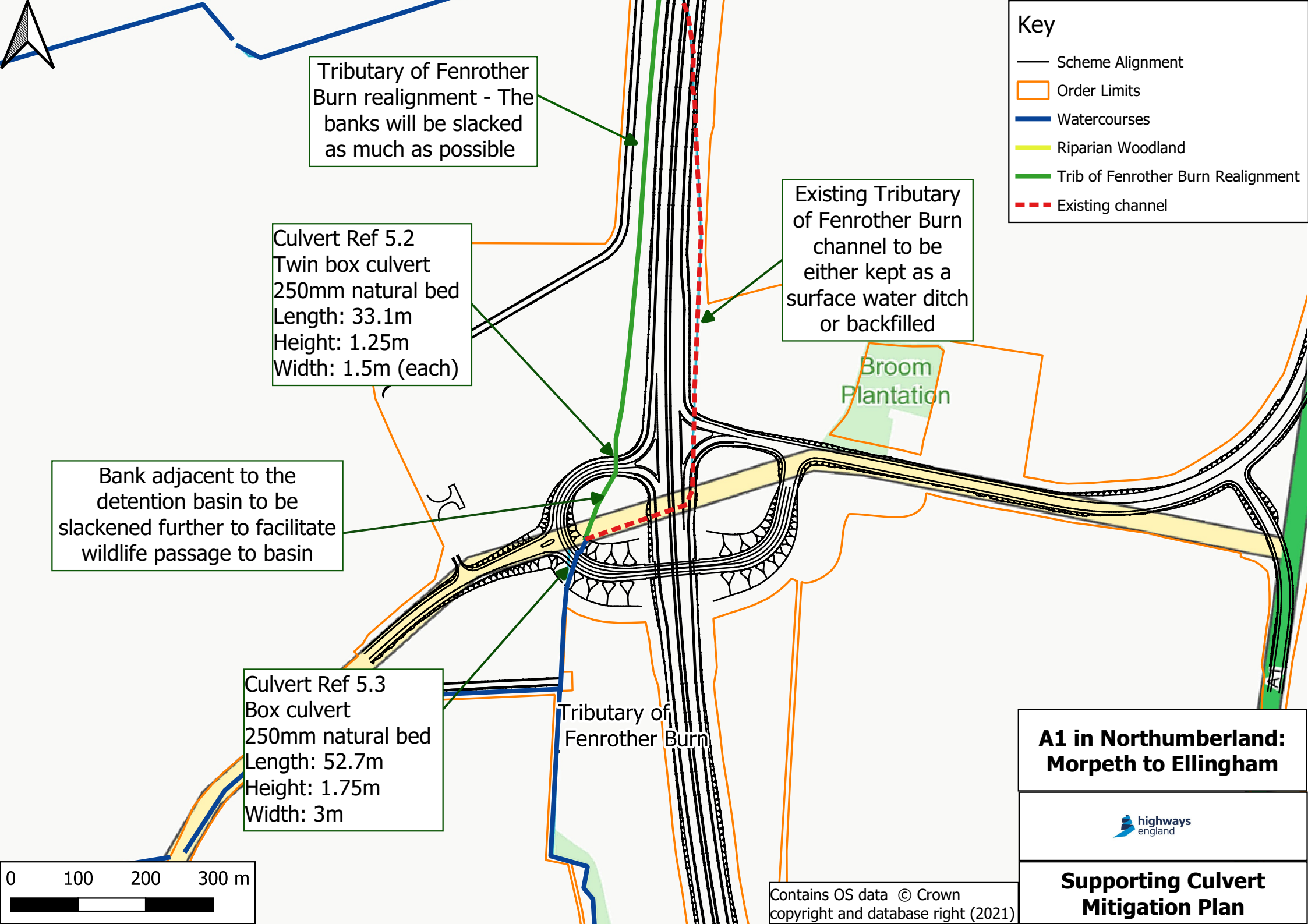


**Supporting Culvert  
 Mitigation Plan**

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Tributary of Fenrother Burn realignment - The banks will be slacked as much as possible

Culvert Ref 5.2  
Twin box culvert  
250mm natural bed  
Length: 33.1m  
Height: 1.25m  
Width: 1.5m (each)

Bank adjacent to the detention basin to be slacked further to facilitate wildlife passage to basin

Culvert Ref 5.3  
Box culvert  
250mm natural bed  
Length: 52.7m  
Height: 1.75m  
Width: 3m

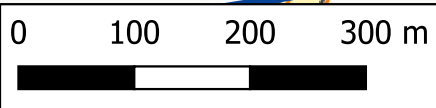
Tributary of Fenrother Burn

Existing Tributary of Fenrother Burn channel to be either kept as a surface water ditch or backfilled

Broom Plantation

**Key**

- Scheme Alignment
- Order Limits
- Watercourses
- ▬ Riparian Woodland
- Trib of Fenrother Burn Realignment
- - - Existing channel

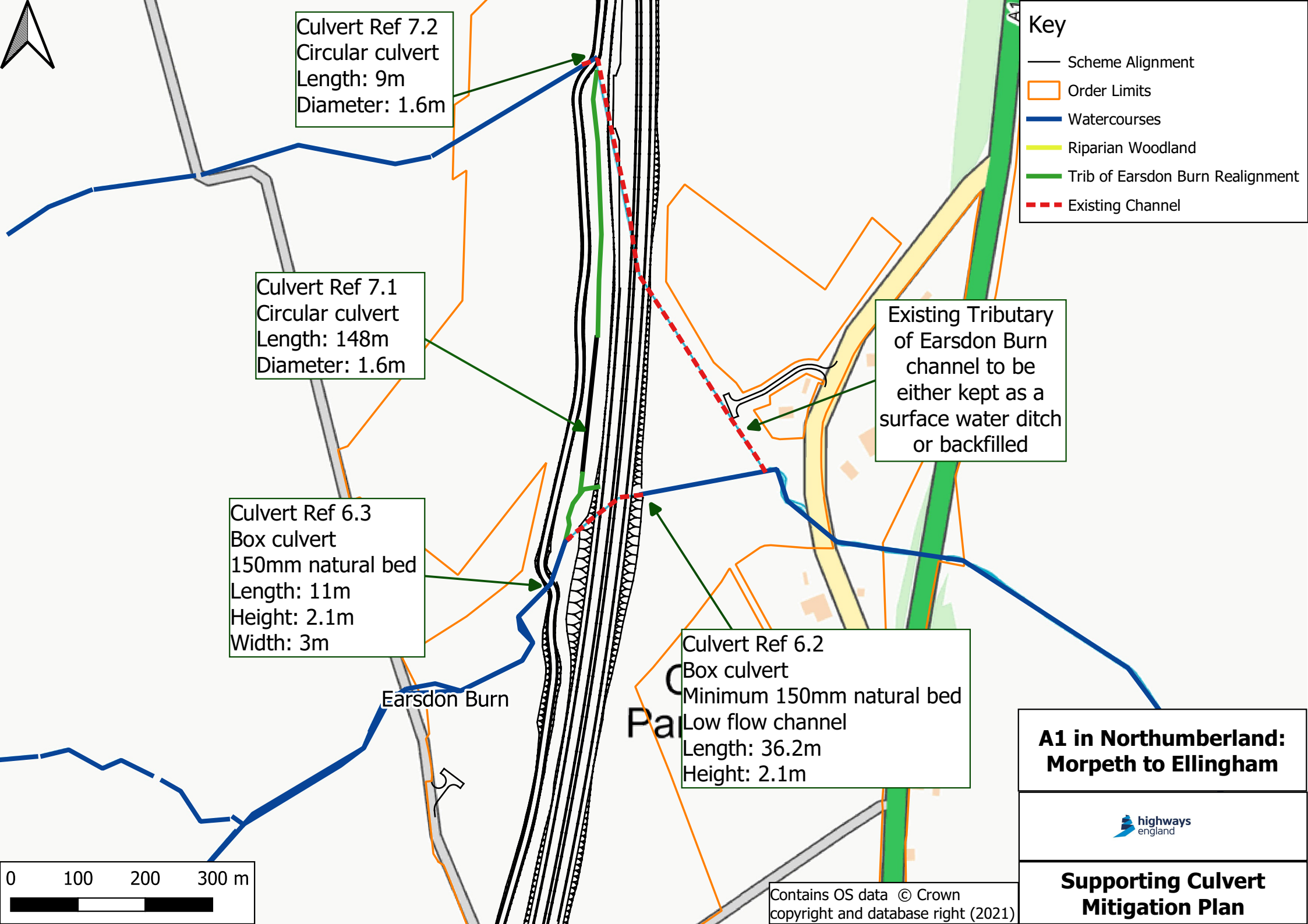


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**A1 in Northumberland:  
Morpeth to Ellingham**



**Supporting Culvert  
Mitigation Plan**



**Key**

- Scheme Alignment
- Order Limits
- Watercourses
- ▨ Riparian Woodland
- Trib of Earsdon Burn Realignment
- - - Existing Channel

Culvert Ref 7.2  
Circular culvert  
Length: 9m  
Diameter: 1.6m

Culvert Ref 7.1  
Circular culvert  
Length: 148m  
Diameter: 1.6m

Culvert Ref 6.3  
Box culvert  
150mm natural bed  
Length: 11m  
Height: 2.1m  
Width: 3m

Culvert Ref 6.2  
Box culvert  
Minimum 150mm natural bed  
Low flow channel  
Length: 36.2m  
Height: 2.1m

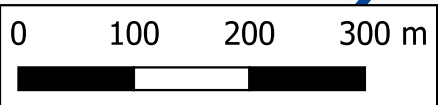
Existing Tributary  
of Earsdon Burn  
channel to be  
either kept as a  
surface water ditch  
or backfilled

Earsdon Burn

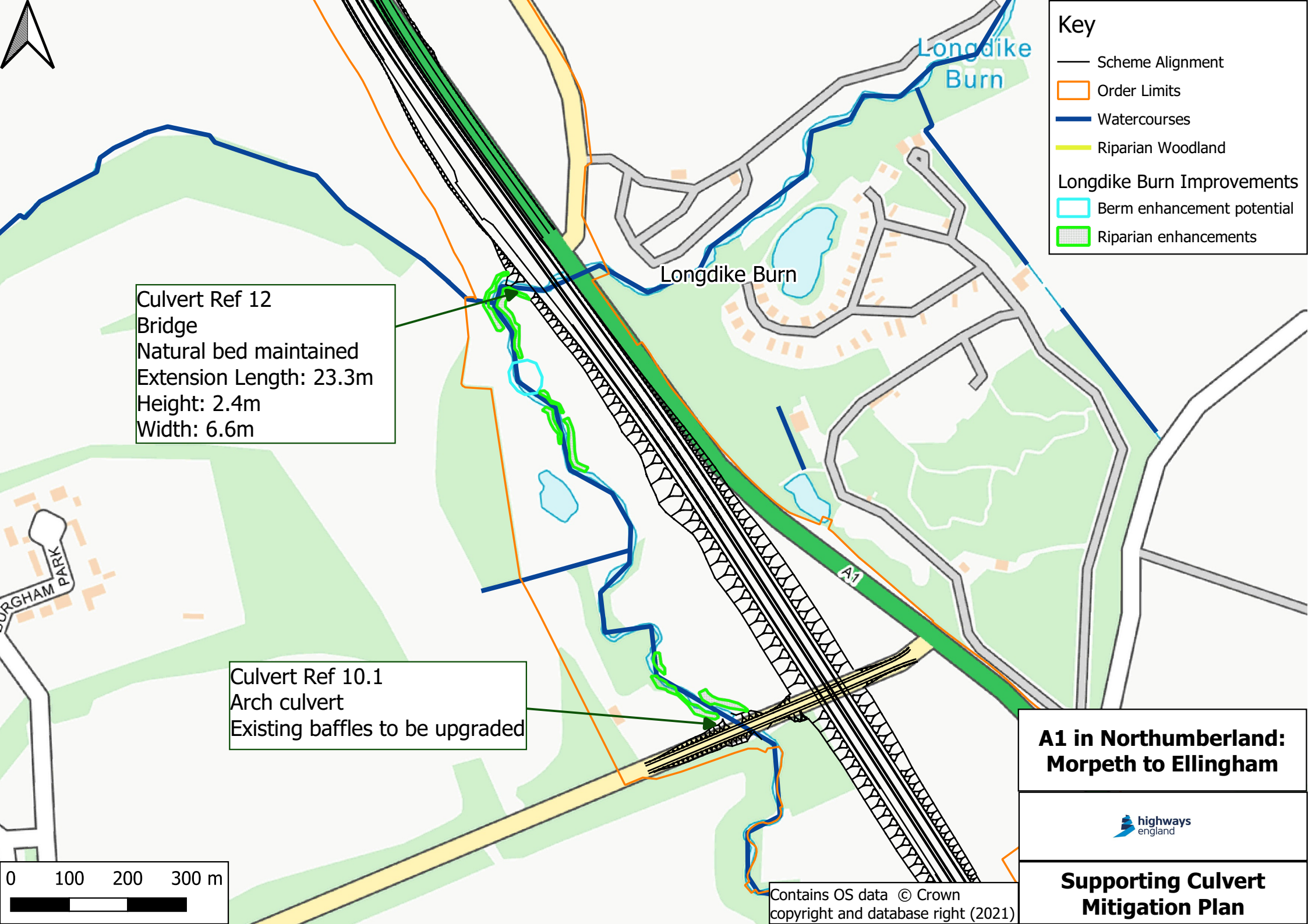
**A1 in Northumberland:  
Morpeth to Ellingham**



**Supporting Culvert  
Mitigation Plan**



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**Key**

- Scheme Alignment
- Order Limits
- Watercourses
- Riparian Woodland

**Longdike Burn Improvements**

- Berm enhancement potential
- ▨ Riparian enhancements

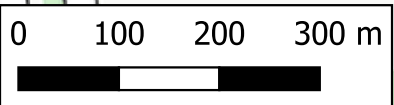
Culvert Ref 12  
 Bridge  
 Natural bed maintained  
 Extension Length: 23.3m  
 Height: 2.4m  
 Width: 6.6m

Culvert Ref 10.1  
 Arch culvert  
 Existing baffles to be upgraded

**A1 in Northumberland:  
 Morpeth to Ellingham**



**Supporting Culvert  
 Mitigation Plan**



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**Key**

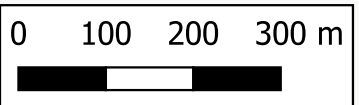
- Scheme Alignment
- Order Limits
- Watercourses
- Riparian Woodland

Culvert Ref 14  
Circular culvert  
Extension Length: 47.6m  
Diameter: 1.35m

Tributary of  
Thirston Burn

West Moor  
House

West Moor  
Plantation  
Cottage



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Morpeth to Ellingham**







**Supporting Culvert  
Mitigation Plan**





**Key**

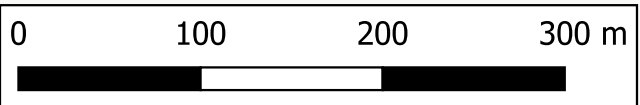
-  Scheme Alignment
-  Order Limits
-  Watercourses
-  Riparian Woodland

Culvert Ref 16  
 Circular culvert  
 150mm natural bed  
 Extension Length: 20m  
 Diameter: 0.9m

Bradley Brook

Longfield  
 Cottage

A1

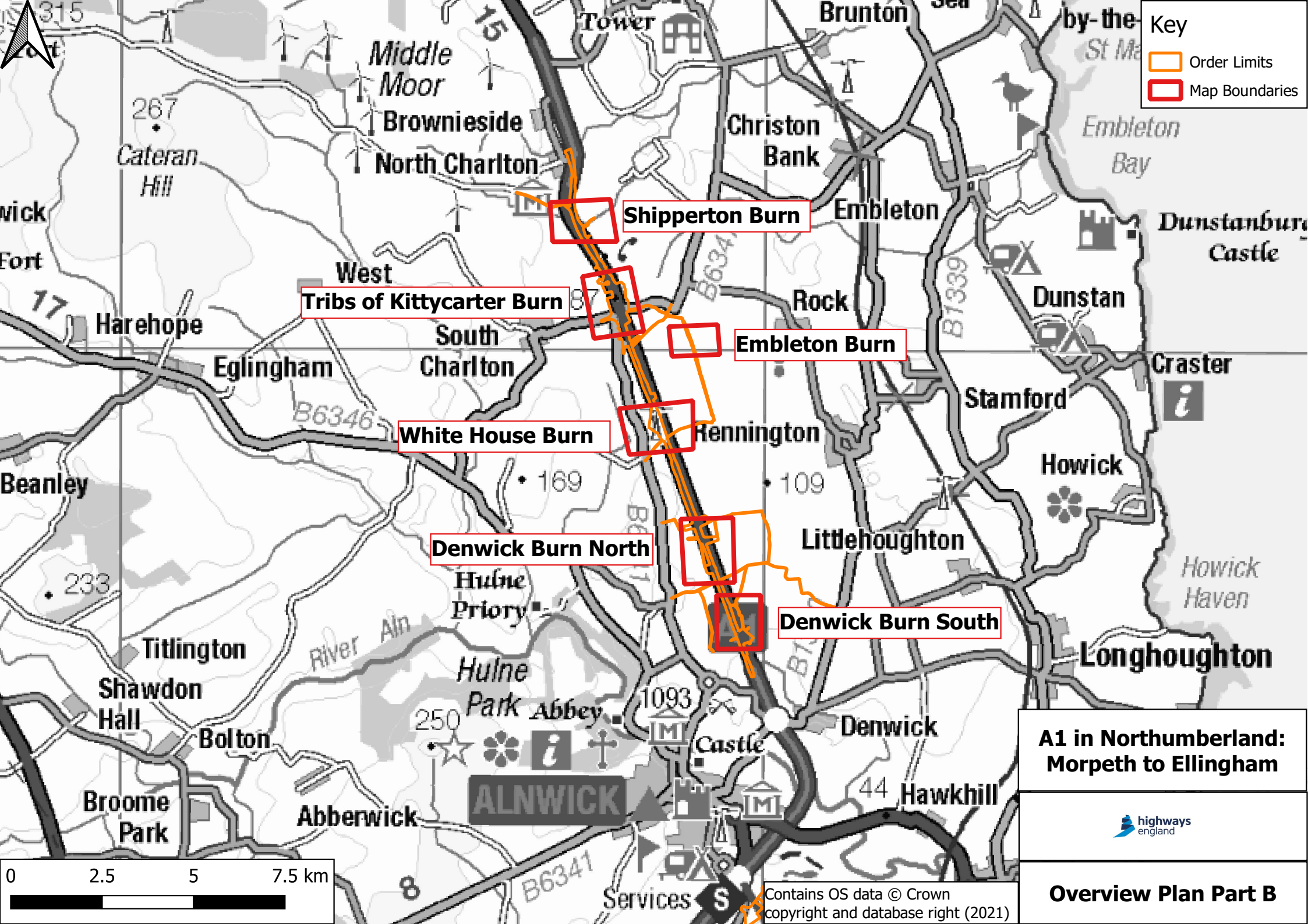


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**A1 in Northumberland:  
 Morpeth to Ellingham**



**Supporting Culvert  
 Mitigation Plan**



**Key**

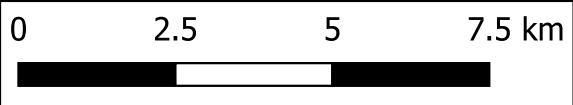
- Order Limits
- Map Boundaries

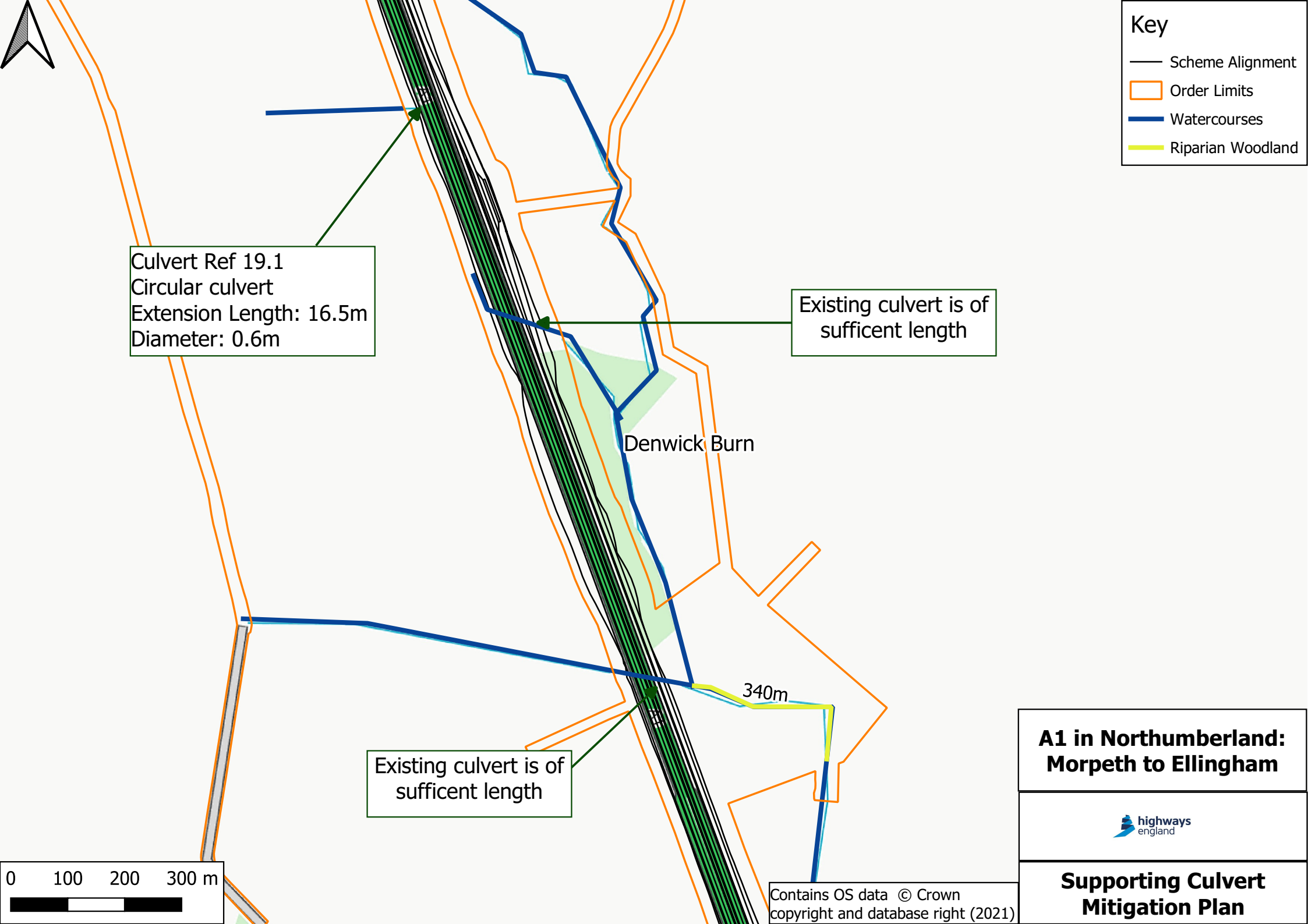
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Morpeth to Ellingham**



**Overview Plan Part B**

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**Key**

- Scheme Alignment
- Order Limits
- Watercourses
- Riparian Woodland

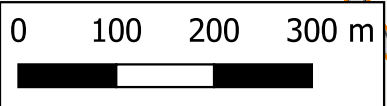
Culvert Ref 19.1  
Circular culvert  
Extension Length: 16.5m  
Diameter: 0.6m

Existing culvert is of  
sufficient length

Denwick Burn

340m

Existing culvert is of  
sufficient length

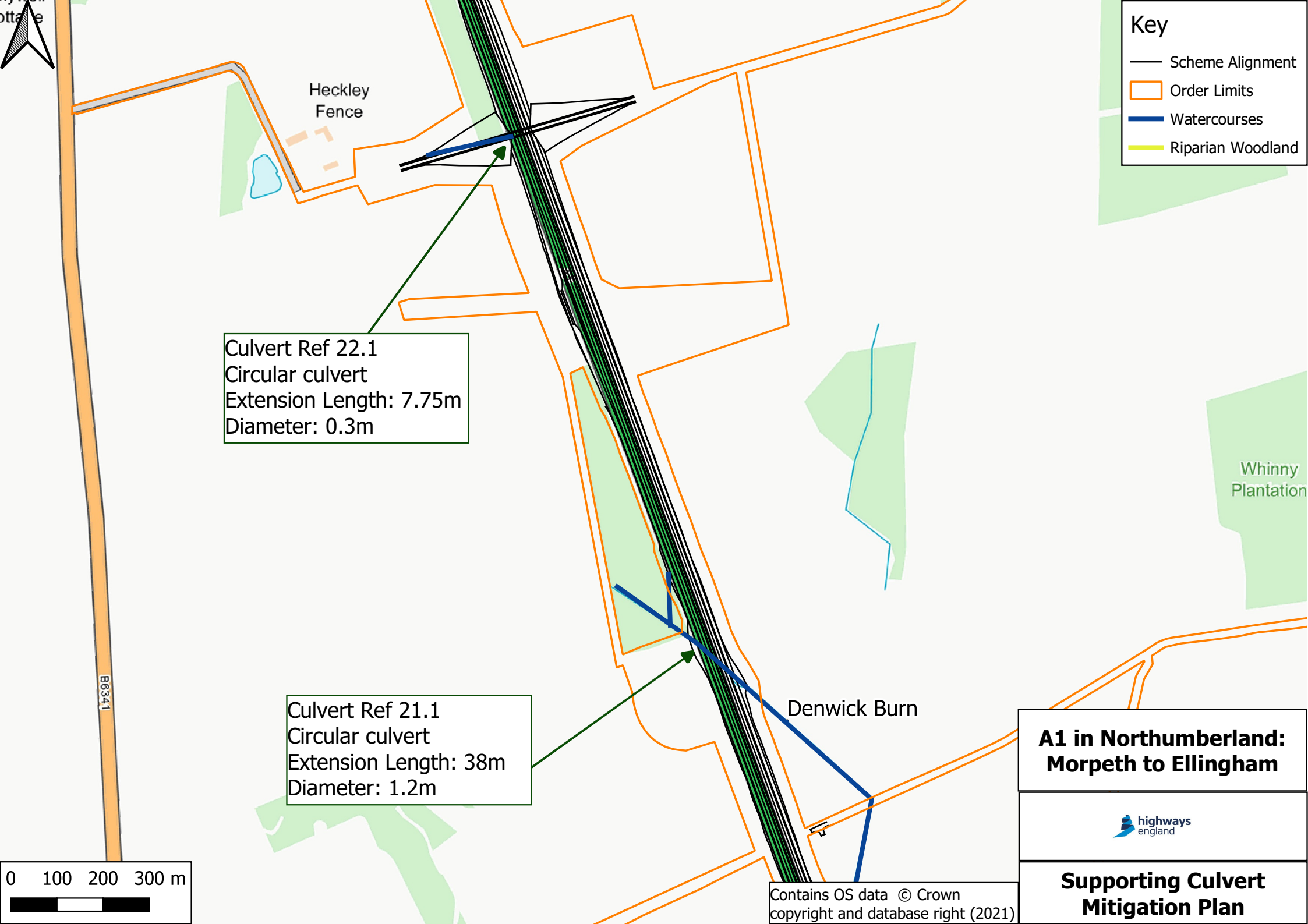


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**A1 in Northumberland:  
Morpeth to Ellingham**



**Supporting Culvert  
Mitigation Plan**

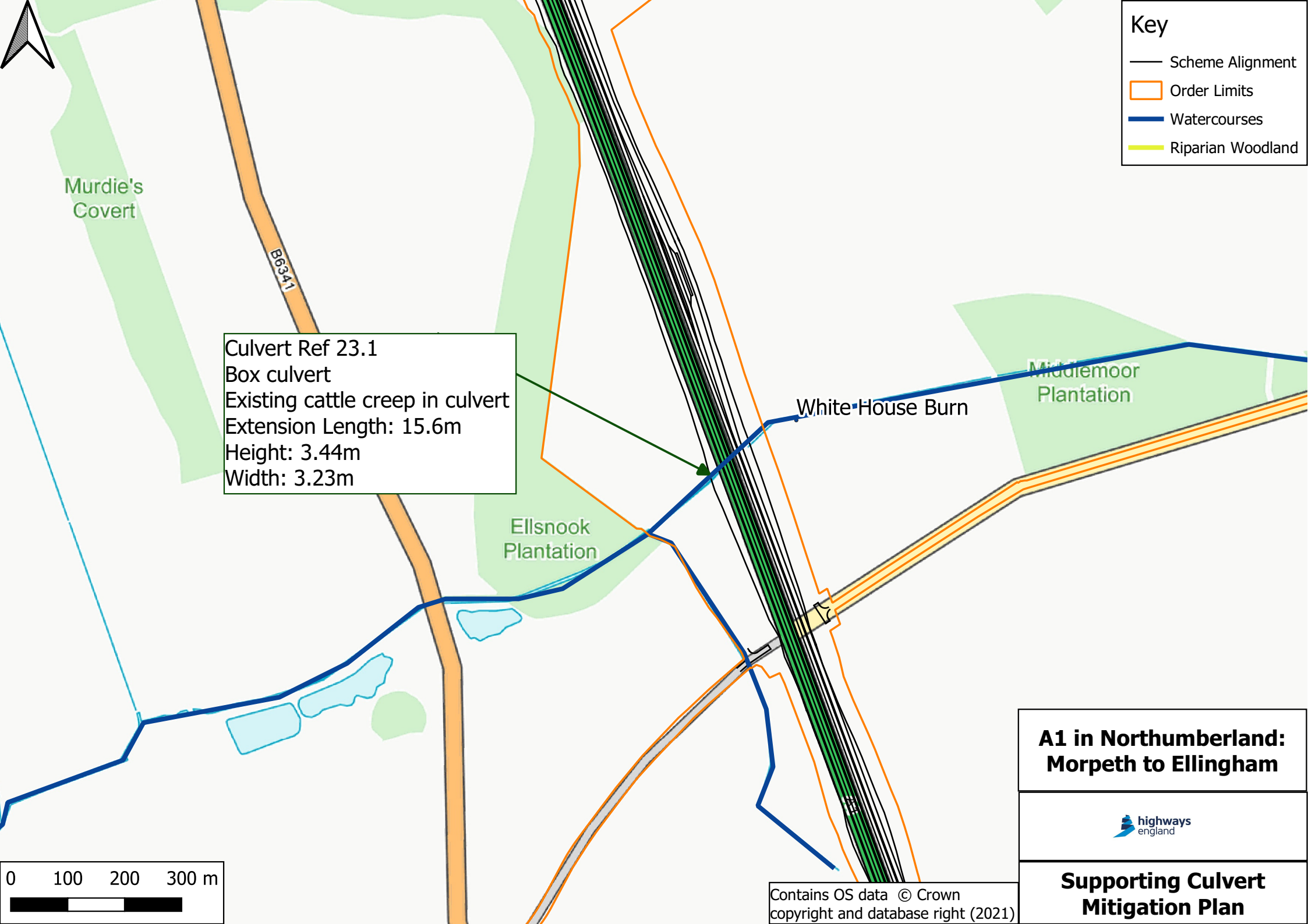


**A1 in Northumberland:  
Morpeth to Ellingham**



**Supporting Culvert  
Mitigation Plan**





**Key**

- Scheme Alignment
- Order Limits
- Watercourses
- Riparian Woodland

Culvert Ref 23.1  
 Box culvert  
 Existing cattle creep in culvert  
 Extension Length: 15.6m  
 Height: 3.44m  
 Width: 3.23m

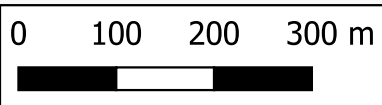
White House Burn

Middlemoor  
 Plantation

Ellsnook  
 Plantation

Murdie's  
 Covert

B6341

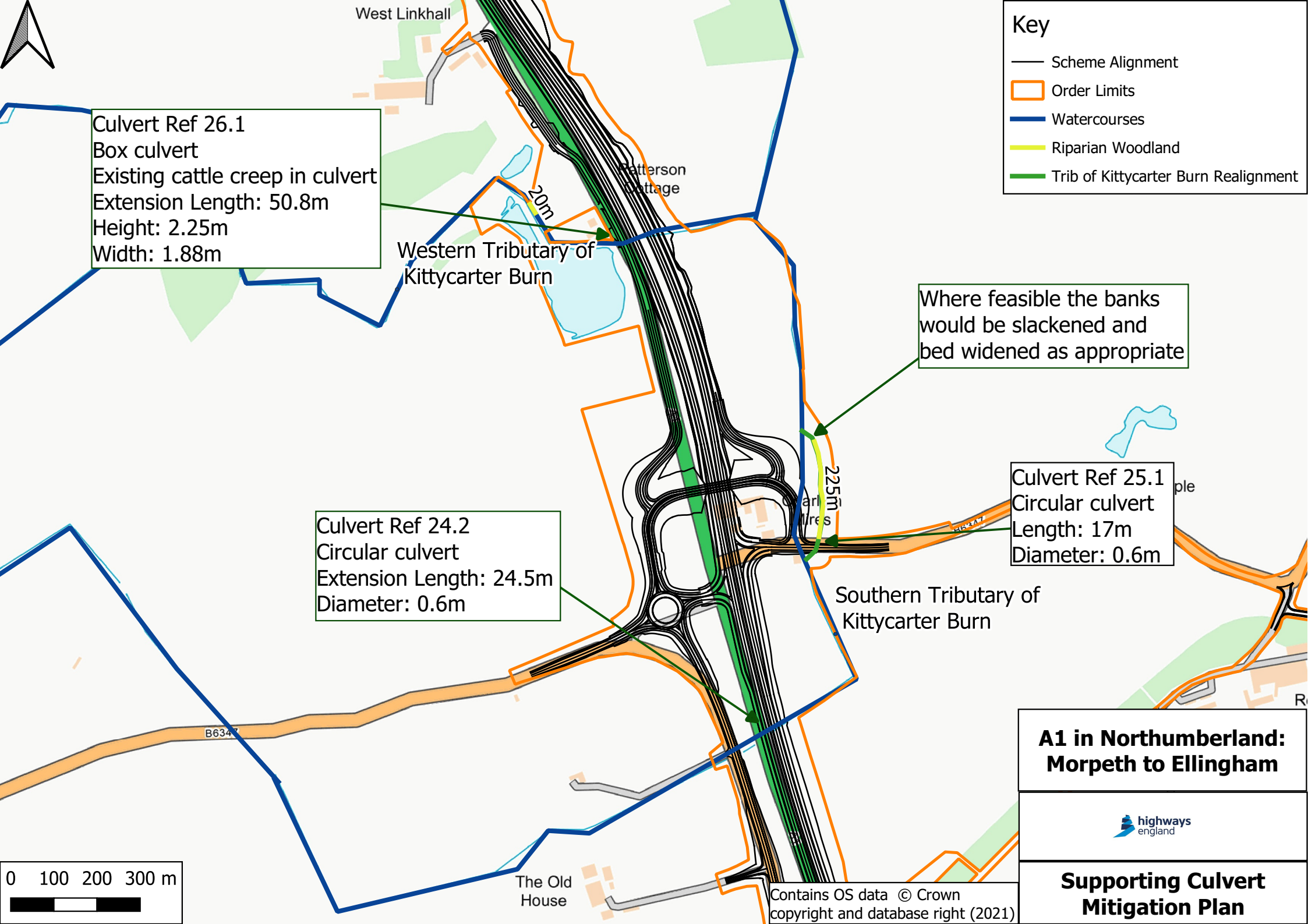


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**A1 in Northumberland:  
 Morpeth to Ellingham**



**Supporting Culvert  
 Mitigation Plan**



**Key**

- Scheme Alignment
- ▭ Order Limits
- Watercourses
- Riparian Woodland
- Trib of Kittycarter Burn Realignment

**Culvert Ref 26.1**  
 Box culvert  
 Existing cattle creep in culvert  
 Extension Length: 50.8m  
 Height: 2.25m  
 Width: 1.88m

**Culvert Ref 24.2**  
 Circular culvert  
 Extension Length: 24.5m  
 Diameter: 0.6m

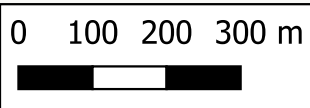
**Culvert Ref 25.1**  
 Circular culvert  
 Length: 17m  
 Diameter: 0.6m

Where feasible the banks would be slackened and bed widened as appropriate

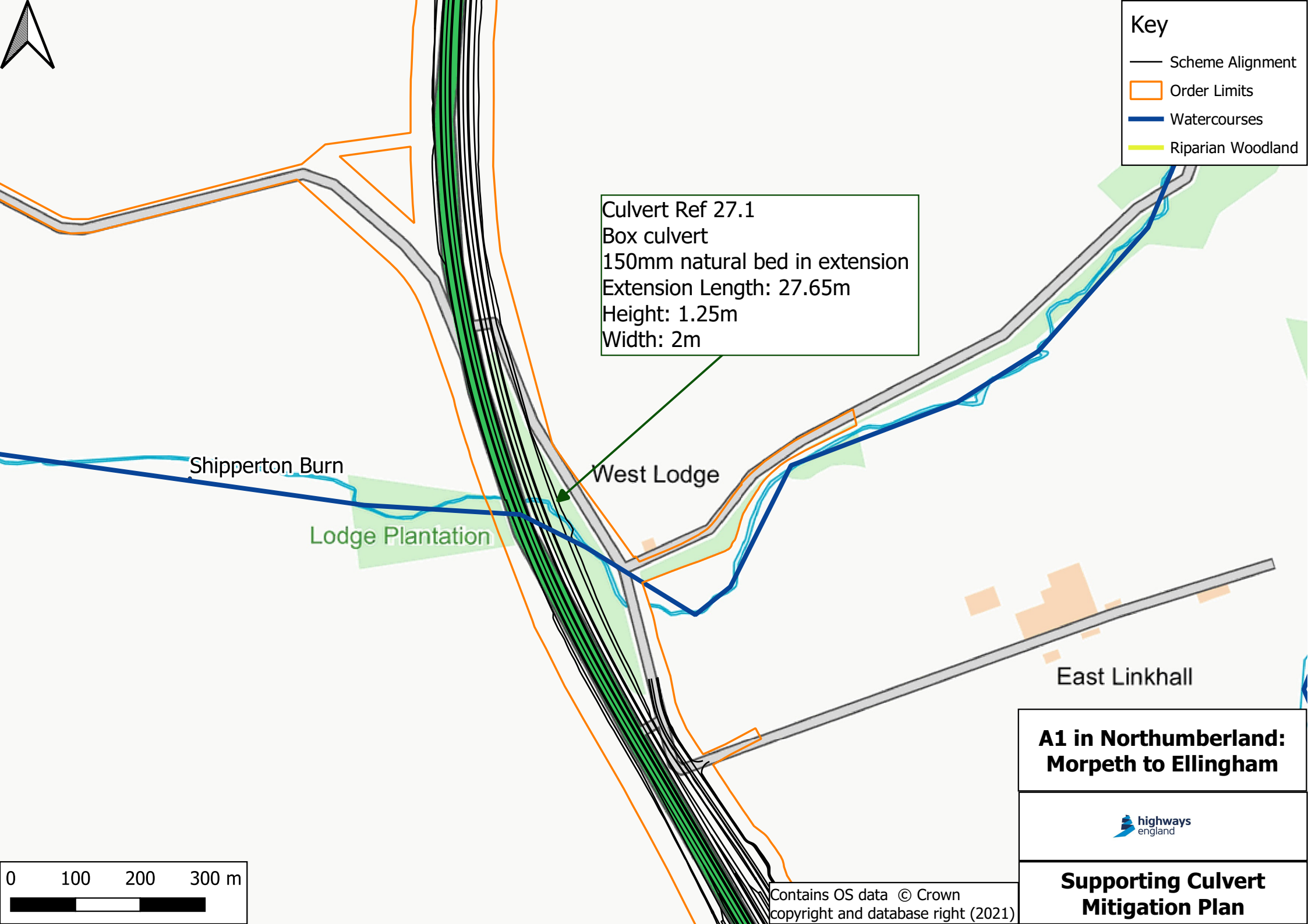
**A1 in Northumberland:  
 Morpeth to Ellingham**



**Supporting Culvert  
 Mitigation Plan**



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**Key**

- Scheme Alignment
- Order Limits
- Watercourses
- Riparian Woodland

Culvert Ref 27.1  
Box culvert  
150mm natural bed in extension  
Extension Length: 27.65m  
Height: 1.25m  
Width: 2m

Shipperton Burn

Lodge Plantation

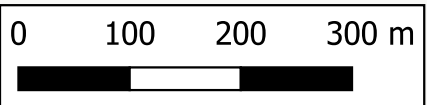
West Lodge

East Linkhall

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Morpeth to Ellingham**



**Supporting Culvert  
Mitigation Plan**



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Rock Midstead

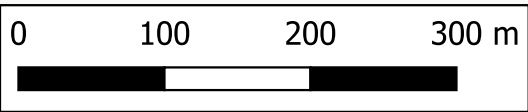
**Key**

- Scheme Alignment
- Order Limits
- Watercourses
- Riparian Woodland

Culvert Ref 28.1  
Circular culvert  
Length: 17m  
Diameter: 1.2m

Tributary of  
Embleton Burn

Kiln Plantation



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Morpeth to Ellingham**

**Supporting Culvert  
Mitigation Plan**



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