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XLINKS' MOROCCO-UK POWER PROJECT

Environmental Statement

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XLINKS' MOROCCO – UK POWER PROJECT

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Ecus Ltd Xlinks 1 Limited

1 RIVER CONDITION ASSESSMENT

1.1 Introduction

- 1.1.1 This document forms Volume 2, Appendix 1.11 of the Environmental Statement (ES) prepared for the United Kingdom (UK) elements of Xlinks' Morocco-UK Power Project (the 'Project'). For ease of reference, the UK elements of the Project are referred to as the 'Proposed Development, which is the focus of the Environmental Statement (ES). The ES presents the findings of the Environmental Impact Assessment (EIA) process for the Proposed Development.
- 1.1.2 This document provides the river condition assessment carried out as part of the Proposed Development in December 2022. The surveys and report have been undertaken by Ecus Ltd (Report No: 19570) and can be viewed below.



XLinks North Devon – River Condition Assessments

RPS Group Plc

December 2022



Ecus Ltd

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1.0	CE	Issue	15/12/2022

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Executive Summary

Ecus Ltd (Ecus) was commissioned by RPS Group Plc in October 2022 to undertake a River Condition Assessment (RCA) of five separate watercourses, located near Bideford, north Devon (National Grid Reference (NGR) SS 42281 27039 (Site 1), SS 43254 24062 (Site 3), SS 44275 24339 (Site 4), SS 49387 24015 (Site 5), SS 49808 23555 (Site 6)). The proposed works are for a new cable route as part of the XLinks project, which will intersect the watercourses. In most cases, the construction works will be directionally drilled under the watercourse to lay the cable, so disturbance to the watercourse will be negligible. This RCA has been undertaken to provide a baseline condition of the watercourses to inform a Biodiversity Net Gain Assessment (BNGA).

The watercourses were all typically upland north Devon streams.

RCA use the Modular River Physical Survey (MoRPh5) methodology for the field surveys. The MoRPh5 field surveys were carried out by an experienced Ecus ecologist between 31st October and 2nd November 2022. MoRPh5 surveys were carried out at the five Sites (or 'reaches'), each consisting of two subreaches, except for Site 1, which consisted of one sub-reach. Each sub-reach consisted of five contiguous modules of 10 metres (m) in length.

The condition score for the streams was **Good** for Sites 1, 3 and 6, and **Fairly Good** for sites 4 and 5. The river type was calculated as **Type C** for sites 1, 3 and 4 and **Type D** for sites 5 and 6.

All sites are immediately bordered by narrow strips of woodland, which are in turn bordered by modified grassland (grazing pasture). There is no development within 10 m of the bank tops along any of the subreaches, so the riparian encroachment band is **no encroachment**. There is also no engineered bank revetment along any of the surveyed sub-reaches, meaning that the in-watercourse encroachment is considered to be **no encroachment**.

The watercourses were all in good or fairly good condition, therefore following the works, the watercourses should be returned to their baseline condition. In the event that the works cause permanent changes to the watercourses, e.g. by increasing in-watercourse encroachment, it may be necessary to carry out enhancements elsewhere along the watercourse to mitigate this.



1. Introduction

1.1 Project Background

1.1.1 Ecus was commissioned by RPS Group Plc in October 2022 to undertake a River Condition Assessment (RCA) of five separate watercourses, located near Bideford, north Devon (National Grid Reference (NGR) SS 42281 27039 (Site 1), SS 43254 24062 (Site 3), SS 44275 24339 (Site 4), SS 49387 24015 (Site 5), SS 49808 23555 (Site 6)). Access was not provided to Site 2 (SS 41763 25421).

1.2 Proposals

1.2.1 The proposed works are for a new cable route, which will intersect the watercourses. In most cases, the construction works will be directionally drilling under the watercourse to lay the cable, so disturbance to the watercourse will be negligible

1.3 Purpose of the RCA

- 1.3.1 The purpose of the RCA is to determine the baseline condition of the river to assist with BNGA. The RCA consists of a desk based assessment of the affected river reach as well as a field survey. The two components are used to determine the river type and baseline condition of the river. The extent of riparian and in-watercourse encroachment was also determined.
- 1.3.2 This report details the methodology and findings of the desk based assessment and field survey in order to inform the BNGA.



2. Methodology

2.1 MoRPh5 Field Survey

2.1.1 The MoRPh5 survey is used to collect field data within 'sub-reaches' of a river. At least 20% of the river length within the proposed development should be surveyed (Gurnell et al., 2020a). MoRPh5 surveys are carried out on short 'modules' of the river, the size of which is determined by the river width (see **Table 1**). The MoRPh5 field surveys were carried out by an experienced Ecus ecologist in good weather conditions between 31st October 2022 and 2nd November 2022.

Table 1. Determining module length from river width.

River width (m)	Module length (m)
< 5	10
5 to < 10	20
10 to < 20	30
20 to < 30	40
Large and navigable rivers and canals	50

2.1.2 Five contiguous modules are surveyed within each sub-reach. The area surveyed within each module includes land within 10 m of the bank top either side of the river, both bank faces and the channel bed. The features captured within the survey include the bank and bed sediments, morphological and hydraulic features, riparian and aquatic vegetation extent and structure, presence of non-native invasive plants, bank top land use pressures and human interventions within the river channel. See Appendix 1 for the list of features used to calculate river condition.

2.2 Condition Analysis

2.2.1 Following the field survey, the data is inputted into the Cartographer web application which calculates a 'condition score' for each sub-reach of Good, Fairly Good, Moderate, Fairly Poor or Poor. Each sub-reach is also assigned a numerical preliminary condition score ranging from -2.5 to ≥ 2.5, a higher number indicates a better condition score.

2.3 Indicative River Type

2.3.1 A combination of a desk based assessment and data from the MoRPh5 field surveys is used to determine 'river type' from one of thirteen near-natural river types. Eight river type indicators are



used to determine river type. Indicators A1 to A5 are derived from maps or aerial images. These indicators are A1 Braiding index, A2 Sinuosity index, A3 Anabranching index, A4 Level of confinement and A5 Valley gradient. Indicators A6 to A8 are derived from the MoRPh5 surveys. These indicators are A6 Bedrock reaches, A7 Coarsest bed material size class and A8 Average alluvial bed material size class.

2.3.2 The data is entered into the Cartographer web application which automatically calculates river type from one of the thirteen types shown in **Figure 1**.

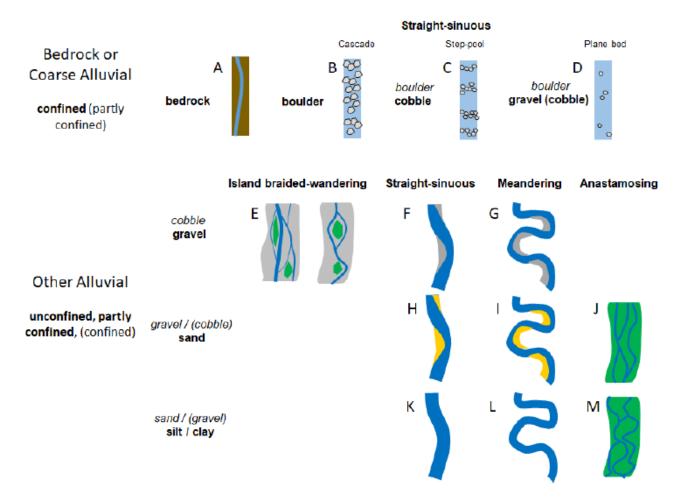


Figure 1. Thirteen near-natural river types that may be encountered in England (extracted from Gurnell et al., 2020).

2.4 Riparian and In-Watercourse Encroachment

2.4.1 The riparian zone is defined as the area within 10 m of the bank top. Any development within this zone is termed 'riparian encroachment'. Encroachment can be classed as minor, moderate or major dependent on the proximity of the development to the bank top and the percentage area that it covers within the riparian zone. Riparian encroachment bands are described in **Table 2**.



Table 2. Description of riparian encroachment bands (Panks et al., 2022).

Riparian Encroachment Band	Description
No encroachment	No development within 10 m of the bank top.
Minor	Any development 8 – 10 m from bank top (up to 100% of area) OR where development footprint occupies 0 – 10% of the riparian zone area 4 – 10 m from bank top.
Moderate	Any development where footprint occupies between 10 – 25% of the riparian zone area 4 – 10 m from bank top.
Major	Any development 0 – 4 m from bank top (except maximum of 5% footprint for amenity features) OR where total development footprint occupies > 25% of the total riparian area.

2.4.2 In-watercourse encroachment is defined as intervention that adversely affects hydrological and geo-morphological processes, creating localised changes in flow and/or sediment dynamics and riverine connectivity. In-watercourse encroachment is classed as minor or major dependent on the percentage of the bank length or channel width affected by the intervention; see **Table 3**.

Table 3. Description of in-watercourse encroachment bands (Panks et al., 2022).

In-Watercourse Encroachment Band	Description
No encroachment	< 5% bank length comprising an engineered bank revetment AND no encroachment into the channel.
Minor	5% - 20% bank length comprising engineered bank revetment OR encroachment up to 10% channel width.
Major	> 20% bank length comprising an engineered bank revetment



1	OR encroachment > 10% of the channel width.
1	or chordaniment > 10% of the original water.

2.5 Limitations

- 2.5.1 There were several limitations to the survey work. There was limited access to all the Sites, meaning that only one sub-reach was surveyed instead of four sub-reaches for Site 1 and two sub-reaches were surveyed instead of three sub-reaches for Sites 3 to 6. This was due to permission being refused to survey parts of Site 1. At the remaining Sites, access was limited by the presence of fencing and dense vegetation.
- 2.5.2 Due to heavy rain in previous days, the streams were all at elevated flow levels. The guidelines recommend that MoRPh5 surveys are carried out during low flow conditions.
- 2.5.3 It was not possible to see the channel bed at site 3 due to the turbidity of the water, or at site 4 due to very steep banks limiting the view of the channel bed.



3. Results

3.1 River Condition Assessment

- 3.1.1 MoRPh5 surveys were carried out at five Sites (or 'Reaches'), each consisting of two sub-reaches, except for Site 1, which consisted of one sub-reach. The locations of each Site/Reach surveyed are displayed in **Figure 2**. Sub-reach locations for each Site are displayed in **Figures 3.1 3.5**. Site habitat photographs are provided in **Appendix 2**.
- 3.1.2 Each sub-reach consisted of five contiguous modules of 10 m in length. Where possible the sub-reaches were located at approximately equal intervals to provide a representative sample of the whole watercourse, however due access limitations this was not always possible.
- 3.1.3 The calculated condition scores for each Site and sub-reach are provided in **Table 4**. The condition score for Sites 1, 3 and 6 is **Good** and **Fairly Good** for Sites 4 and 5.

Table 4. Preliminary and final condition scores for each Site and sub-reach.

Site Number	Sub-reach Number	Preliminary Condition Score	Final Condition Score	Average Final Condition Score
1	1	2.38	Good	Good
3	1	2.32	Good	Good
	2	2.26	Good	
4	1	2.06	Fairly Good	Fairly Good
7	2	1.82	Fairly Good	Tamy Coou
5	1	1.85	Fairly Good	Foirly Cood
5	2	2.01	Fairly Good	Fairly Good
6	1	2.43	Good	Good
O	2	2.06	Fairly Good	Good



3.2 River Type

3.2.1 The results of the river type assessment are summarised in **Table 5**. The river type was calculated as **Type C** for sites 1, 3 and 4, and **Type D** for sites 5 and 6.

Table 5. Results of River Type Assessment.

River Type Indicator	Result				
	Site 1	Site 3	Site 4	Site 5	Site 6
A1 Braiding Index (number of wetted channels)	1 (single cha	nnel)			
A2 Sinuosity Index (reach river length/reach valley length)	1.03 (0.93/0.9)	1.02 (0.64/0.63)	1.01 (0.81/0.81)	1.01 (0.74/0.73)	1.12 (0.8/0.71)
A3 Anabranching Index (number of unvegetated channels separated by vegetated bars or islands)	1 (single cha	nnel)			
A4 Level of Confinement	Partly confined	Partly confined	Confined	Partly confined	Partly confined
A5 Valley Gradient (difference between upstream and downstream elevation divided by the reach valley length)	0.02441731	0.09651899	0.05061728	0.06122449	0.02097902
A6 Bedrock Reach	No	No	No	No	No
A7 Coarsest Bed Material	Boulder	Boulder	Bedrock	Boulder	Boulder
A8 Average Alluvial Bed Material	Cobble	Cobble	Cobble	Gravel / Pebble	Gravel / Pebble
River Type score	Type C	Type C	Type C	Type D	Type D



3.3 Riparian and In-Watercourse Encroachment

- 3.3.1 The Sites were bordered by a mix of semi-natural vegetation, including broadleaved woodland and modified grassland (grazing pasture), which extended 10 m from the bank top. There was no development within 10 m of the bank tops along any of the Sites, so the riparian encroachment band is **no encroachment** for all the Sites.
- 3.3.2 There was little to no engineered bank revetment at the Sites and no encroachment into the channel. Therefore, the in-watercourse encroachment is considered to be **no encroachment** for all the Sites.



4. Conclusion

4.1 Proposals

4.1.1 The proposed works include the construction of a new cable route, which will intersect the five separate watercourses. In most cases, the construction works will be directionally drilling under the watercourse to lay the pipe, so disturbance to the watercourse will be negligible

4.2 Conclusion

4.2.1 The watercourses were all in **good** or **fairly good** condition, therefore following the works, the watercourses should be returned to their baseline condition. In the event that the works cause permanent changes to the watercourses, e.g. by increasing in-watercourse encroachment, it may be necessary to carry out enhancements elsewhere along the watercourse to mitigate this.



5. References

Gurnell, A., England, J., Shuker, L. and Wharton, G. 2020a. *The MoRPh Survey, Technical Reference Manual.* www.modularriversurvey.org/

Gurnell, A., England, J., Scott, S. and Shuker, L. 2020b. *A Guide to Assessing River Condition,* Part of the Rivers and Streams Component of the BioDiversity Net Gain Metric. www.modularriversurvey.org/

Panks, S., White, N., Newsome, A., Nash, M., Potter, J., Heydon, M., Mayhew, E., Alvarez, M., Russell, T., Cashon, C., Goddard, F., Scott, S. J., Heaver, M., Scott, S. H., Treweek, J., Butcher, B. and Stone, D. 2022. *Biodiversity metric 3.1: Auditing and accounting for biodiversity — User Guide*. Natural England, Peterborough.



Appendix 1: River Condition Indicators

Table A1. River Condition Indicators from MoRPh5 Field Surveys (Gurnell et al., 2020b)

(NNIPS = Non-native Invasive Plant Species, <u>Positive Indicators Underlined</u>, *Negative Indicators Italics*)

Location of Feature	Feature	Example/Description
Bank top	Vegetation structure	Natural/lightly managed ground cover including grassland, scrub and trees
	Tree feature richness	Leaning and J-shaped trees
	Water-related features	Ponds, side channels and wetland vegetation
	NNIPS cover	Himalayan balsam, Japanese knotweed, giant hogweed, floating pennywort
	Managed ground cover	Footpaths, transport infrastructure, buildings, landfill, farmland, orchards, parks
Bank face	Riparian vegetation structure	Ground cover including grassland, scrub and trees
	Tree feature richness	Leaning and J-shaped trees
	Natural bank profile extent	Natural bank profile including vertical, steep, gentle and composite
	Natural bank profile richness	Variation in bank profile
	Natural bank material richness	Variation in bank face sediment



Location of Feature	Feature	Example/Description
	Bare sediment extent	Extent of bank face which is unvegetated
	Artificial bank profile extent	Artificial bank profile including reshaped, artificial two-stage, embanked and poached
	Reinforcement extent	Horizontal extent of reinforcement
	Reinforcement material severity	Reinforcement type including concrete, brick, sheet piling, rip-rap and gabions
	NNIPS cover	Himalayan balsam, Japanese knotweed, giant hogweed, floating pennywort
Channel – water margin	Aquatic vegetation extent	Extent of aquatic vegetation including liverworts, mosses, lichens, emergent broad-leaved, emergent linear-leaved, amphibious and filamentous algae
	Aquatic morphotype richness	Variation in aquatic vegetation
	Physical feature extent	Side bars, berms, benches, cliffs
	Physical feature richness	Variation in physical features
	Artificial features	Pipes/outfalls, jettys
Channel bed	Aquatic morphotype richness	Variation in aquatic vegetation



Location of Feature	Feature	Example/Description
	Tree features richness	Trees growing in channel
	Hydraulic features richness	Variation in water surface flow patterns
	Natural features extent	Mid channel bars, islands, cascades, pools, riffles
	Natural features richness	Variation in natural features
	Bed material richness	Variation in bed material including bedrock, boulder, gravel-pebble, sand, wilt, clay, organic matter and peat
	Bed siltation	Continuous or patchy silt layer
	Reinforcement extent	Extent of artificial reinforcement along channel bed
	Reinforcement severity	Reinforcement type including concrete, brick, sheet piling, riprap and gabions
	Artificial features severity	Large trash, weirs, bridge piers
	NNIPS extent	Himalayan balsam, Japanese knotweed, giant hogweed, floating pennywort
	Filamentous algae extent	Abundance of filamentous algae



Appendix 2: Site Habitat Photographs









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- 1 Site 1, Subreach 1, Module 1
- 2 Site 1, Subreach 1, Module 2
- 3 Site 1, Subreach 1, Module 3
- 4 Site 1, Subreach 1, Module 4

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Appendix 2: Site Photographs

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	Oile	4	Oubreach	4	Madula	-
3	Sile		Subreach		MODILLE	2

6 Site 3, Subreach 1, Module 1

7 Site 3, Subreach 1, Module 2

8 Site 3, Subreach 1, Module 3

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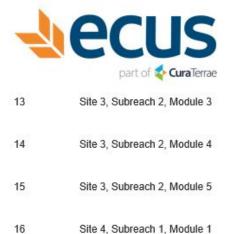








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17	Site 4	Subreach	1 1	Module 2

18 Site 4, Subreach 1, Module 3

19 Site 4, Subreach 1, Module 4

20 Site 4, Subreach 1, Module 5

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21	Site 4.	Subreach	2	Module	1

22 Site 4, Subreach 2, Module 2

23 Site 4, Subreach 2, Module 3

24 Site 4, Subreach 2, Module 4

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Appendix 2: Site Photographs

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25	Site 4	Subreach	2	Module 5

26	Oil- F	Outenande	4 8	Andrel - A
/n	SHES	Subreach	7 1	MOOILIE T

27	Site 5.	Subreach	1. Module 2

28 Site 5, Subreach 1, Module 3

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Appendix 2: Site Photographs

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29	Site 5, Subreach 1, Module 4
30	Site 5, Subreach 1, Module 5
31	Site 5, Subreach 2, Module 1
32	Site 5, Subreach 2, Module 2

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Appendix 2: Site Photographs

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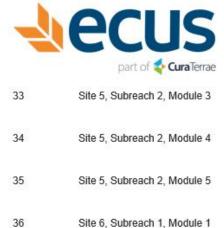








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Appendix 2: Site Photographs

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Site 6, Subreach 1, Module 2

Site 6, Subreach 1, Module 3

Site 6, Subreach 1, Module 4

Site 6, Subreach 1, Module 5

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Appendix 2: Site Photographs

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11	Site 6.	Subreach 2	Module 1
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42 Site 6 Subreach 2 Modu	0 2

40	0.00	O. L	-	The Real Property of the Control of	-
43		Subreach			

44	Site 6.	Subreach 2.	Module

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Appendix 2: Site Photographs

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45 Site 6, Subreach 2, Module 5

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Appendix 2: Site Photographs

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Unit 1 Woodlands Business Village, Coronation Road, Basingstoke, RG21 4JX

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Figure 2: Reach Location Map





--- River Condition Assessment Reaches

0.75 1.5 km

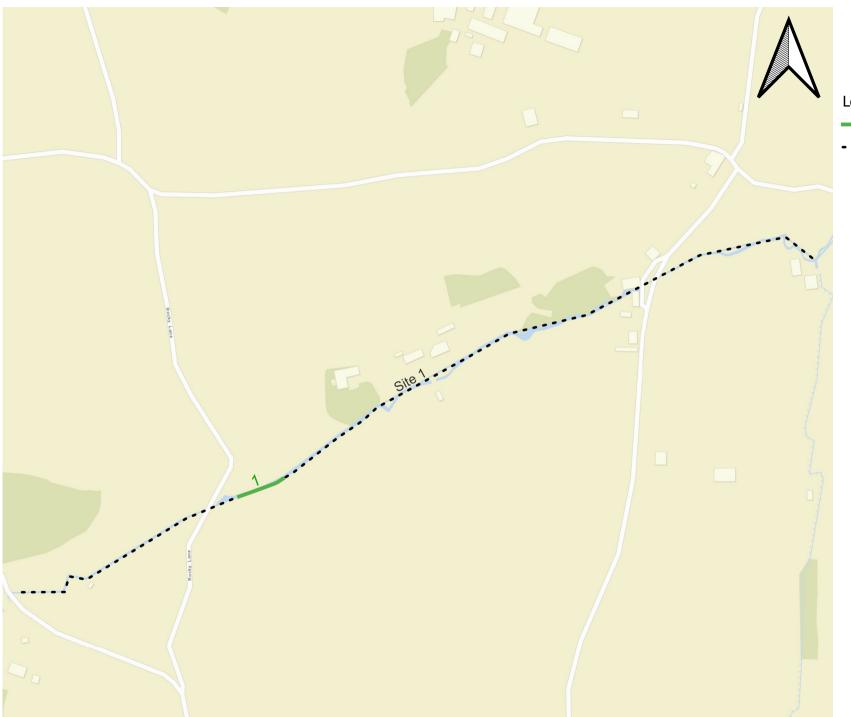
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River Condition Assessments

Figure 2 Reach Locations

@A4

Figure 3.1 – 3.5: Sub-reach Location Maps





Subreach Location

- - - River Condition Assessment Reaches

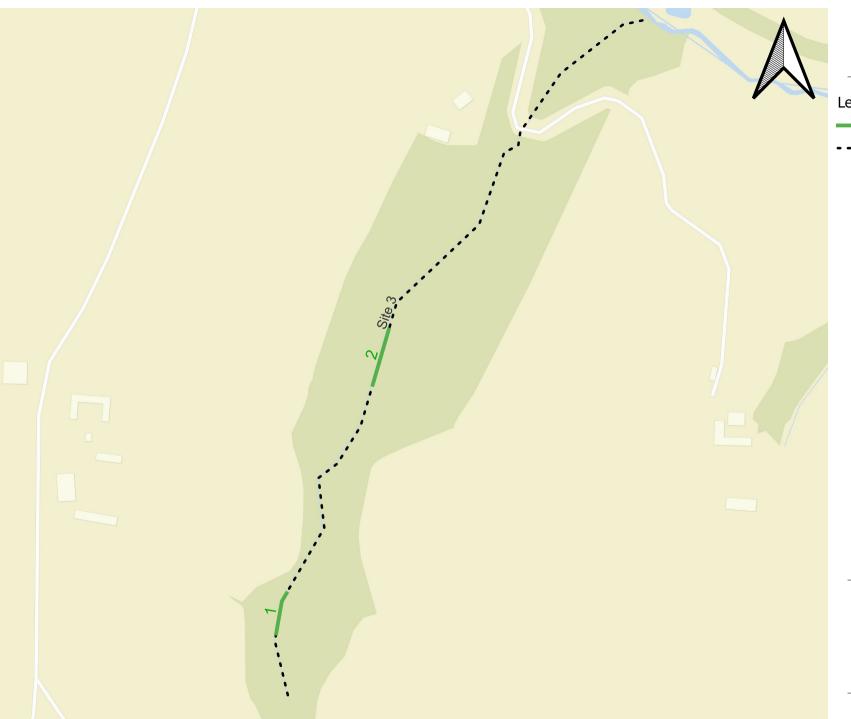
100 m

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Figure 3.1 Site 1 Subreach Location

@A4





Subreach Location

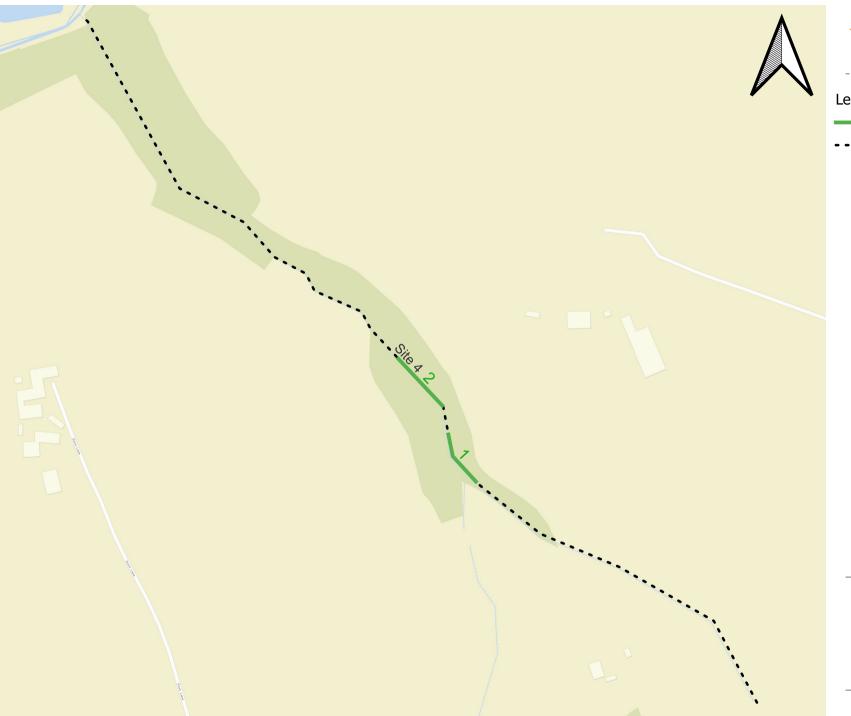
- - - River Condition Assessment Reaches

50 100 m

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Figure 3.2 Site 3 Subreach Location





- Subreach Location
- - River Condition Assessment Reaches

50 100 m

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Figure 3.3 Site 4 Subreach Location





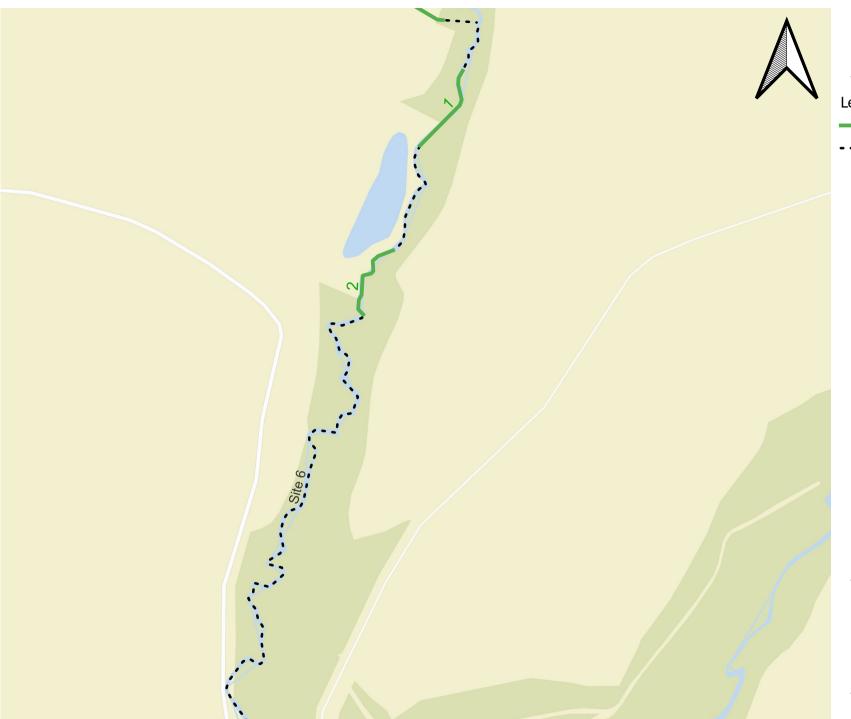
- Subreach Location
- - River Condition Assessment Reaches

50 100 m

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Figure 3.4 Site 5 Subreach Location





Subreach Location

- - - River Condition Assessment Reaches

50 100 m

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Figure 3.5 Site 6 Subreach Location



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