A66 Northern Trans-Pennine Project
TR010062

3.4 Environmental Statement Appendix 6.20 Aquatic Macrophyte and River Corridor Survey

APFP Regulations 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Volume 3

June 2022

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

A66 Northern Trans-Pennine Project Development Consent Order 202x

3.4 ENVIRONMENTAL STATEMENT APPENDIX 6.20 AQUATIC MACROPHYTE AND RIVER CORRIDOR SURVEY

Regulation Number:	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	TR010062
Application Document Reference	3.4
Author:	A66 Northern Trans-Pennine Project Team, National Highways

Version	Date	Status of Version
Rev 1	13/06/22	DCO Application

CONTENTS

6.20 Aquatic Macrophyte and River Corridor Survey

6.20.1 Introduction

6.20.1.1 The A66 Northern Trans-Pennine project is a programme of works to improve the A66 between the M6 at Penrith and A1 at Scotch Corner.

6.20.1.2 Between the M6 and the A1(M) the existing A66 is approximately 80km in length. Along this length it is intermittently dualled, with approximately 30km of single carriageway, in six separate sections, making the route accident prone and unreliable.

6.20.1.3 The route carries high levels of freight traffic and is an important route for tourism and connectivity to local communities. The variable road standards, together with the lack of available diversionary routes when incidents occur, affects road safety, reliability, resilience and attractiveness of the route. For a full project description see Chapter 2: The Project (Application Document 3.2).

6.20.2 Legislation and Policy Framework

Legislation

6.20.2.1 A framework of international, European, national and local legislation and planning policy guidance exists to protect and conserve wildlife and habitats. Legislation relevant to fish and discussed within this report are:

- Natural Environment and Rural Communities (NERC) Act 2006
- EC Directive Conservation of Natural Habitats & Flora (92/43/EEC)
- The Water Framework Directive (WFD) 2000/60/EC
- Wildlife and Countryside Act 1981.

Natural Environment and Rural Communities Act 2006

6.20.2.2 The NERC Act 2006 is designed to help achieve a rich and diverse natural environment and thriving rural communities. Section 41 (S41) of the Act requires the Secretary of State to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England. The S41 list is used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under Section 40.

6.20.2.3 Under Section 40 there is a Duty to conserve biodiversity; specifically, Subsection (1) states “Every public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity.”

6.20.2.4 Numerous species of macrophytes, bryophoytes, lichens and vascular plants associated with watercourses are listed as Species of Principal Importance (SoPI) under S41. Annex I habitat: H3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation and other river habitat types qualify as priority river habitat under NERC, as defined by the criteria in the

UK Biodiversity Action Plan Priority Habitat Descriptions for rivers (Joint Nature Conservation Committee, 2011)[1].

EC Directive Conservation of Natural Habitats & Flora (92/43/EEC)

6.20.2.5 The Conservation of Habitats and Species Regulations 2017 consolidated and updated the Conservation of Habitats and Species Regulations 2010 (as amended). They are the British response to the Habitats and Species Directive 1992 issued by the European Community (EC) (which is now the European Union (EU)). They offer protection to a number of plant and animal species throughout the EC via the designation of Special Areas of Conservation (SACs).

6.20.2.6 Schedule 5 of the Conservation of Habitats and Species Regulations 2017 lists European protected plant species. It is an offence to deliberately pick, collect, cut, uproot or destroy Schedule 5 species, or possess, control or transport them (alive or dead). A mitigation licence is required to carry out any of these actions.

6.20.2.7 Annex I of the Habitats Directive 2017 lists the habitat types for which Natura 2000 sites can be designated. This includes habitat type: 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation, which is a riverine habitat characterised by the abundance of a number of specific water-crowfoot species.

The Water Framework Directive (WFD) 2000/60/EC

6.20.2.8 The WFD is a legal framework for the protection and restoration of inland surface waters, transitional water, coastal waters and groundwater. The WFD introduced a comprehensive river basin management planning system to help protect and improve the ecological health of the water environment. This is underpinned by the use of environmental standards to help assess risks to the ecological quality of the water environment and to identify the scale of improvements that would be needed to bring waters under pressure back into a good condition.

6.20.2.9 Under WFD many activities need approval before they can go ahead. A WFD assessment is required to enable the public body that regulates and grants permissions for your activity to provide consent.

6.20.2.10 The WFD aim is for all water bodies to be at good status. A WFD assessment demonstrate that an activity will not:

- Cause or contribute to deterioration of status
- Jeopardise the water body achieving good status in future.

6.20.2.11 "Macrophytes and Phytobenthos" is one of the biological quality elements (along with "macroinvertebrates" and "fish") typically used to provide WFD status in rivers and form part of the WFD assessment.

[1] Joint Nature Conservation Committee (2011) UK Biodiversity Action Plan Priority Habitat Descriptions "Rivers".

Wildlife and Countryside Act 1981

6.20.2.12 Schedule 8 of the Wildlife and Countryside Act (WCA) 1981 lists plant species that are protected under Section 13. Section 13 protects plants from picking and sale of plants or parts of plants listed in Schedule 8. Numerous species of macrophytes, bryophytes, lichens and vascular plants that can be associated with watercourses are listed on Schedule 8. Schedule 9 lists non-native species that are already established in the wild, but which continue to pose a conservation threat to native biodiversity and habitats, such that further releases should be regulated.

National level policy

6.20.2.13 The primary policy basis for deciding whether or not to grant a Development Consent Order (DCO) is the *National Policy Statement for National Networks (NPSNN)* (Department for Transport, 2014)[2], which sets out policies to guide how DCO applications will be decided and how the effects of national networks infrastructure should be considered by the relevant decision maker. The policies for biodiversity and ecological conservation include statements that:

"Biodiversity is the variety of life in all its forms and encompasses all species of plants and animals and the complex ecosystems of which they are a part. Government policy for the natural environment is set out in the Natural Environment White Paper (NEWP). The NEWP sets out a vision of moving progressively from net biodiversity loss to net gain, by supporting healthy, well-functioning ecosystems and establishing more coherent ecological networks that are more resilient to current and future pressures…" (*NPSNN* paragraph 5.20)

6.20.2.14 The *NPSNN* also advises:

"In taking decisions, the Secretary of State should ensure that appropriate weight is attached to designated sites of international, national and local importance, protected species, habitats and other species of principal importance for the conservation of biodiversity, and to biodiversity and geological interests within the wider environment." (*NPSNN* paragraph 5.26)

Table 1: *NPSNN* policies.

Relevant *NPSNN* paragraph reference	Requirement of the *NPSNN* (paraphrase)
5.22	Outline any likely significant effects on internationally, nationally and locally designated sites of ecological or geological conservation importance on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity and that the statement considers the full range of potential impacts on ecosystems.

[2] Department for Transport (2014) National Policy Statement for National Networksf

Relevant *NPSNN* paragraph reference	Requirement of the *NPSNN* (paraphrase)
5.23	Demonstrate how the project has taken advantage of opportunities to conserve and enhance biodiversity conservation interests.
5.29	Ensure proposals mitigate the harmful aspects of the development and, where possible, to ensure the conservation and enhancement of the site's biodiversity are acceptable.
5.33	Development proposals potentially provide many opportunities for building in beneficial biodiversity features. Opportunities to maximise beneficial biodiversity features should be considered. Planning obligations can be used where appropriate in order to ensure that such beneficial features are delivered.
5.34 and 5.35	Individual wildlife species receive statutory protection under a range of legislative provisions. Other species and habitats have been identified as being of principal importance for the conservation of biodiversity in England and Wales. Undertake measures to ensure these species and habitats are protected from adverse effects. Where appropriate, requirements or planning obligations may be used in order to deliver this protection.
5.36	Include appropriate mitigation measures as an integral part of their proposed development, including identifying where and how these will be secured
5.37	Consider what appropriate requirements should be attached to any consent and/or in any planning obligations entered into in order to ensure that mitigation measures are delivered.
5.38	Take account of what mitigation measures may have been agreed between the applicant and Natural England and/or the Marine Management Organisation (MMO), and whether Natural England and/or or the MMO has granted or refused, or intends to grant or refuse, any relevant licences, including protected species mitigation licences.

National planning policy framework

6.20.2.15 The *National planning policy framework (NPPF)* (Ministry of Housing, Communities & Local Government, 2021)[3] originally published in March 2012 and most recently updated in July 2021, sets out the government's planning policies for England and provides a framework within which locally prepared plans can be produced. The *NPPF* is *"an important and relevant matter to be considered in decision making for NSIP*[4]".

Regional and local level policy

6.20.2.16 A number of lower plants, lichens, mosses and fungi are listed in the Cumbria Biodiversity Action Plan species list (Cumbria Wildlife Trust, 2009)[5]. Targets for rivers and streams, floodplain grazing marsh and

[3] Ministry of Housing, Communities & Local Government (2021) National Planning Policy Framework
[4] Nationally Significant Infrastructure Projects (NSIP)
[5] Cumbria Wildlife Trust (2009) Cumbria BAP Species List Updated 2009

exposed riverine sediments are outlined in the Durham *Rivers and Streams Action Plan* (North East England Nature Partnership, 2016)[6].

Other relevant policy and guidance

6.20.2.17 In addition to compliance with the *NPSNN* and *NPPF*, this report has been written in accordance with professional standards and guidance. The standards and guidance which relate to the assessment are:

- *Guidance for Ecological Impact Assessment in the United Kingdom Third Edition* (Chartered Institute of Ecology and Environmental Management, 2018)[7]

6.20.3 Methodology

Desk study

Environment Agency Data

6.20.3.1 The Environment Agency ecology and fish data explorer (Environment Agency, 2021)[8] and GIS were used to identify Environment Agency macrophyte survey sites located within the Order Limits plus a 2km buffer. Data from between 2010 and 2021 was included in the desk study.

6.20.3.2 Macrophyte survey data were included in the desk study from all watercourses within the 2km search area, whether they were hydraulically connected to watercourses that interact with the project or not to provide context.

6.20.3.3 The Environment Agency macrophyte survey species lists were screened for protected and/or notable macrophytes as defined below. Taxa lists from the surveys identified were screened for notable and/or protected macroinvertebrate species, as defined by Joint Nature Conservation Committee (JNCC) Conservation Designations for UK taxa 2020 (Joint Nature Conservation Committee, 2020)[9].

Field survey

Survey aims

6.20.3.4 A combination of River Corridor Survey (RCS) and macrophyte surveys were undertaken to:

- Identify and map the presence and location (and spatial extents of in-channel macrophyte beds of ≥3m^2) of protected and/or notable species
- Provide the conservation status of protected and/or notable species recorded in the study area according to the JNCC

[6] North East England Nature Partnership (2016) Rivers and Streams Action Plan
[7] Chartered Institute of Ecology and Environmental Management (2018) Guidance for Ecological Impact Assessment in the United Kingdom Third Edition
[8] Environment Agency (2021) Ecology and Fish Data Explorer.
[9] Joint Nature Conservation Committee (2020) Conservation Designations for UK Taxa 2020..

Conservation Designations for UK Taxa list[9] and other species/group specific references

- Confirm the presence / absence and condition the Annex I habitat type 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
- Determine a baseline WFD ecological quality of the rivers according to the macrophyte assemblage using the LEAFPACS2 tool.

Macrophyte survey

6.20.3.5 A total of 18 watercourse crossing points were screened in for macrophyte survey based on habitat assessment, the route alignment and desk study information. The surveys undertaken are described in Table 3: Summary of surveys completed at each site and the location shown in ES Figure 6.18: River Corridor Survey, Macrophyte Survey, Aquatic Invertebrate Survey and White-clawed Crayfish Survey The upstream and downstream location for each survey are provided in Annex 1 (Table 7).

6.20.3.6 RSK Biocensus (hereafter referred to as RSK) undertook the macrophyte surveys; at each watercourse crossing, an upstream and downstream macrophyte survey was required, with the exception of two sites, where only one macrophyte survey was required due to the availability of habitat and confluences with other watercourses.

6.20.3.7 Macrophyte surveys were undertaken in July and August 2021 by a team of two surveyors comprising Richard Lansdown (a specialist aquatic botanist) and an aquatic ecologist from within RSK.

6.20.3.8 Macrophyte surveys were conducted in accordance with the methods detailed in River Assessment Method Macrophytes and Phytobenthos, Macrophytes (River LEAFPACS2), Water Framework Directive[10]. The survey reaches were 100m in length. The surveyors walked / waded the 100m reach and undertook a visual assessment of macrophytes within the reach. Submerged macrophytes were sampled using a grapnel where appropriate. Where possible, macrophyte species were identified to species level. Macrophytes were identified to genus or other aggregate taxon level where species level identification was not possible.

6.20.3.9 An Ecological Quality Ratio (EQR) was calculated for each site using the LEAFPACS2 tool. The tool provides an ecological status class according to macrophytes under the WFD (Table 2: EQRs and corresponding status class boundaries using LEAFPACS2).

6.20.3.10 Alkalinity data required for the LEAFPACS2 tool was obtained using the Environment Agency's openly available water quality data archive (Environment Agency, 2021)[11]. The closest Environment Agency

[10] River LEAFPACS 2: WFD-UKTAG, 2014. UKTAG River Assessment Method Macrophytes and Phytobenthos. Macrophytes (River LEAFPACS2). A report by the Water Framework Directive – United Kingdom Technical Advisory Group.
[11] Environment Agency (2021) Water Quality Archive.

sampling point to each survey location was used, and the average alkalinity (to pH 4.5 as $CaCO_3$) over 12 sampling months was calculated.

Table 2: EQRs and corresponding status class boundaries using LEAFPACS2

EQR	Status class boundary
0.8	High / Good
0.6	Good / Moderate
0.4	Moderate / Poor
0.2	Poor / Bad

River Corridor Survey

6.20.3.11 A total of 18 watercourse crossing points were screened in for River Corridor Survey (RCS) based on habitat assessment, the route alignment and desk study information. The surveys undertaken are described in Table 3 and the location shown in ES Figure 6.18: River Corridor Survey, Macrophyte Survey, Aquatic Invertebrate Survey and White-clawed Crayfish Survey (Application Document 3.3). The upstream and downstream locations for each survey are provided in Annex 1 (Table 7). Where possible a 500m RCS survey was undertaken both upstream and downstream of the watercourse crossing points.

6.20.3.12 Given the conservation value of Trout Beck, which forms part of the River Eden Special Area of Conservation (SAC), additional 500m RCS surveys were undertaken to capture baseline habitat information from the proposed watercourse crossing point to the confluence with the River Eden.

6.20.3.13 RCS surveys were undertaken in July and August 2021 by a team of two RSK ecologists. The surveyors walked / waded the reach and mapped and described the following zones:

- Aquatic Zone: plant communities, flow and current features, substrate and physical features
- Marginal Zone: plant communities, substrate and physical features
- Bank Zone: tree species, other plant communities, physical features
- Adjacent Land Zone: habitat types, land use.

6.20.3.14 The surveys were compliant with methods prescribed in the RCS manual.[12] The surveyors drew maps covering the 500m reach for each site and drew at least one representative cross-section for each site. The presence and spatial extents of protected and / or notable species were drawn on the maps. The surveyors recorded lower plants, lichens, mosses and fungi. Searches for the following moss species: *Thamnobryum angustifolium* and *Anomodon attenuates* and for the lichen species: *Collema dichotomum* were also undertaken. A

[12] National Rivers Authority (1992) River Corridor Surveys. Conservation Technical Handbook 1. Bristol.

descriptive summary for each site was written and representative site photographs were undertaken.

JNCC Screening

6.20.3.15 Species recorded in the samples were screened against the JNCC Conservation Designations for UK Taxa list[9] to identify the presence of protected and/or notable species.

6.20.4 Assumptions and Limitations

6.20.4.1 RCS and / or macrophyte surveys could not be undertaken at certain sites for reasons including sites being dry and due to land access restrictions. A summary of surveys undertaken at each site and reasons why surveys were not undertaken at certain sites is shown in Table 3: Summary of surveys completed at each site. The NGRs for the RCS and macrophyte surveys are shown in Annex 1 (Table 7).

6.20.4.2 Alkalinity data for the LEAFPACS2 calculator was obtained from the Environment Agency's water quality data archive. For some sites, data was not available from the exact watercourse where surveys were undertaken. In these instances, the nearest available data was used. For some sampling points, data had not been collected over the past year and in these instances, the most recent available data was used.

Table 3: Summary of surveys completed at each site

Scheme	Site name	Watercourse	RCS	Macrophyte	Comments
M6 Junction 40 to Kemplay Bank (S0102)	WCP_01_D/S	Thacka Beck	✓	✓	
	WCP_01_U/S	Thacka Beck	✓	✓	
Penrith to Temple Sowerby (S03)	WCP_03_D/S	Light Water	✓	✓	
	WCP_03_D/S	Light Water	✓	✓	
	WCP_04_D/S	Unnamed Tributary of River Eamont 3.3	✓	×	Channel dry, not suitable for macrophyte survey
	WCP_04_U/S	Unnamed Tributary of River Eamont 3.3	×	×	Channel dry, not suitable for survey
Temple Sowerby to Appleby (S0405)	WCP_08_DS-1	Trout Beck	✓	✓	
	WCP_08_DS-2	Trout Beck	✓	Not required[13]	
	WCP_08_DS-3	Trout Beck	✓		
	WCP_08_DS-4	Trout Beck	✓		
	WCP_08_DS-5	Trout Beck	✓		
	WCP_08_US	Trout Beck	✓	✓	

[13] LEAFPACS2 surveys and associated EQR values were obtained from adjacent sites in Trout Beck.

Scheme	Site name	Watercourse	RCS	Macrophyte	Comments
	WCP_08_US-RED	Trout Beck	✓	✓	
	WCP_08_US-RED_KS_D/S	Keld Sike	×	✓	Channel inaccessible due to scrub throughout much of its length
	WCP_08_US-RED_KS_U/S	Keld Sike	×	×	Channel inaccessible due to scrub throughout much of its length; not suitable for RCS or LEAFPACS
Appleby to Brough (S06)	WCP_11_D/S	Unnamed Tributary of Mire Sike 6.12	✓	✓	
	WCP_11_U/S	Unnamed Tributary of Mire Sike 6.12	✓	✓	
	WCP_13_D/S	Cringle Beck	✓	✓	
	WCP_13_U/S	Cringle Beck	✓	✓	
	WCP_15_D/S	Moor Beck	✓	✓	
	WCP_15_U/S	Moor Beck	✓	✓	
	WCP_17_D/S	Eastfield Sike	✓	✓	
	WCP_17_U/S	Eastfield Sike	✓	✓	
	WCP_18_D/S	Unnamed Tributary of Lowgill Beck 6.1	✓	✓	
	WCP_18_U/S	Unnamed Tributary of Lowgill Beck 6.1	✓	✓	
	WCP_19_D/S	Lowgill Beck	✓	✓	
	WCP_19_US	Yosgill Sike	✓	✓	
Bowes Bypass (S07)	WCP_20_D/S	Unnamed Tributary of River Greta 7.3	×	✓	Channel had intermittent flow, was ill-defined and scrub made some sections inaccessible,

Scheme	Site name	Watercourse	RCS	Macrophyte	Comments
					not suitable for RCS
	WCP_20_U/S	Unnamed Tributary of River Greta 7.3	×	×	Channel was inaccessible due to scrub, not suitable for survey
Cross Lanes to Rokeby (S08)	WCP_23_U/S	Unnamed Tributary of Tutta Beck 8.1	×	×	Channel dry, not suitable for survey
	WCP_24_BLUE_D/S	Punder Gill	✓	✓	
	WCP_24_BLUE_U/S	Punder Gill	×	×	Channel dry, not suitable for survey
	WCP_24_D/S	Tutta Beck	✓	✓	
	WCP_24_U/S	Punder Gill	✓	✓	
Stephen Bank to Carkin Moor (S09)	WCP_30_D/S	Mains Gill	×	×	Could not access due to presence of suckler cows[14]
	WCP_30_U/S	Mains Gill	×	✓	Dry in large sections, not suitable for RCS
	WCP_33_D/S	Unnamed Tributary of Holme Beck 9.2	✓	✓	

[14] the landowner informed the surveyors that the channel was mostly dry at this site.

6.20.5 Results

Desk Study

Routewide

6.20.5.1 Table 4: Macrophyte records of conservation value (or Invasive Non-native) within 2km of draft DCO boundary shows the macrophyte species of conservation value and invasive non-native species (INNS) listed on Schedule 9 of the WCA, identified within the desk study search area.

6.20.5.2 Macrophyte species of conservation value, or INNS were identified within the desk study search area for the M6 Junction 40 to Kemplay Bank, Penrith to Temple Sowerby, and Temple Sowerby to Appleby schemes. No macrophyte species of conservation value, or INNS records were identified for any other scheme.

Table 4: Macrophyte records of conservation value (or Invasive Non-native) within 2km of draft DCO boundary

Scheme	Watercourse and EA Site ID	Species	Conservation status / INNS status	Record date	Location	Approximate distance and direction from draft DCO boundary
M6 Junction 40 to Kemplay Bank (S0102)	River Eamont (78316)	Nuttall's waterweed (*Elodea nuttallii)*	INNS - WCA Schedule 9	10/06/2013	NY4982327751	1.2km south west
	River Lowther (135166)	Water crowfoot (*Ranunculus penicillatus* subsp. *penicillatus)*	Annex I habitat H3260 water course indicator	02/07/2015	NY5263828652	245m south east
	River Lowther (135166)	Canadian waterweed (*Elodea canadensis)*	INNS - WCA Schedule 9	05/09/2012	NY5263828652	245m south east
	River Eamont (87558)	Himalayan balsam (*Impatiens glandulifera)*	INNS - WCA Schedule 9	05/07/2010 06/06/2013	NY5522029600	1.9km east
	River Eamont (87558)	Water crowfoot (*Ranunculus fluitans*)	Annex I habitat H3260 water course indicator	05/07/2010 06/06/2013	NY5522029600	1.9km east
	River Eamont (87558)	Water crowfoot (*Ranunculus penicillatus* subsp. *penicillatus)*	Annex I habitat H3260 water course indicator	05/07/2010 06/06/2013	NY5522029600	1.9km east
Penrith to Temple Sowerby (S03)	River Lowther (135166)	Water crowfoot (*Ranunculus penicillatus* subsp. *penicillatus)*	Annex I habitat H3260 water course indicator	02/07/2015	NY5263828652	1.3km west
	River Lowther (135166)	Canadian waterweed (*Elodea canadensis)*	INNS - WCA Schedule 9	05/09/2012	NY5263828652	1.3km west

Scheme	Watercourse and EA Site ID	Species	Conservation status / INNS status	Record date	Location	Approximate distance and direction from draft DCO boundary
	River Eamont (87558)	Himalayan balsam (*Impatiens glandulifera)*	INNS - WCA Schedule 9	05/07/2010 06/06/2013	NY5522029600	205m north
	River Eamont (87558)	Water crowfoot (*Ranunculus fluitans)*	Annex I habitat H3260 water course indicator	05/07/2010 06/06/2013	NY5522029600	205m north
	River Eamont (87558)	Water crowfoot (*Ranunculus penicillatus* subsp. *penicillatus)*	Annex I habitat H3260 water course indicator	05/07/2010 06/06/2013	NY5522029600	205m north
	River Eamont (87559)	Himalayan balsam (*Impatiens glandulifera)*	INNS - WCA Schedule 9	05/07/2010	NY5539229419	100m north
	River Eamont (87559)	Water crowfoot (*Ranunculus fluitans)*	Annex I habitat H3260 water course indicator	05/07/2010	NY5539229419	100m north
	River Eamont (87559)	Water crowfoot (*Ranunculus penicillatus* subsp. *penicillatus)*	Annex I habitat H3260 water course indicator	05/07/2010	NY5539229419	100m north
	River Eamont (92294)	Water crowfoot (*Ranunculus fluitans)*	Annex I habitat H3260 water course indicator	19/09/2014	NY5780030500	1.3km north
	River Eamont (92294)	Canadian waterweed (*Elodea canadensis)*	INNS - WCA Schedule 9	05/07/2013 19/09/2014	NY5780030500	1.3km north
	River Eamont (92294)	Nuttall's waterweed (*Elodea nuttallii)*	INNS - WCA Schedule 9	05/07/2013 19/09/2014	NY5780030500	1.3km north

Scheme	Watercourse and EA Site ID	Species	Conservation status / INNS status	Record date	Location	Approximate distance and direction from draft DCO boundary
	River Eden (92298)	Water crowfoot (*Ranunculus fluitans)*	Annex I habitat H3260 water course indicator	05/07/2010 06/07/2011 05/07/2013 30/09/2015	NY6038528247	950 east
	River Eden (92298)	Himalayan balsam (*Impatiens glandulifera)*	INNS - WCA Schedule 9	05/07/2010 19/09/2014	NY6038528247	950 east
	River Eden (92298)	Canadian waterweed (*Elodea canadensis)*	INNS - WCA Schedule 9	19/09/2014	NY6038528247	950 east
	River Eden (65489)	Water crowfoot (*Ranunculus fluitans)*	Annex I habitat H3260 water course indicator species	05/07/2010	NY6039128147	980m east
	River Eden (65489)	Himalayan balsam (*Impatiens glandulifera)*	INNS	05/07/2010	NY6039128147	980m east
Temple Sowerby to Appleby (S0405)	River Eden (92298)	Water crowfoot (*Ranunculus fluitans)*	Annex I habitat H3260 water course indicator species	05/07/2010 06/07/2011 05/07/2013 30/09/2015	NY6038528247	1.7km north west
	River Eden (92298)	Himalayan balsam (*Impatiens glandulifera)*	INNS - WCA Schedule 9	05/07/2010 19/09/2014	NY6038528247	1.7km north west
	River Eden (92298)	Canadian waterweed (*Elodea canadensis)*	INNS - WCA Schedule 9	19/09/2014	NY6038528247	1.7km north west

Scheme	Watercourse and EA Site ID	Species	Conservation status / INNS status	Record date	Location	Approximate distance and direction from draft DCO boundary
	River Eden (65489)	Water crowfoot (*Ranunculus fluitans)*	Annex I habitat H3260 water course indicator species	05/07/2010	NY6039128147	1.6km north west
	River Eden (65489)	Himalayan balsam (*Impatiens glandulifera)*	INNS - WCA Schedule 9	05/07/2010	NY6039128147	1.6km north west
	Crowdundle Beck (159661)	Japanese knotweed (*Fallopia japonica*)	INNS - WCA Schedule 9	03/08/2012	NY6272528710	1.7km north
	Trout Beck (159569)	Bladder sedge *(Carex vesicaria)*	Vulnerable	26/06/2013	NY6894223367	1.9km north east.
Appleby to Brough (S06)	No records	N/A	N/A	N/A	N/A	N/A
Bowes Bypass (S07)	No records	N/A	N/A	N/A	N/A	N/A
Cross Lanes to Rokeby (S08)	No records	N/A	N/A	N/A	N/A	N/A
Stephen Bank to Carkin Moor (S09)	No records	N/A	N/A	N/A	N/A	N/A

Field Survey

Routewide

River Corridor Survey

6.20.5.3 River Corridor Survey (RCS) were undertaken at 28 sites and LEAFPACS2 macrophyte surveys were undertaken at 25 sites.

6.20.5.4 Eight sites were recorded conforming to the 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation. These were:

- Light Water, downstream of the existing A66 (WCP_03_D/S)
- Trout Beck, the entire of the surveyed reach (WCP_08_D/S-1, WCP_08_D/S-2, WCP_08_D/S-3, WCP_08_D/S-4, WCP_08_D/S-5, WCP_08_U/S and WCP_08_RED_U/S).

6.20.5.5 Three sites with areas of adjacent land were recorded conforming to the 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*. These were:

- Light Water, both upstream and downstream of the existing A66 (WCP_03_D/S and WCP_03_U/S).
- Crook Becks, near Warcop (WCP_17_D/S).

6.20.5.6 Four species of conservation interest were recorded from three sites. Sites that contain species that are of conservation interest according to the JNCC Conservation Designations for UK Taxa are listed in Table 5: Species of conservation interest and the sites where they were recorded. No S41 species or species listed in Section 13 of WCA were recorded.

6.20.5.7 The invasive non-native riparian plant Himalayan balsam (*Impatiens glandulifera*) was recorded at a number of sites:

- Unnamed Tributary of River Eamont 3.3 (WCP_04_D/S)
- All sites on Trout Beck, with the exception of WCP_08_D/S-4.

Table 5: Species of conservation interest and the sites where they were recorded

Scheme	Site name	Watercourse	Species	Conservation designation
Penrith to Temple Sowerby (S03)	WCP_03_DS	Light Water	Valerian *(Valeriana officinalis)*	UK Red List: Least concern England Red List: Near threatened
Appleby to Brough (S06)	WCP_11_DS	Unnamed Tributary of Mire Sike 6.12	Valerian *(Valeriana officinalis)*	UK Red List: Least concern England Red List: Near threatened
	WCP_18_U/S	Unnamed Tributary of Lowgill Beck 6.1	Valerian *(Valeriana officinalis)*	UK Red List: Least concern England Red List: Near threatened
			Marsh pennywort	UK Red List: Least concern England Red List: Near threatened

Scheme	Site name	Watercourse	Species	Conservation designation
			Hydrocotyle vulgaris	
			Ragged robin (*Lychnis flos-cuculi*)	UK Red List: Least concern England Red List: Near threatened

Macrophyte surveys (LEAFPACS)

6.20.5.8 The EQR of each site calculated using the LEAFPACS2 tool is shown in Table 6: EQR and corresponding WFD classification for each site. This corresponds to a WFD classification status ranging between high, good, moderate, poor and bad.

6.20.5.9 There were eight sites with a WFD classification of good or high. These were located in sections of Trout Beck (WCP_08_US, WCP_08_RED-US), Keld Sike (WCP_08_US_RED-KS), Cringle Beck (WCP_13_DS and WCP_13_US), Moor Beck (WCP_15_US), Eastfield Sike/Crook Becks (WCP_17_US) and Lowgill Beck (WCP_18_US).

Table 6: EQR and corresponding WFD classification for each site

Scheme	Site name	Watercourse	EQR	WFD Classification
M6 Junction 40 to Kemplay Bank (S0102)	WCP_01_D/S	Thacka Beck	0.259	Poor
	WCP_01_U/S	Thacka Beck	0.366	Poor
Penrith to Temple Sowerby (S03)	WCP_03_D/S	Light Water	0.486	Moderate
	WCP_03_D/S	Light Water	0.449	Moderate
Temple Sowerby to Appleby (S0405)	WCP_08_D/S	Trout Beck	0.466	Moderate
	WCP_08_US	Trout Beck	0.648	Good
	WCP_08_US-RED	Trout Beck	0.751	Good
	WCP_08_US-RED_KS_D/S	Keld Sike	0.668	Good
Appleby to Brough (S06)	WCP_11_D/S	Unnamed Tributary of Mire Sike 6.12	0.339	Poor
	WCP_11_U/S	Unnamed Tributary of Mire Sike 6.12	0.127	Bad
	WCP_13_D/S	Cringle Beck	0.846	High
	WCP_13_U/S	Cringle Beck	0.802	High
	WCP_15_D/S	Moor Beck	0.513	Moderate
	WCP_15_U/S	Moor Beck	0.612	Good
	WCP_17_D/S	Eastfield Sike	0.334	Poor
	WCP_17_U/S	Eastfield Sike	0.866	High

Scheme	Site name	Watercourse	EQR	WFD Classification
	WCP_18_D/S	Unnamed Tributary of Lowgill Beck 6.1	0.500	Moderate
	WCP_18_U/S	Unnamed Tributary of Lowgill Beck 6.1	0.920	High
	WCP_19_D/S	Lowgill Beck	0.466	Moderate
	WCP_19_US	Yosgill Sike	0.319	Poor
Bowes Bypass (S07)	WCP_20_D/S	Unnamed Tributary of River Greta 7.3	0.270	Poor
Cross Lanes to Rokeby (S08)	WCP_24_BLUE_ D/S / WCP_24_U/S	Punder Gill	0.321	Poor
	WCP_24_D/S	Tutta Beck	0.432	Moderate
Stephen Bank to Carkin Moor (S09)	WCP_30_U/S	Mains Gill	0.540	Moderate
	WCP_33_D/S	Unnamed Tributary of Holme Beck 9.2	0.149	Bad

River corridor Surveys (RCS)

M6 Junction 40 to Kemplay Bank

6.20.5.10 The RCS survey extents for all sites and shown in ES Figure 6.18: River Corridor Survey, Macrophyte Survey, Aquatic Invertebrate Survey and White-clawed Crayfish Survey (Application Document 3.3); upstream and downstream survey extents are listed in Annex 1: Survey locations. A descriptive summary of the RCS findings for each site is provided below. The accompanying RCS drawn maps are shown in Plate 1: Thacka Beck (WCP_01_D/S) RCS map to Plate 27: Unnamed Tributary of Holme Beck 9.2 (WCP_33_D/S) RCS map.

Thacka Beck (WCP_01_D/S) RCS

6.20.5.11 Overview: The RCS map for this site is shown in Plate 1. The WCP_01_D/S survey reach was 100 m in length and ran from the culvert associated with the existing A686, the A66 and the Cumbria Constabulary buildings downstream to the confluence with the River Eamont. The channel width was 3.00 m and the depth was 0.15 to 0.20 m. The watercourse was uniformly trapezoid in section with tall, steep banks. The substrate was mostly comprised of cobbles, with some gravel and sand present. Both banks were steeply sloping earth banks throughout except for a short length of hard bank at the upstream survey extent. The only sign of recreation was a footpath with a bridge crossing the channel immediately upstream of the River Eamont confluence. The only features were the track bridge defining the upstream end of the section, the footpath bridge toward the downstream end and the confluence with the River Eamont.

6.20.5.12 Adjacent land use: Both banks were backed by heavily-grazed, improved grassland.

6.20.5.13 Vegetation: The vegetation on the banks was characterised by tall, fairly rank, coarse grasses such as false oat-grass (*Arrhenatherum elatius*) with herbs such as great willowherb (*Epilobium hirsutum*), meadowsweet (Filipendula ulmaria), hedge bedstraw (*Galium album*), hogweed (*Heracleum sphondylium*), common nettle (*Urtica dioica*), valerian (*Valeriana officinalis*) and occasional small sycamore (*Acer pseudoplatanus*) trees.

6.20.5.14 Marginal vegetation was limited to wetland-tolerant plants, including meadowsweet and great willowherb.

6.20.5.15 The channel supported sparse cover of bryophytes including *Fissidens crassipes* and *Leptodictyum riparium*, with the algae *Cladophora glomerata* and *Vaucheria* sp., as well as lichens of the genus *Verrucaria* on some cobbles. Vascular plants were scattered mainly in the upstream part, including: watercress (*Nasturtium officinalis* agg.), reed canary-grass (*Phalaris arundinacea*) and branched bur-reed (*Sparganium erectum*). There were patches of *Fontinalis antipyretica* on the stones at the downstream end of the section.

6.20.5.16 Threats, potential and evaluation: The section lies immediately downstream of a long culvert, it has been completely modified and supports no species of note. There are no evident threats. Floristically, the section has low potential conservation value unless the channel can be restored to a semi-natural form. Overall, the site has low conservation value and supports no notable floral species.

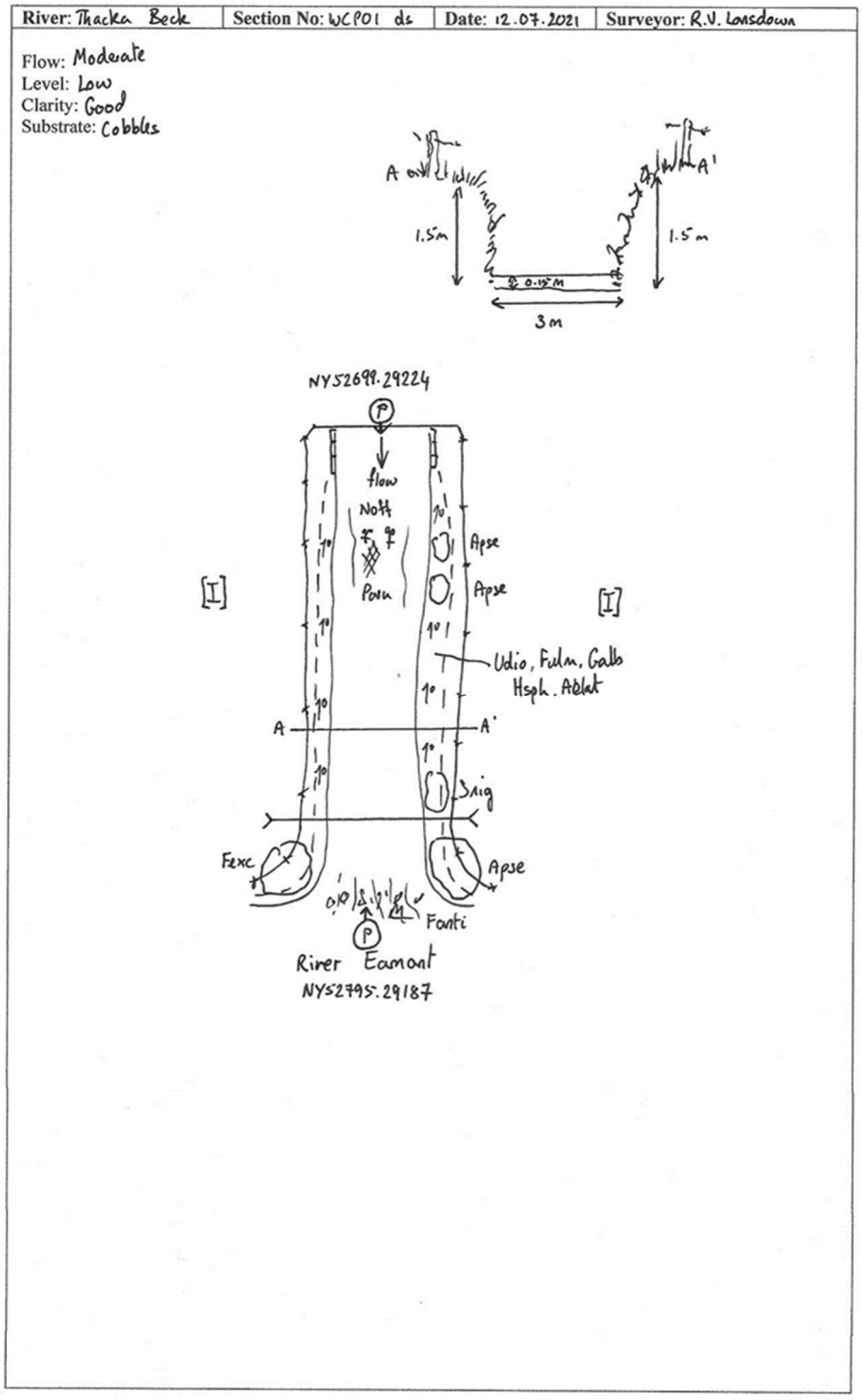

Plate 1: Thacka Beck (WCP_01_D/S) RCS map

Thacka Beck (WCP_01_U/S) RCS

6.20.5.17 Site overview: The RCS map for this site is shown in Plate 2. The survey reach was 500 m in length, the channel width was 3.00 - 4.00 m and the depth was 0.10 - 0.50 m, with some additional deep areas of over 1.00 m. Both banks were predominantly walled. Recreational

use included the presence of a well-used footpath and evidence of dog-walking on the right bank. There were numerous tracks through the woodland on the left bank but no formal access.

6.20.5.18 Adjacent land use: The adjacent land use on the right bank was improved pasture, rough and fairly rank characterised by brown bent (*Agrostis capillaris*), perennial rye-grass (*Lolium perenne*) and Yorkshire-fog (*Holcus lanatus*), with tall herbs such as common nettle (*Urtica dioica*) and creeping thistle (*Cirsium arvense*).

6.20.5.19 The adjacent land use on the left bank was gardens in the section upstream of the footbridge (NGR: NY 52363 29344). Downstream of this, the watercourse flowed alongside mature deciduous woodland characterised by ash (*Fraxinus excelsior*), with some planted beech *(Fagus sylvatica*) and Scots pine (*Pinus sylvestris*). The ground flora was dominated by brambles (*Rubus* sp.) and ivy (*Hedera helix*) but included a number of species likely to have derived from the adjacent gardens such as bellflower (*Campanula* sp.), French crane's-bill (*Geranium endressii*), ground elder (*Aegopodium podagraria*) and yellow archangel (*Lamiastrum galeobdolon* subsp. *argentatum*). There was also a clump of gooseberry on the bank toward the downstream end of the section, however this could be native. Immediately downstream of the footbridge, the woodland was more open with hawthorn (*Crataegus monogyna*) and rowan (Sorbus aucuparia) over tall ruderals. There were also small stands of sycamore (*Acer pseudoplatanus*) and planted hybrid black poplars (*Populus × canadensis*).

6.20.5.20 Vegetation: The right bank supported tall ruderals and herbs such as meadowsweet (*Filipendula ulmaria*), common nettle (*Urtica dioica*) and hogweed (*Heracleum sphondylium*), as well as brambles (*Rubus* sp.) throughout beneath and between stands of ash (*Fraxinus excelsior*) and alder *(Alnus glutinosa*) trees. The left bank supported woodland ground flora and brambles.

6.20.5.21 The channel was dominated by algae, particularly *Cladophora glomerata* and *Vaucheria* sp., with frequent bryophytes such as *Fissidens crassipes*, *Fontinalis antipyretica* and *Leptodictyum riparium*. Cyanobacteria were sparse within the channel.

6.20.5.22 Threats, potential and evaluation: The stream appears to be nutrient-rich and it is clear that non-native plant species are colonising the woodland, but there are no other obvious threats. The presence of gooseberry (*Rubus uva-ursi*) in the woodland on the left bank suggests that it may be ancient, however it is a small unit with low conservation potential. Overall, there are no notable species or features on the section and this section has low conservation value from a botanical perspective.

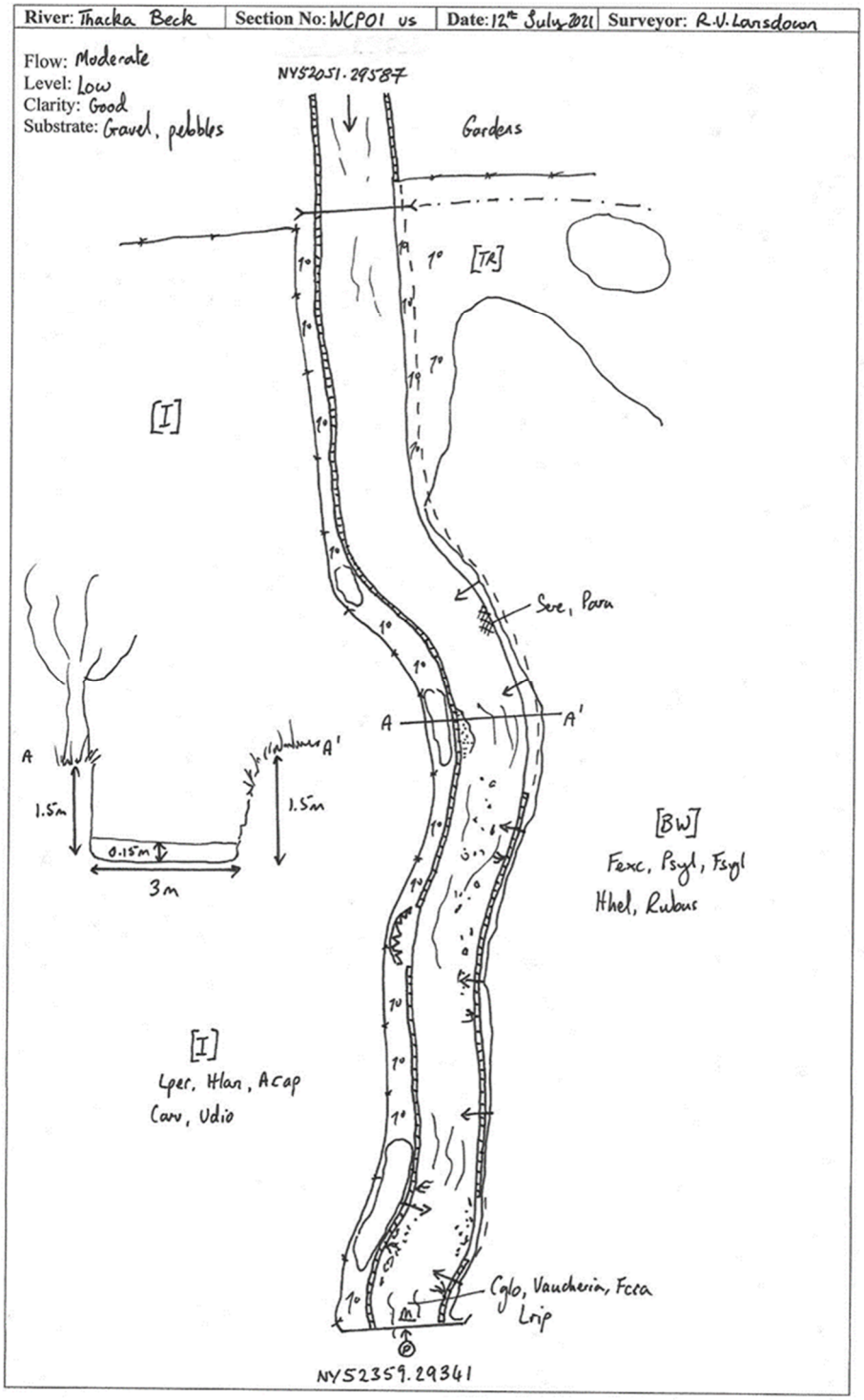

Plate 2: Thacka Beck (WCP_01_U/S) RCS map

Penrith to Temple Sowerby

Light Water (WCP_03_D/S) RCS

6.20.5.23 Site overview: The RCS map for this site is shown in Plate 3. The survey reach was 500 m in length the channel width was 3.00 - 4.00 m and the depth was 0.40 - 0.80 m. The substrate was mainly cobbles, with some areas of gravel and extensive silt banks in areas of slow flow. The reach was shaded throughout much of its length, in the upstream part by planted conifers, in the downstream part by a combination of natural riparian woodland and a small area of planted *Populus* sp. Both banks were earth throughout and were generally steep, but more gently sloping toward the downstream end of the section. There was no evidence of recreational use of the section. The only feature of note was a farm track bridge at the upstream end of the section and the A66 culvert marking the upstream limit.

6.20.5.24 Adjacent land use: On the right bank there was a heavily improved field with low species diversity at the upstream extent. Downstream of this, there was a fringe of broadleaved woodland backed by a conifer plantation. This was fairly species-poor, the central area contained grey willow (*Salix cinerea*) and purple willow (*S. purpurea*) over slender tufted-sedge (*Carex acuta*), cleavers (*Galium aparine*), marsh bedstraw (*G. palustre*), soft rush (*Juncus effusus*), water mint (*Mentha aquatica*), water forget-me-not (*Myosotis scorpioide*s) and wood dock (*Rumex sanguineus*) with *Conocephalum conicum* on the ground and a reasonable range of epiphytic bryophytes, including *Amblystegium serpens, Cryphaea heteromalla, Hypnum cupressiforme* var. *cupressiforme*, *H. cupressiforme var. resupinatum, Metzgeria consanguinea, Orthotrichum affine, O. diaphanum, O. lyellii, O. pulchellum* and *Ulota phyllantha*. Downstream of this there was a stand of planted poplars (*Populus* sp.) and at the downstream end, the channel flowed alongside mature broadleaved woodland.

6.20.5.25 On the left bank there was heavily improved grassland with very low species diversity, apart from a band of planted poplars, backed by conifer plantation and with a fringe of tall ruderal vegetation on the northern side.

6.20.5.26 Vegetation: The vegetation on the banks was mainly characterised by woodland ground flora on the right bank and tall, grassland with scattered herbs on the left bank.

6.20.5.27 Most of the margins supported no vegetation different to that on the lower banks or in the channel. However, at the downstream end of the section, the left bank was open and gradually sloped down to the water. At this point, there were stands of plants on both margins, including creeping bent (*Agrostis stolonifera*), marsh foxtail (*Alopecurus geniculatus*), marsh marigold (*Caltha palustris*), marsh bedstraw (*Galium palustre*), floating sweet-grass (*Glyceria fluitans*), plicate sweet-grass (*G. notata*), water forget-me-not (*Myosotis*

scorpioides), watercress (*Nasturtium* × *sterilis*) and bittersweet (*Solanum dulcamara*).

6.20.5.28 The main vegetation in the channel was pond water-crowfoot (*Ranunculus peltatus*) which was scattered throughout and formed dense stands in places. Other species occurring in the channel included common water-starwort (*Callitriche stagnalis*), the mosses *Cratoneuron filicinum* and *Hygroamblystegium tenax*, as well as the algae *Gongrosira* sp. and *Vaucheria* sp. and lichens of the genus *Verrucaria* sp.

6.20.5.29 Threats, potential and evaluation: There were no obvious threats to the section, although deposition of needles by conifers can lead to acidification of the water and substrate, which can adversely affect the vegetation. The block of woodland at NY 549291 between the conifer plantation and the channel could be considered to conform to the 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*). It is fairly species-poor and is a floodplain forest, rather than the stands on shingle and gravel of the active channels for which the Eden catchment is noted as being of importance. The channel supported pond water-crowfoot (*Ranunculus peltatus*) throughout and can be seen to conform to the 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation. It is likely that this habitat can be considered to be connected to associated communities in the River Eamont, a short distance downstream.

6.20.5.30 The woodland noted above, adjacent to the right bank is important and conforms to the 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior.* The channel vegetation can be considered to conform to the 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation. The whole section can therefore be seen to have high conservation value, even though the species and structural diversity of the section are both low.

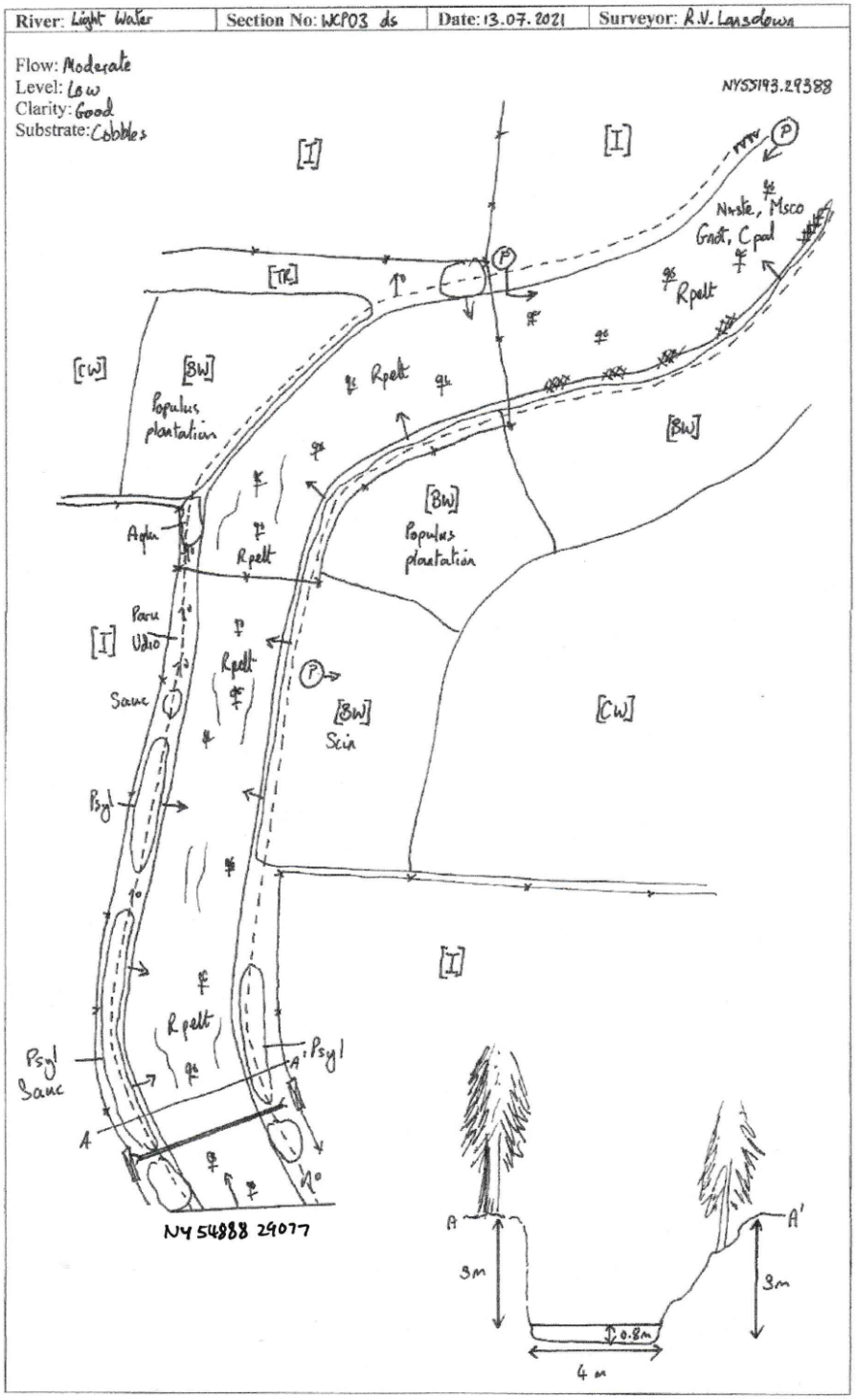

Plate 3: Light Water (WCP_03_D/S) RCS map

Light Water (WCP_03_U/S) RCS

6.20.5.31 Site overview: The RCS map for this site is shown in Plate 4. The survey length was 500 m, the channel width was 2.0 m and the depth was 0.50 - 0.80 m. The banks were earth throughout and were steep.

The substrate was pebble and gravel. There was no evidence of recreational use of the section. The only features of the section were the track bridge crossing the channel just downstream of the mid-section, and the A66 culvert at the downstream end.

6.20.5.32 Adjacent land use: On the right bank, the upstream half was dominated by alder (*Alnus glutinosa*) woodland, grading into scrubby elder (*Sambucus nigra*) and tall ruderals in the middle of the section. The alder woodland ground flora was dominated by brambles (*Rubus* sp.) but was reasonably diverse where the substrate was wetter, due to surface flow, with false oat-grass (*Arrhenatherum elatius*), lady-fern (*Athyrium felix-femina*), marsh marigold (Caltha palustris), enchanter's-nightshade (*Circaea lutetiana*), tufted hair-grass (*Deschampsia cespitosa*), scaly male-fern (*Dryopteris affinis* agg.), narrow buckler-fern (*D. carthusiana*), broad buckler-fern (*D. dilatata*), male fern (*D. filix-mas*), hybrid buckler-fern (*D. ×deweveri*), giant fescue (*Festuca gigantea*), meadowsweet (*Filipendula ulmaria*), marsh bedstraw (*Galium palustre*), herb bennet (*Geum urbanum*), herb Robert (*Geranium robertianum*), creeping soft-grass (*Holcus mollis*), soft rush (*Juncus effusus*), nipplewort (*Lapsana communis*), water mint (*Mentha* aquatica), rough poa (*Poa trivialis*), creeping buttercup (*Ranunculus repens*), black currant (*Ribes nigrum*), wood dock (*Rumex sanguineus*), common figwort (*Scrophularia nodosa*), bittersweet (*Solanum dulcamara*), hedge woundwort (*Stachys sylvatica*) and common valerian (*Valeriana officinalis*), with patches of the liverwort *Pellia endiviifolia*. The understorey was sparse but included species such as hawthorn (*Crataegus monogyna*), blackthorn (*Prunus spinosa*), elder and grey willow (*Salix cinerea*). The downstream half of the section ran alongside an improved pasture field.

6.20.5.33 On the left bank, the upstream and downstream parts of the section were characterised by improved pasture, separated by a narrow stand of planted Scots pine (*Pinus sylvestris*).

6.20.5.34 Vegetation: Bank vegetation throughout was fairly coarse and dominated by a combination of coarse grasses such as false oat-grass, cock's-foot (*Dactylis glomerata*) and Yorkshire-fog (*Holcus lanatus*), with herbs such as hogweed (*Heracleum sphondylium*) and common nettle (*Urtica dioica*) and some wetland-dependent species such as meadowsweet (*Filipendula ulmaria*) and soft rush (*Juncus effusus*) which grade into the margins.

6.20.5.35 The marginal vegetation was characterised by species such as meadowsweet and soft rush in the downstream half. In the central section there were stands of reed canary-grass (*Phalaris arundinacea*) and in the upstream half, occasional stands of marsh marigold, water mint, water forget-me-not (*Myosotis scorpioides*), reed canary-grass, bittersweet (*Solanum dulcamara*) and blue water-speedwell (*Veronica anagallis-aquatica*).

6.20.5.36 The channel supported scattered populations of bryophytes such as *Cratoneuron filicinum, Fontinalis antipyretica* and *Leptodictyum riparium*, as well as occasional patches of intermediate water-starwort (*Callitriche brutia*) and reed canary-grass.

6.20.5.37 Additional information: A small population of the hybrid grass *Alopecurus* × *brachystylus* was found with both parents marsh (*A. geniculatus*) and meadow foxtail (*A. pratensis*) found in the damp corner of the field on the left bank near the A66. This hybrid is rarely recorded, but this is likely to be more due to it being overlooked than actually being rare.

6.20.5.38 Threats, potential and evaluation: There were no obvious threats to the section. The block of woodland at NY551285 conforms with the class 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*). It is fairly species-poor and is a floodplain forest, rather than the stands on shingle and gravel of the active channels for which the Eden catchment is noted as being of importance. However, the presence of wet areas, with some overland flow and associated species such as narrow buckler-fern and its hybrid with broad buckler-fern *Dryopteris* × *deweveri* are an indication of the importance of the sites. No other habitats associated with the section are of conservation value.

6.20.5.39 The woodland noted above, adjacent to the upstream margin of the right bank is important and conforms to the 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*, otherwise no species or habitats of note were recorded on the section.

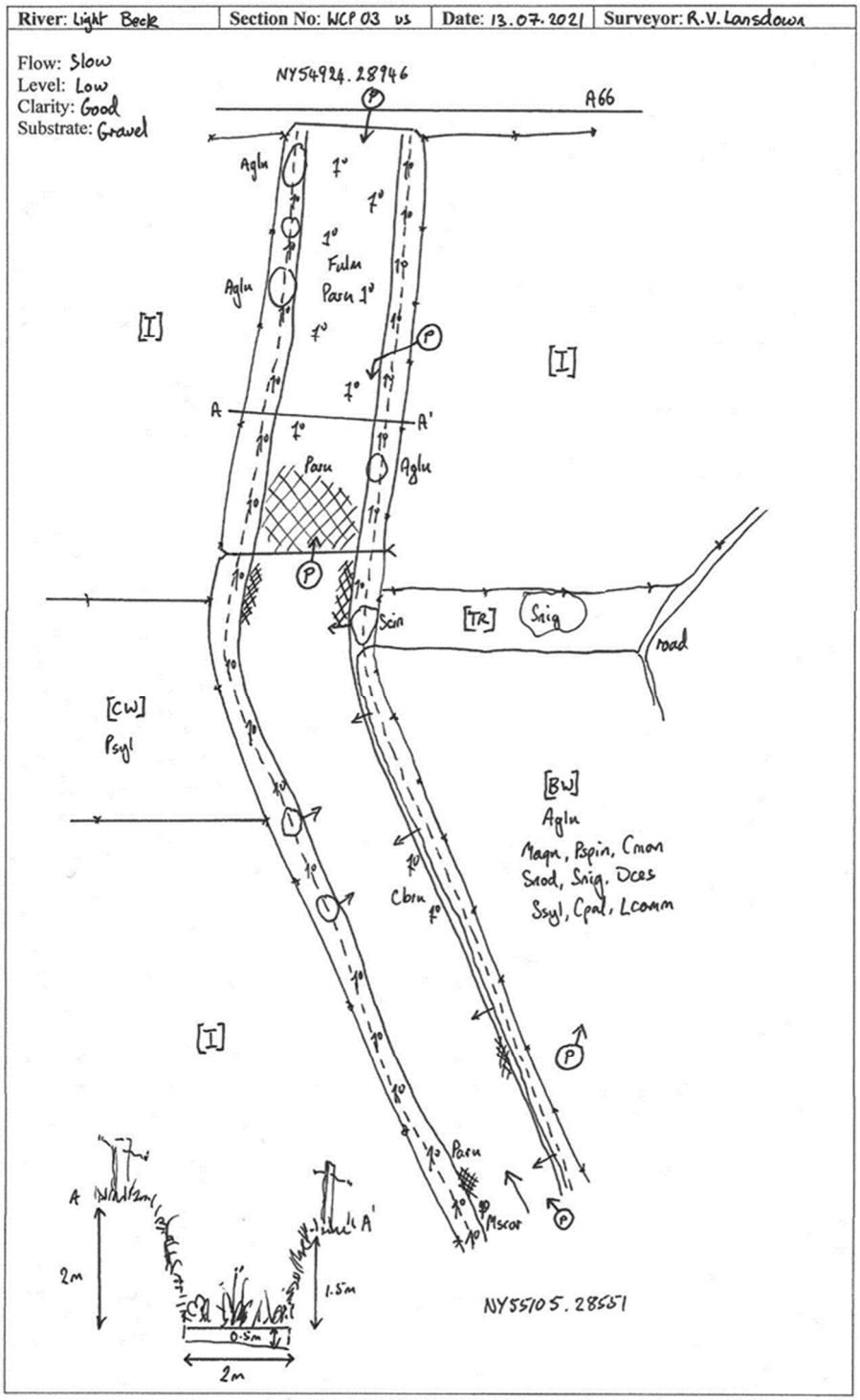

Plate 4: Light Water (WCP_03_U/S) RCS map

Unnamed Tributary of River Eamont 3.3 (WCP_04_D/S) RCS

6.20.5.40 Site overview: The RCS map for this site is shown in Plate 5. The survey reach was 350 m in length, the channel width was 1.00 - 1.15 m and the depth was 0.00 - 0.20 m. There was a short meandering section near the confluence with the River Eamont and the rest of the survey reach was straight. Both banks were earth throughout and were shallow and gently sloping upstream of the fence located at the NGR NY 55671 29270; downstream of this point, the banks were steep. Recreational use was indicated by a footbridge located immediately upstream of the fence where a footpath crosses the channel. The only features were a culvert associated with a farm track bridge at the upstream end, the footbridge and the fence toward the downstream end of the section

6.20.5.41 Adjacent land use: Both banks flowed through improved grassland in the upstream part. In the middle of the section, the area adjacent to the channel on both banks supported rush pasture, including species such as marsh marigold (*Caltha palustris*), oval sedge (*Carex leporina*), soft rush (*Juncus effusus*), marsh bedstraw (*Galium palustre*), field mint (*Mentha arvensis*), common sorrel (*Rumex acetosa*) and common nettle (*Urtica dioica*). Downstream of the fence, the vegetation involved semi-improved grassland grading into tall herbs, including brown bent (*Agrostis capillaris*), false oat-grass (*Arrhenatherum elatius*), meadowsweet (*Filipendula ulmaria*), wood crane's-bill (*Geranium sylvaticum*), Yorkshire-fog (*Holcus lanatus*), Himalayan balsam (*Impatiens glandulifera*), reed canary-grass (*Phalaris arundinacea*), small timothy (*Phleum bertolinii*), smooth meadow-grass (*Poa pratensis*), rough meadow-grass (*P. trivialis*), common sorrel and broad-leaved dock (*Rumex obtusifolius*).

6.20.5.42 Vegetation: The vegetation on the banks was a continuation of the vegetation of the adjacent habitats, grading from improved grassland in the upstream part, through rush pasture to tall herbs toward the downstream end of the section.

6.20.5.43 The marginal vegetation was dominated by grasses throughout the reach upstream of the fence, mainly creeping bent (*Agrostis stolonifera*), marsh foxtail (*Alopecurus geniculatus*) and plicate sweet-grass (*Glyceria notata*), with occasional patches of soft rush and water forget-me-not (*Myositis scorpioides*). Downstream of the fence the margins were shaded by the bank vegetation and were largely bare.

6.20.5.44 Where the channel was dry it supported species occurring in the adjacent grassland and the marginal grasses. Where the water was sufficiently long-standing, pools supported fat duckweed (*Lemna gibba*) and the alga *Vaucheria* sp. Downstream of the fence, the channel supported a dense stand of reed canary-grass and branched bur-reed (*Sparganium erectum*), with occasional Himalayan balsam (*Impatiens glandulifera*).

6.20.5.45 Threats, potential and evaluation: It is clear that intensive sheep-grazing of the pasture is causing a reduction in species diversity, however there are no obvious, significant, threats to the section. The section is species-poor and the vegetation of low conservation value. The tall grassland and herbs upstream of the confluence with the River Eamont has some conservation value but supports no species of note. The section has low conservation value and low potential for restoration.

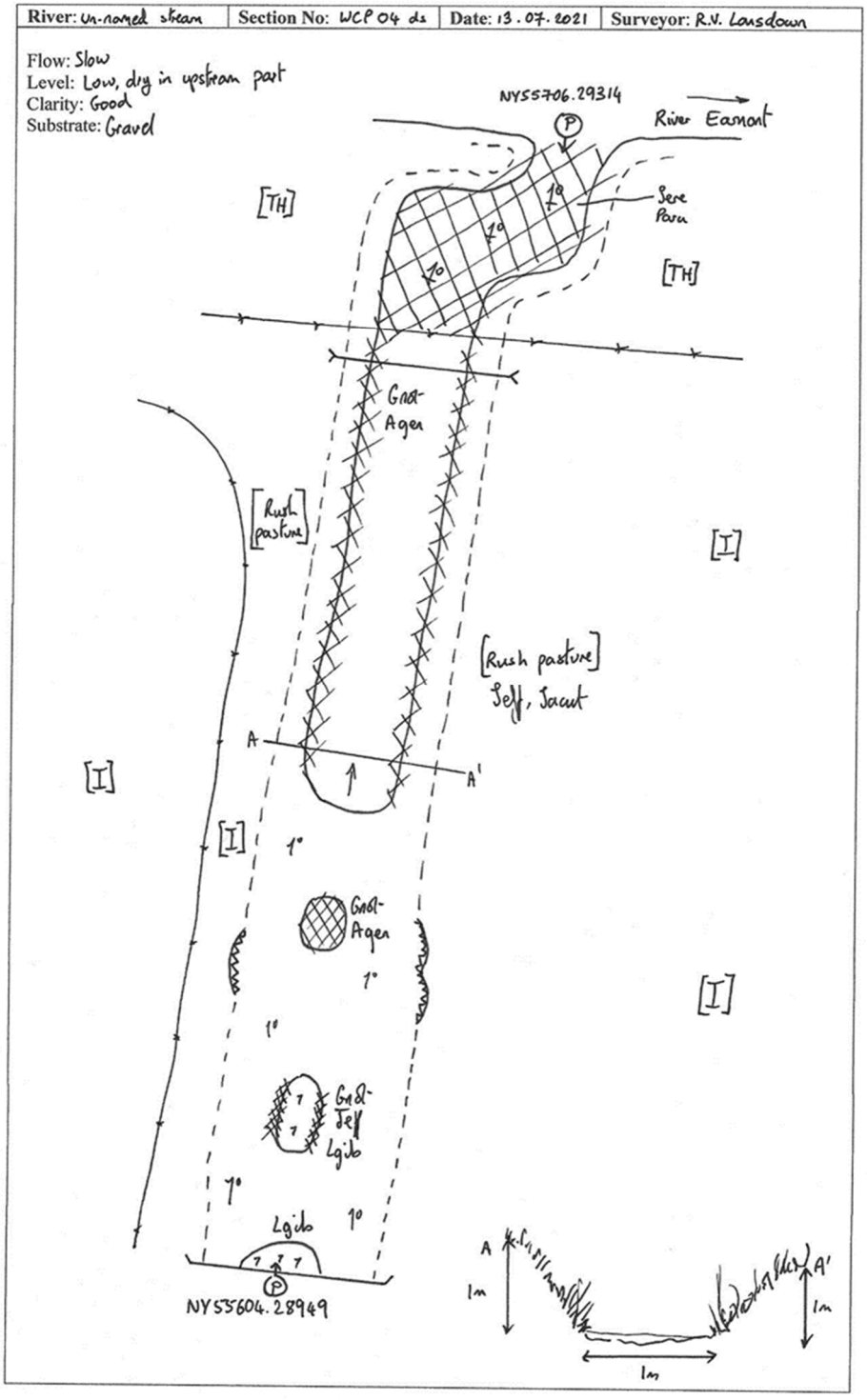

Plate 5: Unnamed Tributary of River Eamont 3.3 (WCP_04_D/S) RCS map

Temple Sowerby to Appleby

Trout Beck (WCP_08_D/S-1) RCS

6.20.5.46 Site overview: The RCS map for this site is shown in Plate 6. The survey length was 500 m in length, the channel width was 10.00 - 12.00 m and was over 1.00 m in depth. The channel was characterised by two long, gently meandering bends. The banks were earth throughout, typically steep to vertical with a long section of actively eroding cliff on the left bank. Throughout much of Trout Beck, including most of this section, there were the remains of wooden bank reinforcement, generally broken and degraded but locally still functional. There was no evidence of recreational use of this section. The main features on this section were the meander bends, as well as gravel bars which were exposed at the time of the survey.

6.20.5.47 Adjacent land use: The entire section flowed through heavily improved grassland.

6.20.5.48 Vegetation: The banks mainly supported lines of trees separated from the adjacent fields by barbed wire fences. The trees were mainly alder (*Alnus glutinosa*), ash (*Fraxinus excelsior*) and hazel (*Corylus avellana*) with less frequent quaking aspen (*Populus tremula*) and hybrid poplar (*P.* × *canadensis*). The ground flora was typically characterised by tall herbs and grasses such as false oat-grass (*Arrhenatherum elatius*), spear thistle (*Cirsium vulgaris*), cock's-foot (Dactylis glomerata), meadowsweet (*Filipendula ulmaria*), there was also abundant Himalayan balsam (*Impatiens glandulifera*) throughout.

6.20.5.49 Throughout most of the section, marginal vegetation was limited due to the shade from bankside trees. However, where the light reached the margins and on gravel bars, there were stands of a range of vascular plant species such as creeping bent (Agrostis stolonifera), floating sweet-grass (*Glyceria fluitans*), watercress (*Nasturtium officinale* agg.), water-pepper (*Persicaria hydropiper*) and bittersweet (*Solanum dulcamara*). Rocks and the remains of wooden bank protection supported stands of mosses such as *Leptodictyum riparium*.

6.20.5.50 Channel vegetation was almost entirely dominated by river water-crowfoot (*Ranunculus fluitans*), while pebbles and larger stones supported lichens of the genus *Verrucaria* and many supported the algae *Hildenbrandia rivularis*. *Cladophora glomerata* was also frequent and there was an extensive cover of diatoms in areas where there was little scour.

6.20.5.51 Site threats, potential and evaluation: There are no obvious threats to this section, apart from the intensive agricultural improvement of the adjacent habitats. The left bank is eroding very actively which is affecting the fences. The steep banks and almost continuous shade from bankside trees severely limits the conservation value of the section. Removal of bank protection and allowing the channel to move through erosion and deposition would dramatically increase its

conservation value. The channel supports a hybrid water-crowfoot (*Ranunculus fluitans*) and can be seen to conform to the 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation.

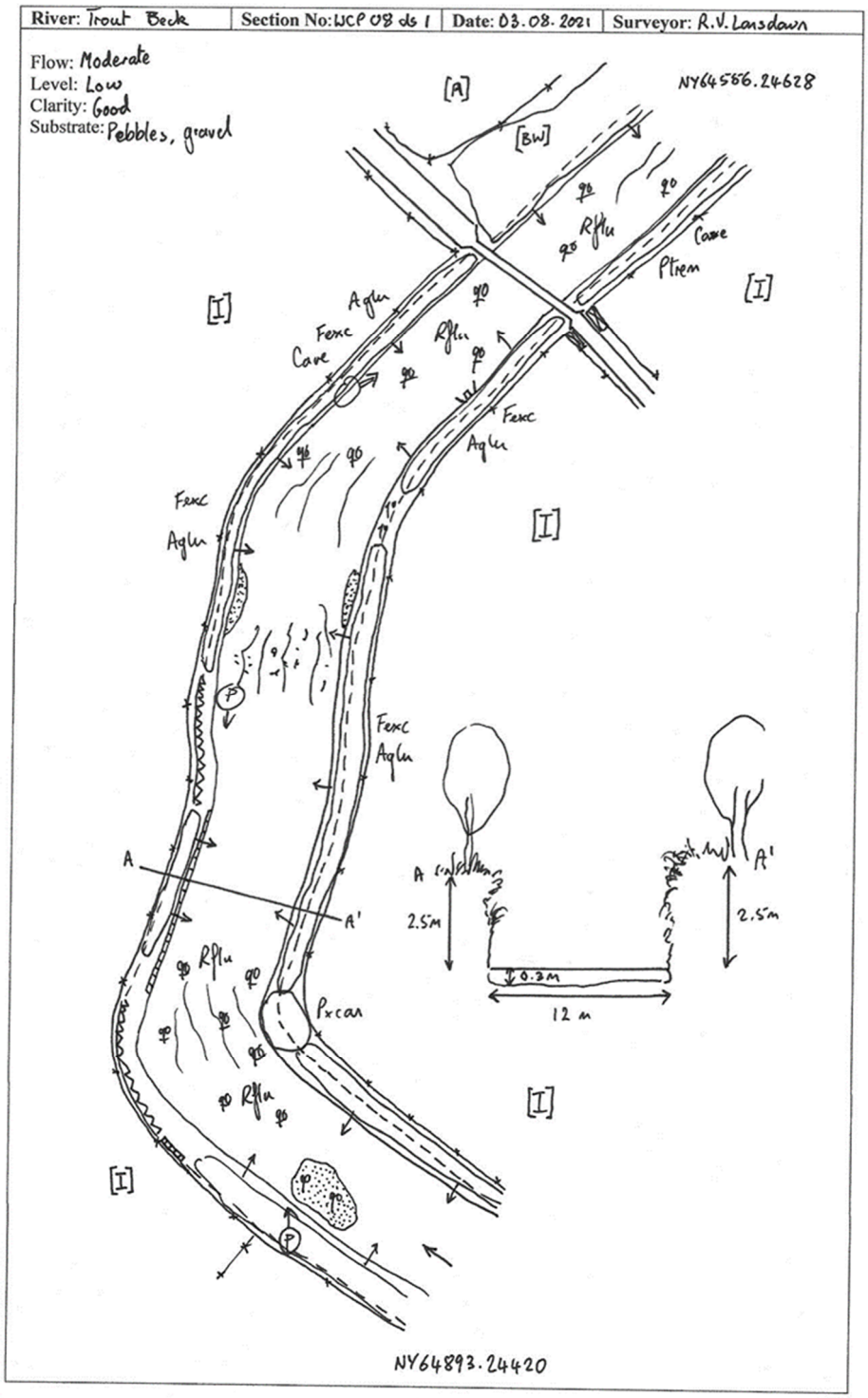

Plate 6: Trout Beck (WCP_08_D/S-1) RCS map

Trout Beck (WCP_08_D/S-2) RCS

6.20.5.52 Site overview: The RCS map for this site is shown in Plate 7. The survey reach was 500 m in length, the channel width was 10.00 - 12.00 m and the depth was 0.30 - 0.80 m. The substrate was dominated by gravel and pebbles with limited bedrock and cobbles plus local sand and silt deposits. The bank type was earth throughout and banks were typically steep to vertical with a long section of actively eroding cliff on the left bank. Throughout much of Trout Beck, including most of this section, there were the remains of wooden bank reinforcement, generally broken and degraded but locally still functional. There was no evidence of recreational use of this section. The main features on this section are the meander bends, as well as gravel bars which were exposed at the time of the survey.

6.20.5.53 Adjacent land use: The entire section flowed through heavily improved grassland.

6.20.5.54 Vegetation: The banks mainly supported lines of trees separated from the adjacent fields by barbed wire fences. The trees were mainly alder (*Alnus glutinosa*), ash (*Fraxinus excelsior*) and quaking aspen (*Populus tremula*) and common osier (*Salix viminalis*). The ground flora is typically characterised by tall herbs and grasses such as false oat-grass (*Arrhenatherum elatius*), wood crane's-bill (*Geranium sylvaticum*), hogweed (*Heracleum sphondylium*), Yorkshire-fog (*Holcus lanatus*), common sorrel (*Rumex acetosa*) and common nettle (*Urtica dioica*), there was also abundant Himalayan balsam (*Impatiens glandulifera*) more or less throughout.

6.20.5.55 The steep banks and almost continuous lines of trees along the banks mean that vascular plants only survived in a few places on the margins and included species such as creeping bent (*Agrostis stolonifera*), toad rush (*Juncus bufonius*), water forget-me-not (*Myosotis scorpioides*) and brooklime (*Veronica beccabunga*). However, bryophytes were fairly frequent on stones and the remains of wooden bank defences, including *Brachythecium plumosum*, *B. rivulare*, *Chiloscyphus polyanthus*, *Cinclidotus fontinaloides*, *Conocephalum conicum* and *Platyhypnidium riparioides*, as well as a single patch of *Scapania undulata*, with Pellia epiphylla and *Lunularia cruciata* on the earth of the banks.

6.20.5.56 In the channel, there were occasional patches of branched bur-reed (*Sparganium erectum*) or reed canary-grass (*Phalaris arundinacea*) but vascular plants were mainly limited to extensive stands of the hybrid derived from river water-crowfoot (*Ranunculus fluitans*) which occur in faster flow, particularly riffles. Lower plants which occurred throughout included *Verrucaria* species and *Hildenbrandia rivularis* on rocks and stones, together with *Cladophora glomerata* and *Fontinalis antipyretica*.

6.20.5.57 Threats, potential and evaluation: There are no obvious threats to this section, apart from the intensive agricultural improvement of the adjacent habitats. The steep banks and almost continuous shade

from bankside trees severely limit the conservation value of the section. The channel supports a hybrid derived from river water-crowfoot (*Ranunculus fluitans*) and can be seen to conform to the 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation.

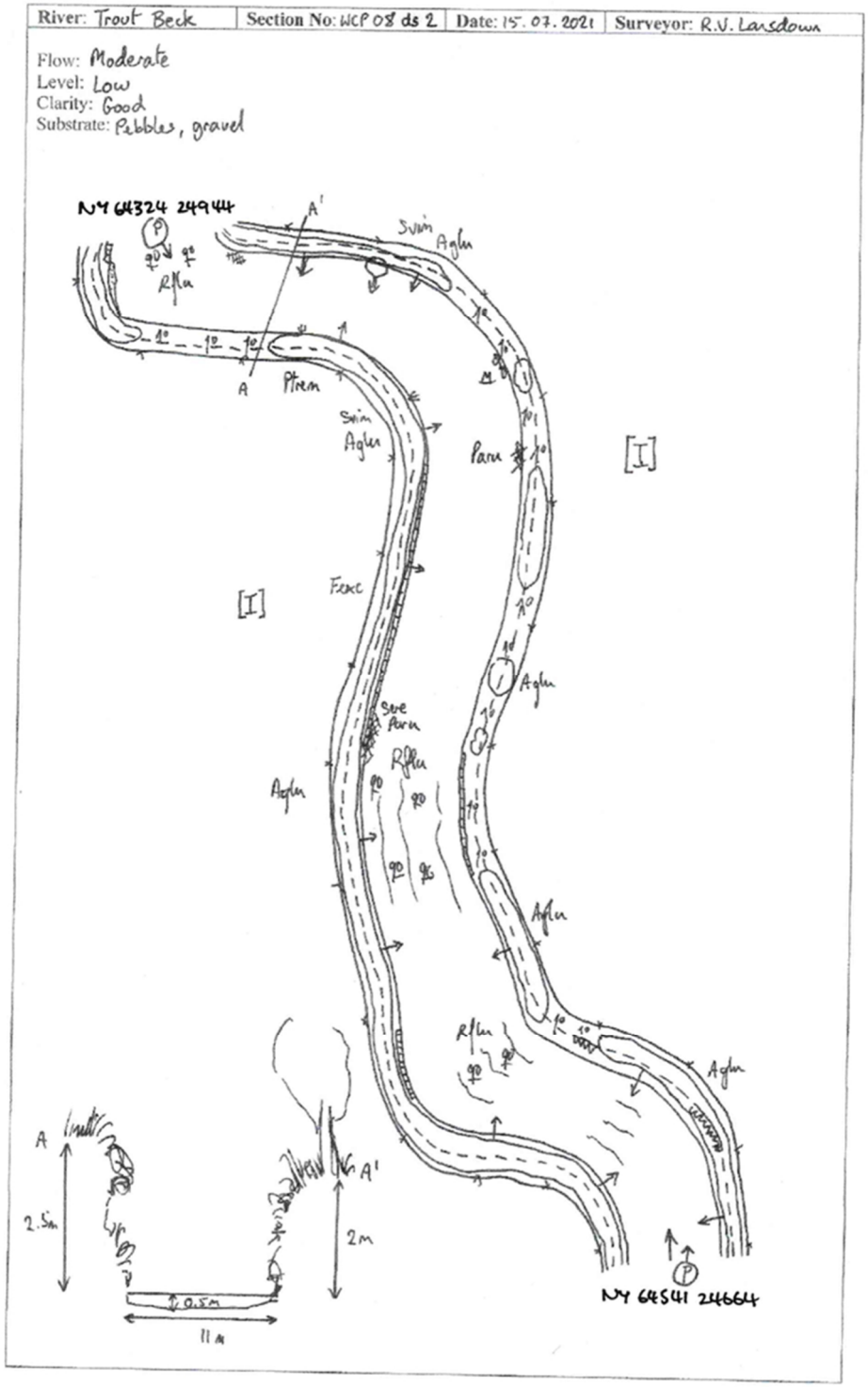

Plate 7: Trout Beck (WCP_08_D/S-2) RCS map

Trout Beck (WCP_08_D/S-3) RCS

6.20.5.58 Site overview: The RCS map for this site is shown in Plate 8. The survey reach was 500 m in length, the channel width was 10.00 - 12.00 m in width and the depth was 0.30 - 0.80 m with some additional deeper sections that were over 1.00 m deep. The reach was a meandering section characterised by steep earth banks lined with trees and backed by intensively improved grassland. There was a long section of actively eroding cliff on the left bank. The substrate was dominated by gravel and pebbles with limited bedrock and cobbles plus local sand and silt deposits. Throughout much of Trout Beck, including most of this section, there were the remains of wooden bank reinforcement, generally broken and degraded but locally still functional. There was no evidence of recreational use of this section. The main features on this section were the meander bends, as well as gravel bars which were exposed at the time of the survey.

6.20.5.59 Adjacent land use: The entire section flowed through heavily improved grassland.

6.20.5.60 Vegetation: The banks mainly supported lines of trees separated from the adjacent fields by barbed wire fences. The trees were mainly alder (*Alnus glutinosa*), crack willow (*Salix × fragilis*) and quaking aspen (*Populus tremula*). The ground flora was typically characterised by tall herbs and grasses such as greater bur-dock (*Arctium lappa*), false oat-grass (*Arrhenatherum elatius*), rosebay willowherb (*Chamaerion angustifolium*), cock's-foot (*Dactylis glomerata*), great willowherb (*Epilobium hirsutum*), wood crane's-bill (*Geranium sylvaticum*), broad-leaved dock (*Rumex obtusifolius*) and red campion (*Silene dioica*). There was also abundant Himalayan balsam (*Impatiens glandulifera*) throughout.

6.20.5.61 The steep banks and almost continuous lines of trees along the banks mean that vascular plants only survived in a few places on the margins and included species such as creeping bent (*Agrostis stolonifera*), intermediate water-starwort (*Callitriche brutia subsp. hamulata*), plicate sweet-grass (*Glyceria notata*), jointed rush (*Juncus articulatus*), water forget-me-not (*Myosotis scorpioides*), watercress (*Nasturtium officinale* agg.), reed canary-grass (*Phalaris arundinacea*), rough meadow-grass (*Poa trivialis*), creeping buttercup (*Ranunculus repens*), branched bur-reed (*Sparganium erectum*) and common nettle (*Urtica dioica*).

6.20.5.62 In the channel, there were occasional patches of branched bur-reed (*Sparganium erectum*) or reed canary-grass (*Phalaris arundinacea*) but vascular plants were mainly limited to extensive stands of the hybrid water-crowfoot (*Ranunculus fluitans*) which occurred in faster flow, particularly riffles. Lower plants which occurred throughout include *Verrucaria* species and *Cladophora glomerata*.

6.20.5.63 Threats, potential and evaluation: There are no obvious threats to this section, apart from the intensive agricultural improvement of the adjacent habitats. The steep banks and almost continuous shade from bankside trees severely limit the conservation value of the section. The channel supports a hybrid derived from river water-crowfoot (*Ranunculus fluitans*) and can be seen to conform to the 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation.

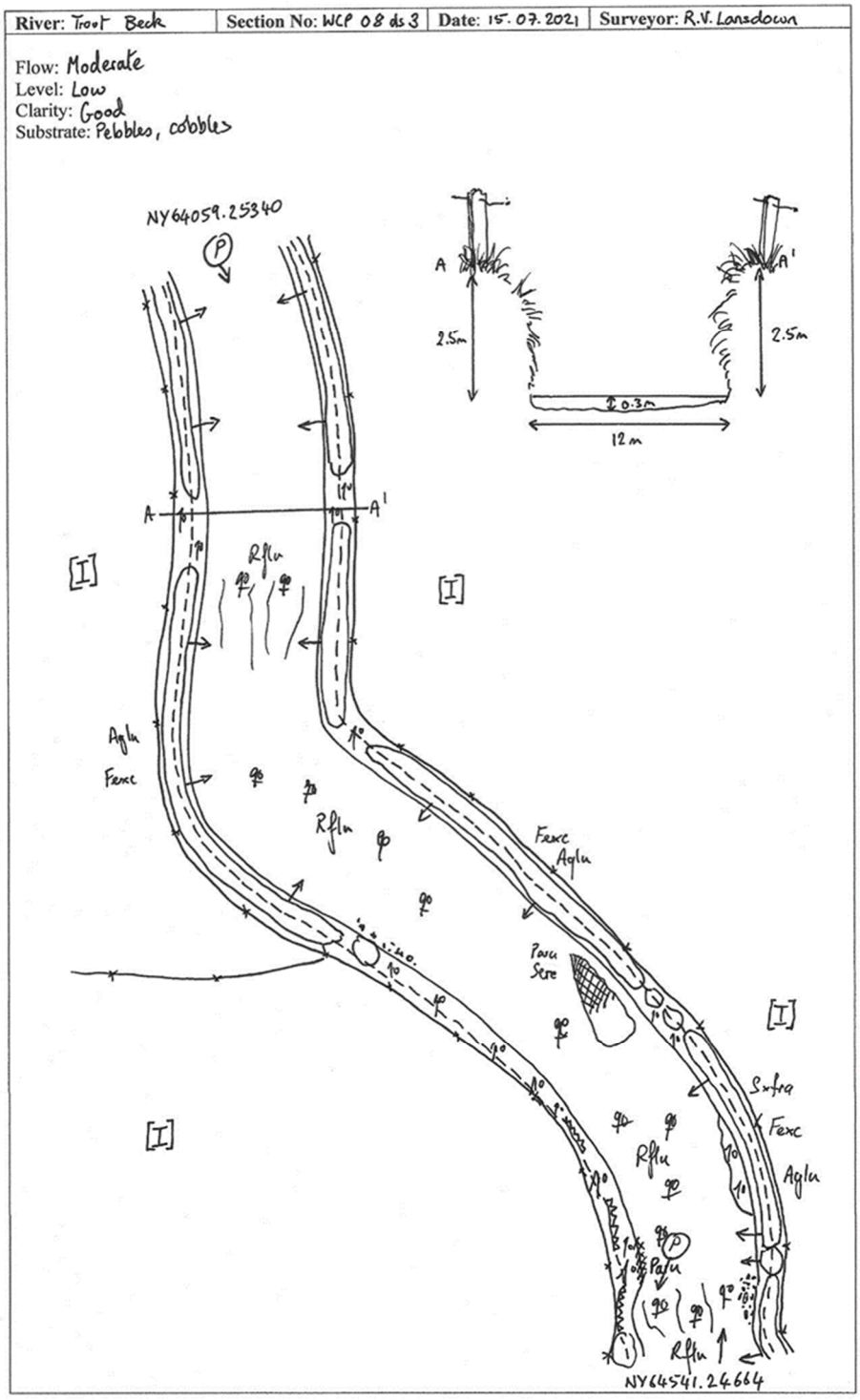

Plate 8: Trout Beck (WCP_08_D/S-3) RCS map

Trout Beck (WCP_08_D/S-4) RCS

6.20.5.64 Site overview: The RCS map for this site is shown in Plate 9. The survey reach was 500 m in length, the channel width was 10.00 - 12.00 m and the depth was 0.30 - 0.80 m, with some deeper sections that were greater than 1.00 m. The survey reach was a short, broad, meandering section characterised by steep earth banks lined with trees and backed by intensively improved grassland. The substrate was dominated by boulders and cobbles, with limited pebbles plus local sand and silt deposits. There was no evidence of recreational use of this section. The main features on this section were the meander bends, as well as gravel bars which were exposed at the time of the survey. There was a farm track bridge at the upstream end, the downstream end of the section was at the A66 bridge and there were brick walls alongside houses just upstream of the existing A66.

6.20.5.65 Adjacent land use: The entire section flowed through heavily improved grassland, apart from a short section toward the downstream end of the right bank which supported tall ruderals.

6.20.5.66 Vegetation: The banks mainly supported lines of trees separated from the adjacent fields by barbed wire fences. The trees were mainly alder (*Alnus glutinosa*), crack willow (*Salix × fragilis*), European violet willow (*S. daphnoides*) and grey willow (*S. cinerea*). The ground flora was typically characterised by tall herbs and grasses such as brown bent (*Agrostis capillaris*), false oat-grass (*Arrhenatherum elatius*), field bindweed (*Convolvulus arvensis*), cock's-foot (*Dactylis glomerata*) and rough meadow-grass (*Poa trivialis*), there was also abundant Himalayan balsam (*Impatiens glandulifera*) throughout.

6.20.5.67 The steep banks and almost continuous lines of trees along the banks meant that vascular plants only survived in a few places on the margins and involved species such as creeping bent (*Agrostis stolonifera*) and reed canary-grass (*Phalaris arundinacea*).

6.20.5.68 In the channel, there were occasional patches of branched bur-reed (*Sparganium erectum*) or reed canary-grass (*Phalaris arundinacea*) but vascular plants were mainly limited to extensive stands of the hybrid derived from river water-crowfoot (*Ranunculus fluitans*) which occurred in faster flow, particularly riffles. Lower plants which occurred more or less throughout included *Vaucheria* sp. and *Cladophora glomerata*.

6.20.5.69 Threats, potential and evaluation: There are no obvious threats to this section, apart from the intensive agricultural improvement of the adjacent habitats. The steep banks and almost continuous shade from bankside trees severely limit the conservation value of the section. The channel supports a hybrid derived from river water-crowfoot (*Ranunculus fluitans*) and can be seen to conform to the 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation.

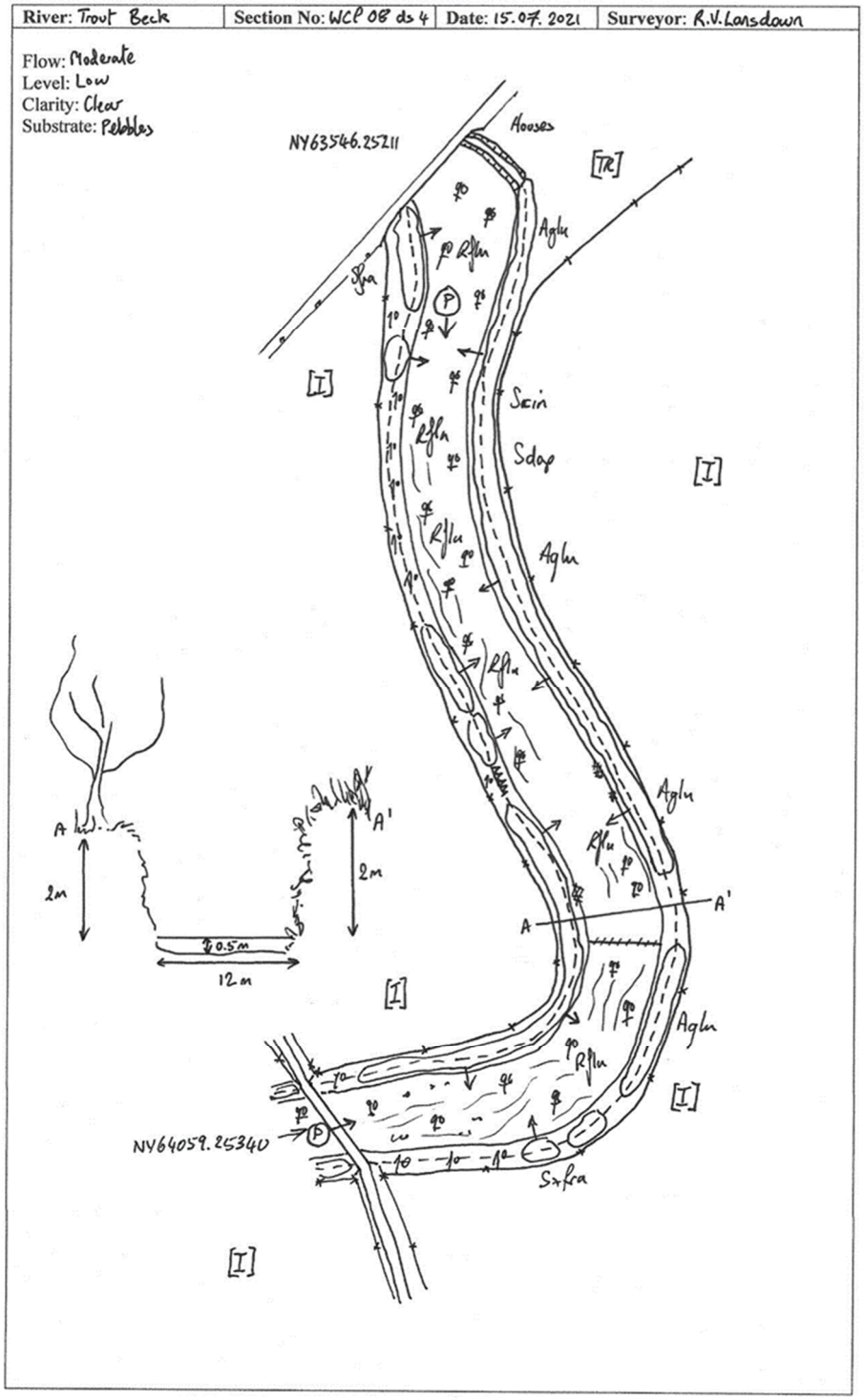

Plate 9: Trout Beck (WCP_08_D/S-4) RCS map

Trout Beck WCP_08_D/S-5) RCS

6.20.5.70 Site overview: The RCS map for this site is shown in Plate 10. The survey reach was 300 m in length, the channel width was 10.00 - 12.00 m and the depth was 0.30 - 0.80 m, with some deeper sections that were greater than 1.00 m. The survey reach was broad and meandering and characterised by steep earth banks lined with trees and backed by intensively improved grassland. There was a long section of actively eroding cliff on the left bank. The substrate was dominated by gravel and pebbles with limited bedrock and cobbles plus local sand and silt deposits. There was no evidence of recreational use of this section. The main features on this section were the existing A66 bridge at the upstream end, a farm track bridge in mid-section and various structures associated with the farm and houses, including a number of pipe discharges.

6.20.5.71 Vegetation: Vegetation on the banks was dominated by large, sprawling trees which were mainly alder (*Alnus glutinosa*) and crack willow (*Salix × fragilis*) with some hawthorn (*Crataegus monogyna*), ash (*Fraxinus excelsior*), common osier (*Salix viminalis*) and guelder rose (*Viburnum opulus*). The ground flora was sparse and dominated by ruderals. There was a small patch of redcurrant (*Ribes rubrum*) on the right bank. Toward the downstream end of the right bank at the confluence with the River Dene, there was a reasonably diverse bank vegetation with species such as great willowherb (*Epilobium hirsutum*), butterbur (*Petasites hybridus*), broad-leaved dock (*Rumex obtusifolius*) and common nettle (*Urtica dioica*).

6.20.5.72 The marginal vegetation was very sparse and limited to small patches of marsh marigold (*Caltha palustris*), water mint (*Mentha aquatica*), water forget-me-not (*Myosotis scorpioides*) and reed canary-grass (*Phalaris arundinacea*) with frequent bryophytes on rocks and wood, including *Hygroamblystegium tenax*, *Leptodictyum riparium* and *Platyhypnidium tenax*.

6.20.5.73 The vegetation in the channel was dominated by the hybrid derived from river water-crowfoot (*Ranunculus fluitans*), with frequent bryophytes such as *Leptodictyum riparium* and *Fontinalis antipyretica*, as well as lichens of the genus *Verrucaria* and the algae *Hildenbrandia rivularis* on stones and rocks, as well as *Vaucheria* sp. and *Cladophora glomerata* more or less throughout.

6.20.5.74 Threats, potential and evaluation: There were no obvious threats to this section. The steep banks and almost continuous shade from bankside trees severely limit the conservation value of the section. The channel supports a hybrid derived from river water-crowfoot (*Ranunculus fluitans*) and can be seen to conform to the 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation.

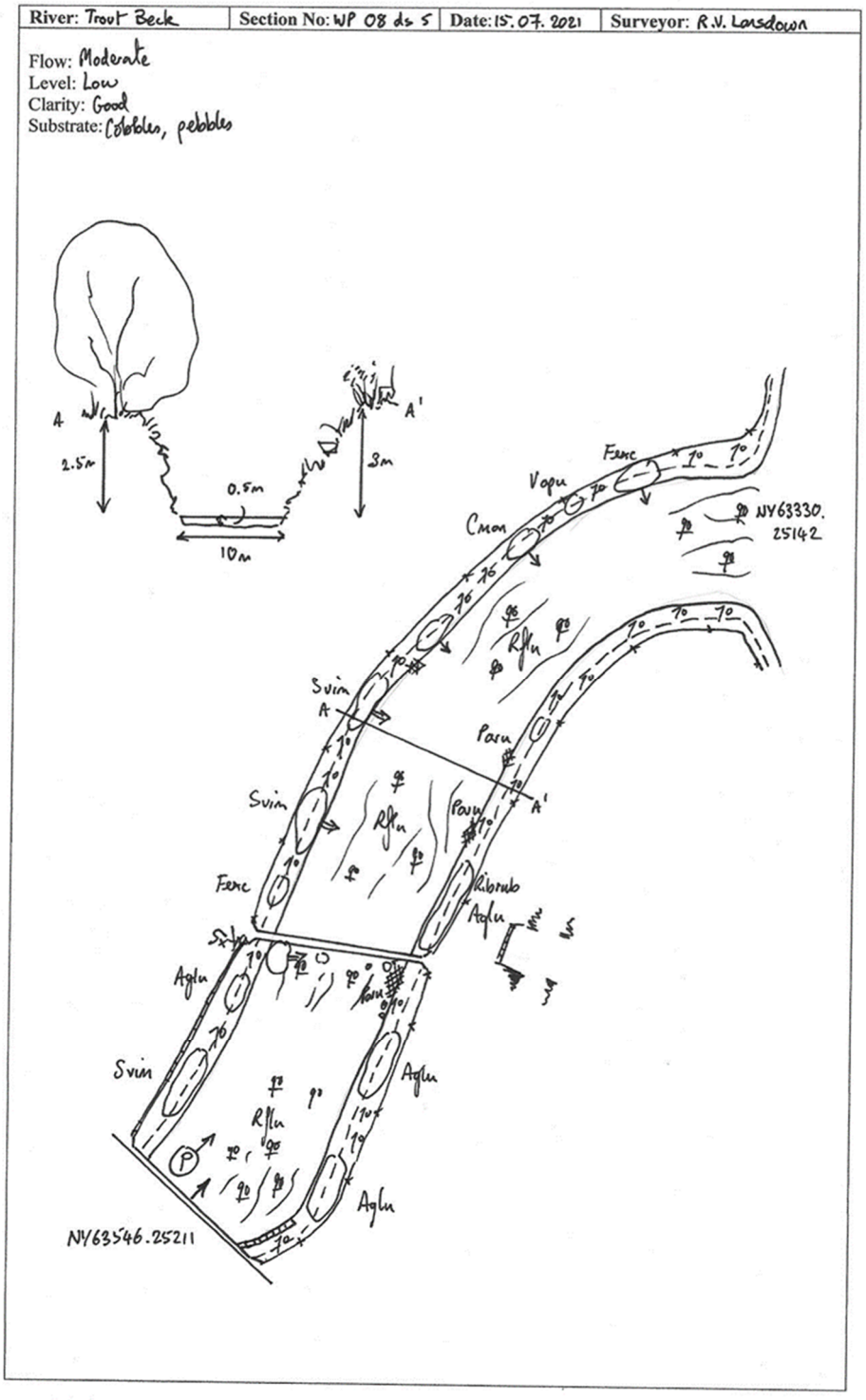

Plate 10: Trout Beck (WCP_08_D/S-5) RCS map

Trout Beck (WCP_08_U/S) RCS

6.20.5.75 Site overview: The RCS map for this site is shown in Plate 11. The survey reach was 500 m in length, the channel width was 8.00 - 10.00

m and the depth was 0.30 - 0.80 m with some deeper sections that were greater than 1.00 m. The banks were earth throughout, typically steep to vertical but generally stable. However, throughout much of Trout Beck, including parts of this section, there were the remains of wooden bank reinforcement, generally broken and degraded but locally still functional. The substrate was dominated by gravel and pebbles with limited bedrock and cobbles plus local sand and silt deposits. There was no evidence of recreational use of this section. The main features on this section were the meander bends, as well as gravel bars which were exposed at the time of the survey.

6.20.5.76 Adjacent land use: The entire section flowed through heavily improved grassland.

6.20.5.77 Vegetation: The banks mainly supported lines of trees separated from the adjacent fields by barbed wire fences. The trees were mainly alder (*Alnus glutinosa*), ash (*Fraxinus excelsior*) and common osier (*Salix viminalis*) with less frequent silver birch (*Betula pendula*), hazel (*Corylus avellana*), hawthorn (*Crataegus monogyna*), apple (*Malus pumila*), grey willow (*Salix cinerea*), bay willow (*S. pentandra*), purple willow (*S. purpurea*), crack willow (*Salix × fragilis*) a hybrid willow (*S. × reichardtii*), elder (*Sambucus nigra*) and guelder rose (*Viburnum opulus*). The ground flora was typically characterised by tall herbs and grasses such as false oat-grasses (*Arrhenatherum elatius*), spear thistle (*Cirsium vulgare*), cock's-foot (Dactylis glomerata), meadowsweet (*Filipendula ulmaria*), Himalayan balsam (*Impatiens glandulifera*) and common nettle (*Urtica dioica*). However, in a few places on the right bank there were species more typical of a woodland ground flora, including ramsons (*Allium ursinum*), dog's-mercury (*Mercurialis perennis*) and redcurrant (*Ribes rubrum*). Where the banks were particularly steep, there were stands of bryophytes such as *Lunularia cruciata* and *Pohlia nutans*.

6.20.5.78 Throughout most of the section, marginal vegetation was limited due to the shade from bankside trees. However, where the light reaches the margins and on gravel bars, there were stands of a range of vascular plant species such as marsh marigold (*Caltha palustris*), field horsetail (*Equisetum arvense*), Himalayan balsam, water forget-me-not (*Myosotis scorpioides*), marsh ragwort (*Senecio aquaticus*) and marsh woundwort (*Stachys palustris*). Rocks and the remains of wooden bank protection support stands of mosses such as *Brachythecium plumosu*m, *Leptodictyum riparium* and *Fontinalis antipyretica*.

6.20.5.79 Most of the pebbles and larger stones supported lichens of the genus *Verrucaria* and many support the algae *Hildenbrandia rivularis*, as well as some *Cladophora glomerata*. Where light was able to reach the channel, there were beds of a hybrid water crowfoot derived from river water-crowfoot (*Ranunculus fluitans*). There were very few other species in the channel, apart from patches of fat duckweed (*Lemna gibba*) in backwaters and some of the bryophytes which also occurred in the margins.

6.20.5.80 Threats, potential and evaluation: There are no obvious threats to this section. The steep banks and almost continuous shade from bankside trees severely limit the conservation value of the section. Removal of bank protection and allowing the channel to move through erosion and deposition would dramatically increase its conservation value. The channel supports a hybrid derived from river water-crowfoot (*Ranunculus fluitans*) in the downstream third and can be seen to conform to the 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation.

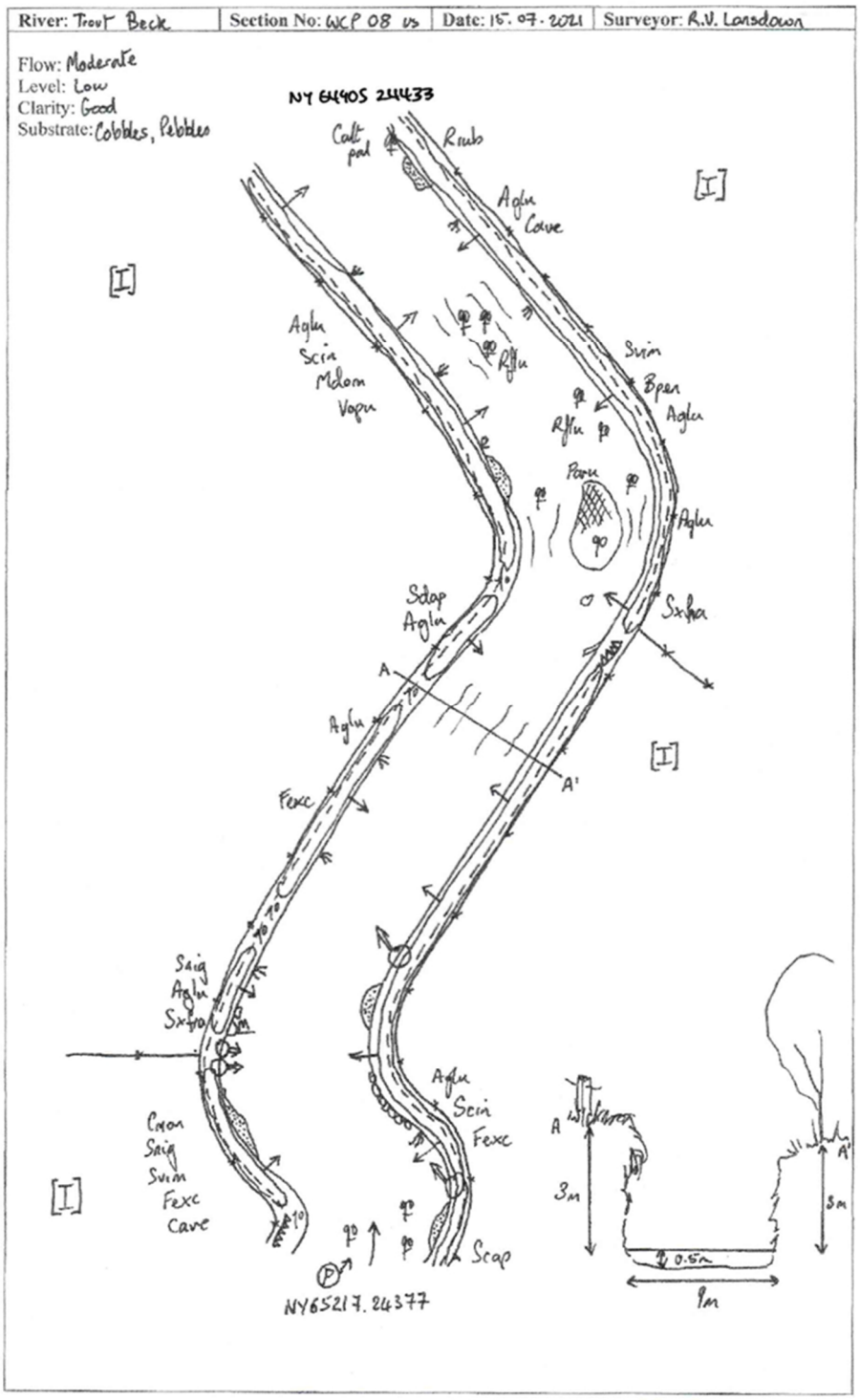

Plate 11: Trout Beck (WCP_08_U/S) RCS map

Trout Beck (WCP_08_US_RED) RCS

6.20.5.81 Site overview: The RCS map for this site is shown in Plate 12. The survey length was 500 m in length, the channel width was 10.00 -

12.00 m and the depth was 0.10 - 0.13 m. The survey reach was a gently meandering section, the upstream part flowed alongside steep slopes and low sandstone cliffs grading up into mixed woodland on the left bank. The right bank and downstream end of the left bank involved fairly level ground. The bank type was mainly earth and typically very steep throughout most of the section, but in the upstream part of the left bank there were short sections of sandstone cliff. The substrate was varied, mainly comprised of gravel and pebbles, but with expanses of level bedrock in the upstream part, with some larger cobbles and boulders throughout and local sand and silt deposits. There were no signs of recreation on this section. The only feature on this section was a ford for farm access in the downstream end of the section.

6.20.5.82 Vegetation: The bank vegetation was mainly characterised by tall grasses and herbs such as false oat-grass (*Arrhenatherum elatius*) and Yorkshire-fog (*Holcus lanatus*), with frequent alder (*Alnus glutinosa*), ash (*Fraxinus excelsior*) and quaking aspen (*Populus tremula*) trees. However steep slopes and sandstone cliffs on the left bank supported a wide range of bryophytes, including *Calypogeia arguta*, *C. fissa, Chiloscyphus polyanthus, Dicranella heteromalla, Diplophyllum albicans, Mnium hornum* and *Pogonatum aloides*.

6.20.5.83 In the upstream two thirds of the section, vascular plants only occurred on silt banks and scattered in the margin, they include marsh marigold (*Caltha palustris*), large bittercress (*Cardamine amara*), pink purslane (*Claytonia sibirica*), floating sweet-grass (*Glyceria fluitans*), plicate sweet-grass (*G. notata*), tufted forget-me-not (*Myosotis laxa*), water forget-me-not (*M. scorpioides*), creeping forget-me-not (*M. secunda*) and butterbur (*Petasites hybridus*). There was also a small stand of the liverwort *Porella cordaeana* on boulders in the right margin at the upstream end of the section. Further downstream the margins were more open with creeping bent (*Agrostis stolonifera*), great willowherb (*Epilobium hirsutum*), Himalayan balsam *(Impatiens glandulifera*), toad rush (*Juncus bufonius*), a hybrid rush (*Juncus ×surrejanus*), reed canary-grass (*Phalaris arundinacea*), rough meadow-grass (*Poa trivialis*), bog stitchwort (*Stellaria alsine*) and brooklime (*Veronica beccabunga*), with bryophytes such as *Conocephalum conicum*, *Lunularia cruciata* and *Pohlia carnea* on the steeper banks.

6.20.5.84 In the upstream, more shaded part, the channel was dominated by bryophytes such as *Brachythecium plumosum*, *Fontinalis antipyretica* and *Platyhypnidium riparium*, algae such as *Cladophora glomerata*, *Hildenbrandia rivularis* and *Ulva flexuosa* and lichens of the genus *Verrucaria* sp. In the downstream third there were extensive beds of a hybrid of river water-crowfoot (*Ranunculus fluitans*), with smaller quantities of fat duckweed (*Lemna gibba)* and pedunculate water-starwort (*Callitriche brutia* subsp. *brutia*).

6.20.5.85 Additional information: The population of the liverwort *Porella cordaeana* is of note*;* however*,* this is not a species recognised as rare.

6.20.5.86 Threats, potential and evaluation: There are no obvious threats to this section, although there was extensive silt deposition on the bedrock outcrops in the upper part of the section at the time of survey. The section already has high conservation value. The absence of river jelly-lichen (*Collema dichotomum*) on the exposed bedrock is curious. It is possible that it was never present (there are no previous records of this species from Trout Beck) or that is has disappeared due to siltation or eutrophication. The section is of high conservation value both for the structure, involving very varied substrate with extensive submerged and exposed bedrock outcrops, low stable sandstone cliffs and a range of substrates. The channel supports a hybrid derived from river water-crowfoot (*Ranunculus fluitans*) in the downstream third and can be seen to conform to the 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation.

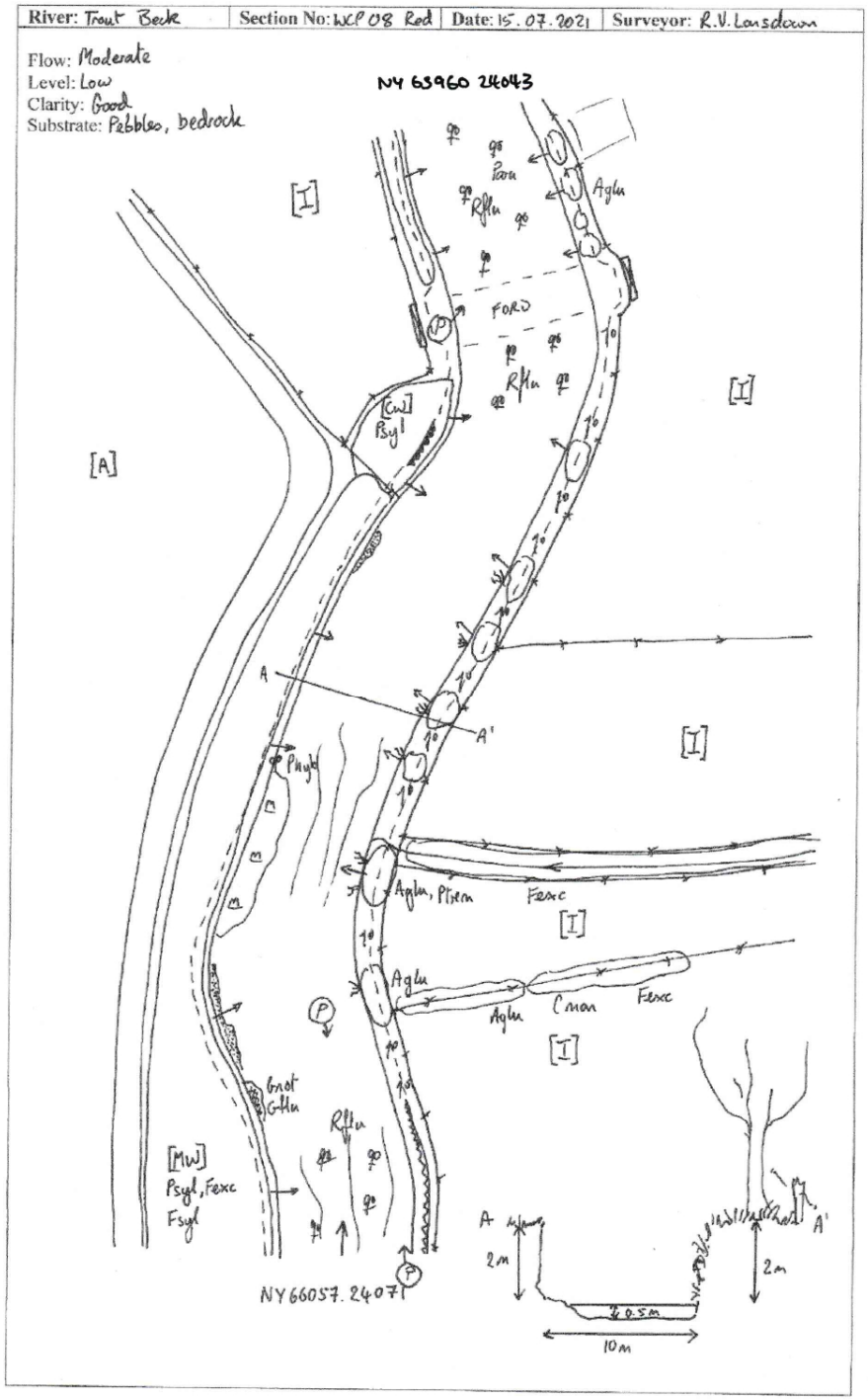

Plate 12: Trout Beck (WCP_08_US_RED) RCS map

Appleby to Brough

Unnamed Tributary of Mire Sike 6.12 (WCP_11_D/S) RCS

6.20.5.87 Site overview: The RCS map for this site is shown in Plate 13. The survey reach was 500 m in length, the channel width was 1.00 - 2.00 m and the depth was 0.15 m. The survey reach was a highly modified, largely straightened section with trapezoid channel

throughout much of its length, apart from a short reach flowing through woodland and fen in the middle of the section. Banks were earth throughout, were generally steep and fairly high except in the centre of the section. The substrate was gravel, pebbles, cobbles and scattered boulders throughout. There was no sign of recreational use of this section. The main features of this section were three road crossings and a railway crossing.

6.20.5.88 Adjacent land use: Both banks had improved grassland upstream of the railway line, although on the right bank there was a pond with associated mown paths and a copse of alder (*Alnus glutinosa*) and common osier (*Salix viminalis*). On the left bank there was a marshy area in the field upstream of the with oval sedge (*Carex leporina*), common sedge (*C. nigra*), jointed rush (*Juncus articulatus*), hybrid rush (*J. × surrejanus*) and lesser spearwort (*Ranunculus flammula*). Downstream of the railway bridge there was a field of improved grassland bordered to the south by a drystone wall which is separated from the B6259 by a band of scrubby grey willow (*Salix cinerea*) woodland. Between the B6259 and the minor road heading south, there was an area of fen grading into grey willow scrub on both sides of the channel with sneezewort (*Achillea ptarmica*), brown bent (*Agrostis capillaris*), rosebay willowherb (*Chamerion angustifolia*), tufted hair-grass (*Deschampsia cespitosa*), great willowherb (*Epilobium hirsutum*), meadowsweet (*Filipendula ulmaria*), cleavers (*Galium aparine*), hogweed (*Heracleum sphondylium*), Yorkshire-fog (*Holcus lanatus*), sharp-flowered rush (*Juncus acutiflorus*), meadow vetchling (*Lathyrus pratensis*), greater bird's-foot trefoil (*Lotus pedunculatus*), whorled mint (*Mentha × verticillata*), amphibious bistort (*Persicaria amphibia*), reed canary-grass (*Phalaris arundinacea*), greater burnet (*Sanguisorba officinalis*), betony (*Stachys betonica*), marsh woundwort (*Stachys palustris*) and common valerian (*Valieriana officinalis*). Downstream of the minor road the stream flowed through improved acid grassland with patchy gorse (*Ulex europaeus*) but there was a wet hollow on the right bank with species-poor rush pasture and a pool supporting common spike-rush *(Eleocharis palustris*), floating sweet-grass (*Glyceria fluitans*), common duckweed (*Lemna minor*), spiked water-milfoil (*Myriophyllum spicatum*), lesser spearwort (*Ranunculus flammula*) and branched bur-reed *(Sparganium erectum*).

6.20.5.89 Vegetation: Throughout much of the section the bank vegetation was simply an extension of the adjacent habitats. However, in the upstream field where the banks are fenced, there was a more diverse grassy vegetation with brown bent, creeping bent (*Agrostis stolonifera*), wild angelica (*Angelica sylvestris*), false oat-grass (*Arrhenatherum elatius*), marsh thistle (*Cirsium palustre*), red fescue (*Festuca rubra*), meadowsweet, hedge bedstraw (*Galium album*), hogweed (*Heracleum sphondylium*), Yorkshire-fog, sharp-flowered rush, hard rush (*Juncus inflexus*), meadow vetchling, common sorrel (*Rumex acetosa*), clustered dock *(R. conglomeratus*) and common valerian.

6.20.5.90 Throughout most of the section marginal vegetation was simply a continuation of the bank vegetation, with a few additions, such as greater tussock-sedge (*Carex paniculata*) toward the upstream end.

6.20.5.91 In a few places the channel supported species not found in the marginal or bank vegetation including fool's-watercress (*Apium nodiflorum*), floating sweet-grass, water mint (Mentha aquatica), hybrid forget-me-not (*Myosotis* × *suzae*), watercress (*Nasturtium officinale* agg.), branched bur-reed and the moss *Leptodictyum riparium*.

6.20.5.92 Threats, potential and evaluation: There are no obvious threats to this section. The small remnant fen habitats between the roads and on the banks through the upstream field, together with the small stands of scrubby grey willow have some conservation value as they are not as intensively improved as other habitats. However, they are not of high conservation value. The section has been modified throughout much of its length and supports only small areas of semi-natural habitats.

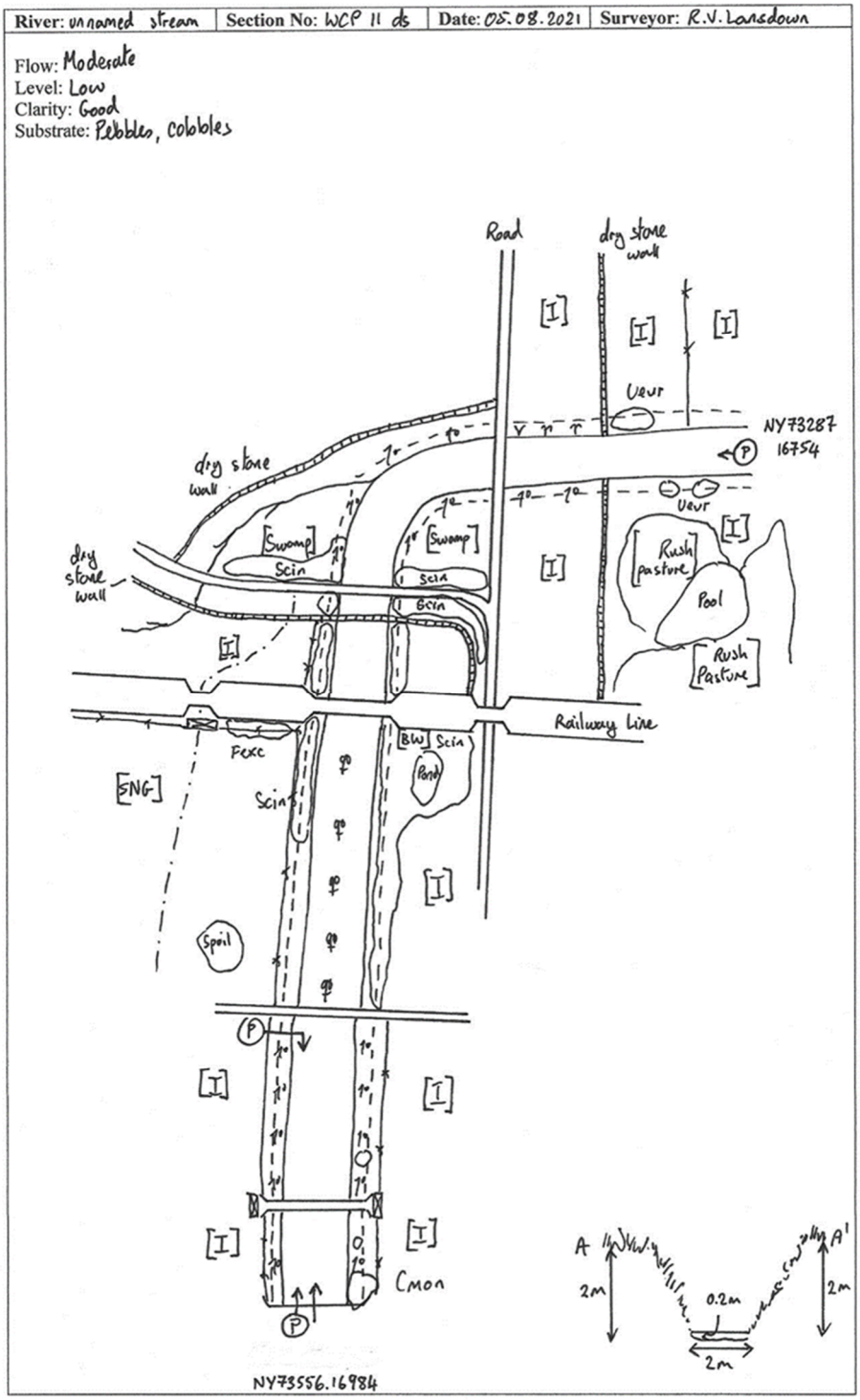

Plate 13: Unnamed Tributary of Mire Sike 6.12 (WCP_11_D/S) RCS map

Unnamed Tributary of Mire Sike 6.12 (WCP_11_U/S) RCS

6.20.5.93 Site overview: The RCS map for this site is shown in Plate 14. The survey reach was 250 m in length undertaken between the outflow the from the lake and the culvert under the existing A66. The channel width was 1.00 - 1.50 m and the bank height was 1.00 - 3.00 m. The survey reach was straight, trapezoid and modified apart from the upstream extent which had been diverted around the lake. A public footpath crossed the channel toward the downstream end but otherwise there was no sign of recreational use of the section. The main features of this section were the farm track / MOD bridge crossing the section toward the downstream end and the features associated with the lake at the upstream end.

6.20.5.94 Adjacent land use: The downstream half of the right bank was mainly dry, improved, acid grassland grazed by sheep and rabbits. There was a planted copse toward the downstream end, set back from the channel. There was also a stand of planted Scots pine (*Pinus sylvestris*) upstream toward the lake. There was a copse of alder (*Alnus glutinosa*) and grey alder (*A. incana*) on the left bank in mid-section, as well as a stand of Scots pine on the margin of the reservoir. Elsewhere, both banks supported species-rich rush pasture with sneezewort (*Achillea ptarmica*), bugle (*Ajuga reptans*), wild angelica (*Angelica sylvestris*), false oat-grass (*Arrhenatherum elatius*), lady-fern (*Athyrium felix-femina*), marsh marigold (*Caltha palustris*), cuckooflower (*Cardamine pratensis*), brown sedge (*Carex disticha*), glaucous sedge (*C. flacca*), tawny sedge (*C. hostiana*), long-stalked yellow-sedge (*C. lepidocarpa*), carnation sedge (C. panicea), flea sedge (*C. pulicaris*), hybrid sedge (*C. ×fulva*), common knapweed (*Centaurea nigra*), common mouse-ear (*Cerastium fontanum*), creeping thistle (*Cirsium arvense*), marsh thistle (C. palustre), marsh willowherb (Epilobium palustre), marsh horsetail (*Equisetum palustre*), marsh bedstraw (*Galium palustre*), Yorkshire-fog (*Holcus lanatus*), square-stalked St. John's-wort (Hypericum tetrapterum), sharp-flowered rush (*Juncus acutiflorus*), compact rush (*J. conglomeratus*), soft rush (*J. effusus*), hard rush (*J. inflexus*), meadow vetchling (Lathyrus pratensis), greater bird's-foot trefoil (*Lotus pedunculatus*), heath wood-rush (*Luzula multiflora* subsp. *multiflora*), ragged robin (Lychnis flos-cuculi), field mint (Mentha arvensis), purple moor-grass (*Molinia caerulea*), marsh lousewort (*Pedicularis palustris*), ribwort plantain (*Plantago lanceolata*), rough meadow-grass (*Poa trivialis*), tormentil (*Potentilla erecta*), self-heal (*Prunella vulgaris*), meadow buttercup (*Ranunculus acris*), creeping buttercup (*R.repens*), clustered dock (*Rumex conglomeratus*), broad-leaved dock (R. obtusifolius), hybrid dock (*Rumex ×abortivus*), devil's-bit (*Succisa pratensis*), white clover (*Trifolium repens*), marsh arrowgrass (*Triglochin palustre*), colt's-foot *(Tussilago farfara*), common nettle (*Urtica dioica*), marsh valerian (*Valeriana dioica*), brooklime (*Veronica beccabunga*), tufted vetch (*Vicia cracca*), bitter vetch (*V. sepium*) and the mosses *Calliergonella cuspidata*, C*ampylium stellatum, Cratoneuron filicinum, Plagiomnium undulatum,*

Pohlia wahlenbergii, Polytrichum commune, Pseudoscleropodium purum, Rhytidiadelphus squarrosus, Sphagnum palustre, S. russowii and *Thuidium tamariscinum*. In the upstream part of the right bank, this habitat was invaded by common reed (*Phragmites australis*), while away from the channel on both sides, this habitat graded into improved acid grassland.

6.20.5.95 Vegetation: The bank vegetation was an extension of the marginal vegetation throughout but there were scattered grey willows (*Salix cinerea*).

6.20.5.96 The vegetation of adjacent habitats extended throughout, with the addition of a few species such as fool's-watercress (*Apium nodiflorum*), a water-starwort (*Callitriche* sp.), great willowherb (*Epilobium hirsutum*) and floating sweet-grass (*Glyceria fluitans*).

6.20.5.97 The channel vegetation was generally sparse, with a few patches of species such as water mint (*Mentha aquatica*), water forget-me-not (*Myosotis scorpioides*) and hybrid watercress (*Nasturtium* × *sterilis*), as well as stands of the marginal species spreading into the channel.

6.20.5.98 Threats, potential and evaluation: There are no obvious threats to this section, although increased drainage or overgrazing could threaten the species-rich rush pasture. The rush pasture has high conservation value, relaxation of grazing and abandonment of the lake would lead to development of more extensive wetland habitats of conservation value. The rush pasture is species-rich and supports a number of species which have not been recorded from the 10 km square in recent years, such as flea sedge, marsh arrowgrass and marsh lousewort, while the hybrid sedge (*Carex* × *fulva*) appears to be new to the 10 km square. It appears that the habitat is poorly represented along the A66 corridor, although it is likely to be more frequent with more species-rich examples in Teesdale. The channel itself has low conservation value.

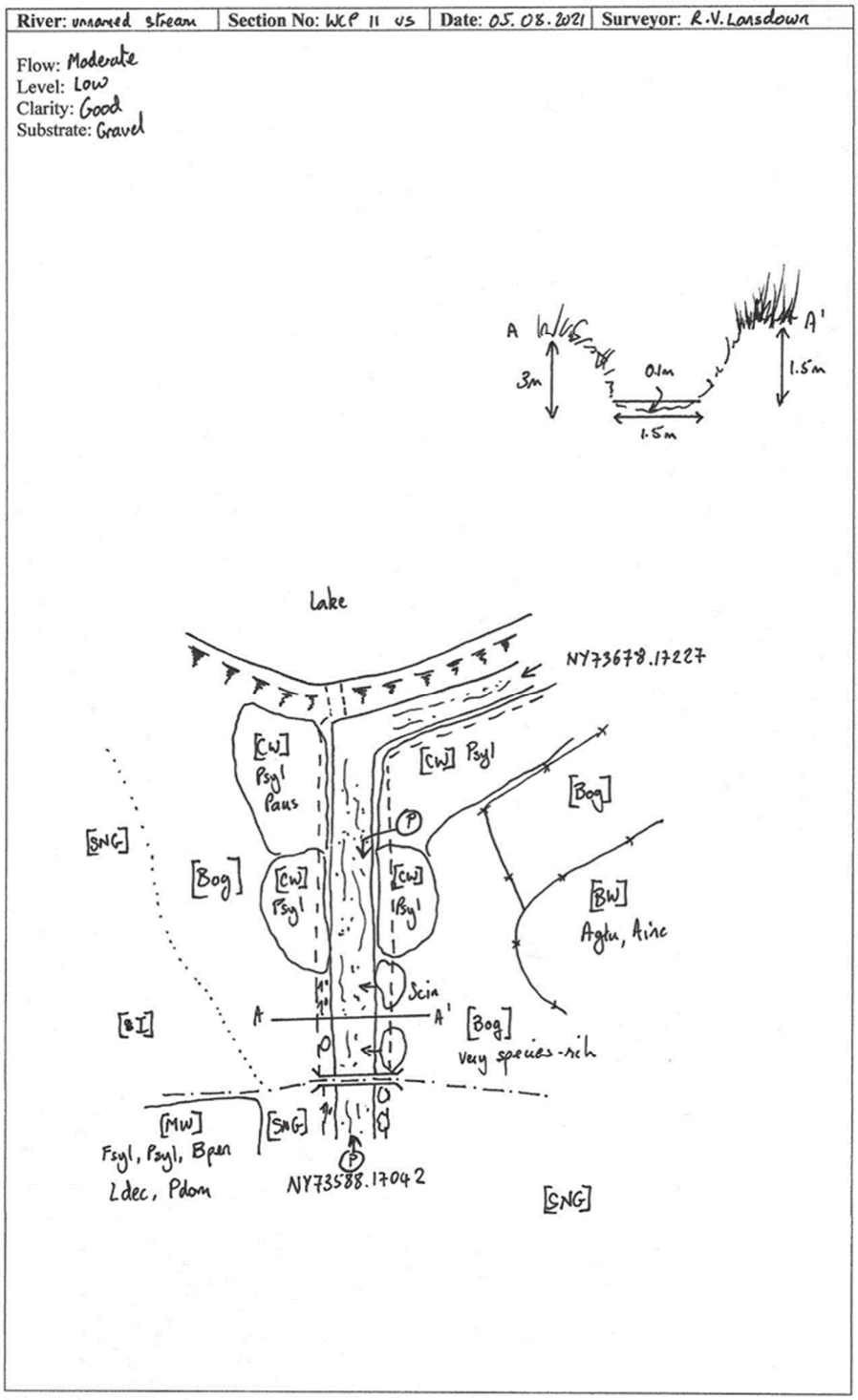

Plate 14: Unnamed Tributary of Mire Sike 6.12 (WCP_11_U/S) RCS map

Cringle Beck (WCP_13_D/S) RCS

6.20.5.99 Site overview: The RCS map for this site is shown in Plate 15. The survey reach was 300 m in length, the channel width was 1.00 - 1.20 m and the depth was 0.10 - 0.15 m. The survey reach was an almost completely straight section running through improved and some semi-improved grassland from the garden of a house on the A66 to the railway line. There was an eroding “nick point” immediately downstream of the bridge in the downstream part of the section. Flow was very low and down to a trickle in places. The banks were earth throughout, were fairly gentle in the upstream part but vertical and shading the narrow channel downstream, particularly downstream of the “nick point”. The substrate was mainly cobbles with some boulders, pebbles and gravel. A public footpath ran along the length of the section. The main feature of the section was the farm track ridge in the downstream half.

6.20.5.100 Adjacent land use: The adjacent land use on both banks was intensively improved, sheep-grazed pasture except from the downstream field on both banks where the pasture was less improved and includes some species diversity with species such as false oat-grass (*Arrhenatherum elatius*), tufted hair-grass (*Deschampsia cespitosa*), meadowsweet (*Filipendula ulmaria*), Yorkshire-fog (*Holcus lanatus*), soft rush (*Juncus effusus*), rough meadow-grass (*Poa trivialis*) and common valerian (*Valeriana officinalis*), but no notable species. There was a small copse at the downstream end of the left bank dominated by planted Scots pine (*Pinus sylvestris*) with beech (*Fraxinus excelsior*) and ash (Fraxinus excelsior).

6.20.5.101 Vegetation: In general, the bank vegetation was a continuation of the vegetation of adjacent habitats, however there is a line of quaking aspen (*Populus tremula*) and hawthorn (*Crataegus monogyna*).

6.20.5.102 The marginal vegetation was generally a continuation of adjacent and bank vegetation, apart from a few species such as marsh ragwort (*Senecio aquaticus*).

6.20.5.103 There was very little channel vegetation, apart from two stands of reed canary-grass (*Phalaris arundinacea*) in the upstream half of the section, scattered stands of bryophytes including *Brachythecium plumosum, Hygroamblystegium tenax* and *Orthotrichum cupulatum*.

6.20.5.104 Threats, potential and evaluation: There are no obvious threats to this section. The section has been straightened and deepened and so has little or no conservation value. Adjacent habitats are improved or semi-improved but support no species of note. The section must therefore be considered to have low conservation value and potential from a botanical perspective.

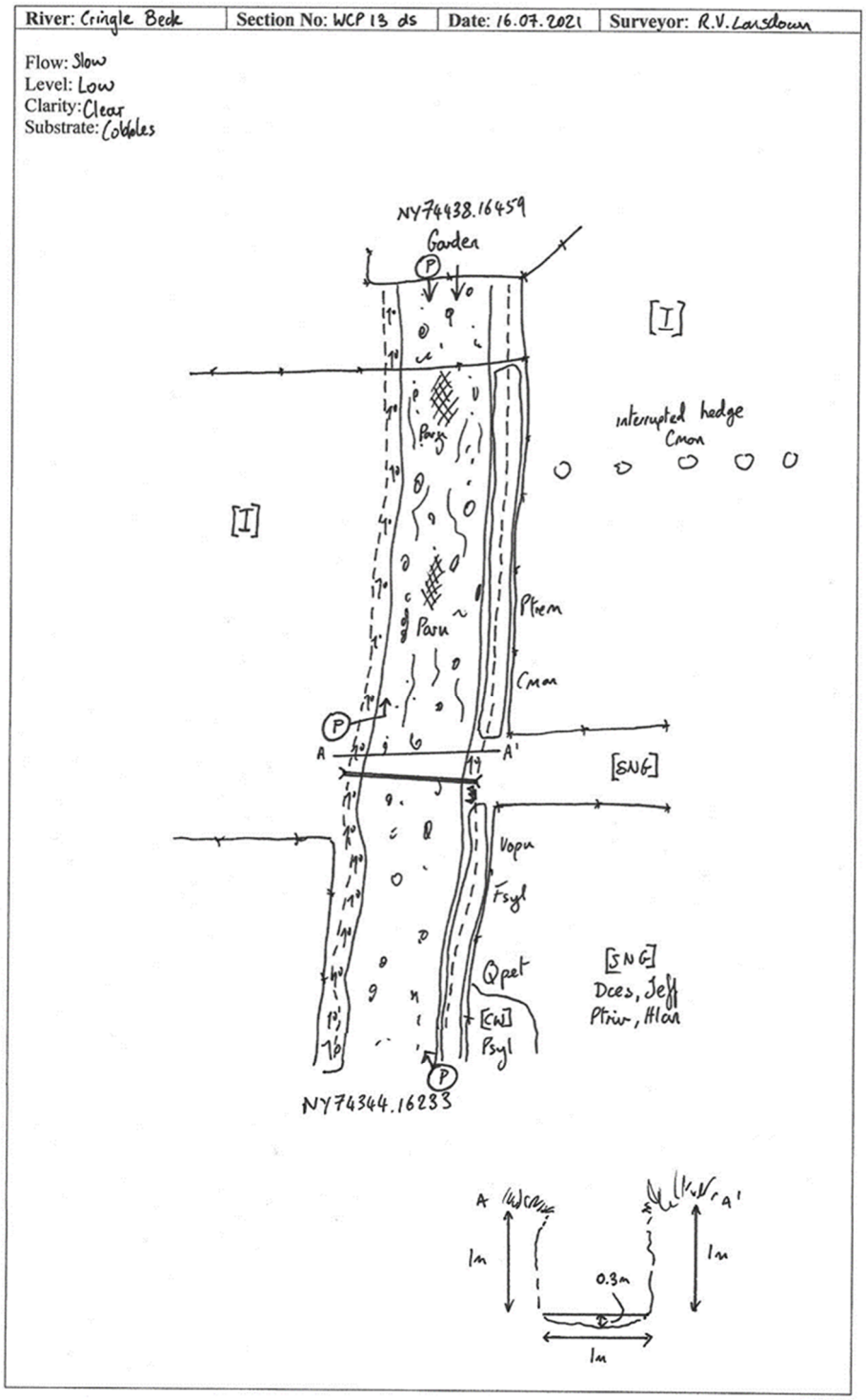

Plate 15: Cringle Beck (WCP_13_D/S) RCS map

Cringle Beck (WCP_13_U/S) RCS

6.20.5.105 Site overview: The RCS map for this site is shown in Plate 16. The survey reach was 500 m, the channel width was 2.00 - 3.00 m and

the depth was 0.10 - 0.80 m. The survey reach was a small, strongly meandering stream flowing through a small field of rush pasture and improved pasture. The banks were earth throughout, steeper in the upstream part with steep to vertical banks and becoming gentle and sloping in the main field. There was no sign of recreation on this section. The substrate typically comprised gravel and cobble. The main features on this section were the repeated crossing of the channel by the drystone wall and the strongly meandering channel.

6.20.5.106 Adjacent land use: Both banks had an area of rush pasture in semi-improved grassland in the upstream part with species such as false oat-grass (*Arrhenatherum elatius*), betony (*Betonica officinalis*), hairy sedge (*Carex hirta*), creeping thistle (*Cirsium arvense*), pig-nut (*Conopodium majus*), cock's-foot (*Dactylis glomerata*), common sorrel (*Rumex acetosa*) and common nettle (*Urtica dioica*). Downstream of this, there was an extensive area of scrubby hawthorn (*Crataegus monogyna*), elder (*Sambucus nigra*) and gorse (*Ulex europaeus*) on the hill but the remainder of the field was species-poor improved grassland.

6.20.5.107 Vegetation: The bank vegetation typically reflected that of the adjacent habitats throughout much of the section, although throughout the downstream field the banks had a fairly impoverished sward dominated by soft (*Juncus effusus*) and hard (*J. inflexus*) rush. At the extreme upstream end of the section the banks supported species such as field horsetail (*Equisetum arvense*), sharp-flowered rush (*Juncus acutiflorus*), water mint (*Mentha aquatica*) and reed canary-grass (*Phalaris arundinacea*).

6.20.5.108 There was very little marginal vegetation in the upstream field, apart from a stand of branched bur-reed (*Sparganium erectum*) on a sharp bend. The marginal vegetation in the downstream field reflected the adjacent vegetation with a range of vascular plants including creeping bent (*Agrostis stolonifera*), small sweet-grass (*Glyceria declinata*), floating sweet-grass (*G. fluitans*), hybrid rush (*Juncus* × *surrejanus*), soft rush (*J. effusus*), tufted forget-me-not (*Myosotis laxa*), lesser spearwort (*Ranunculus flammula*) and brooklime (*Veronica beccabunga*), while bryophytes such as *Cratoneuron filicinum, Fontinalis antipyretica*, *Marchantia polymorpha* subsp. *polymorpha*, *Orthotrichum rivulare* and *Platyhypnidium riparioides* occurred on larger stones throughout.

6.20.5.109 The channel vegetation was sparse and mainly limited to occasional patches of bryophyte such as *Hygroamblystegium fluviatile* and *H. tenax*, although lichens of the genus *Verrucaria* occurred throughout.

6.20.5.110 Threats, potential and evaluation: There are no obvious threats to this section. The structure of the channel was good throughout, while both the margins and parts of adjacent habitats supported reasonable diversity. However, most of the adjacent habitats are fairly species-poor and have been improved to the point where they cannot be considered to have conservation value. The channel has reasonable

conservation value, but supports no notable flora, while marginal and adjacent habitats are mainly species-poor.

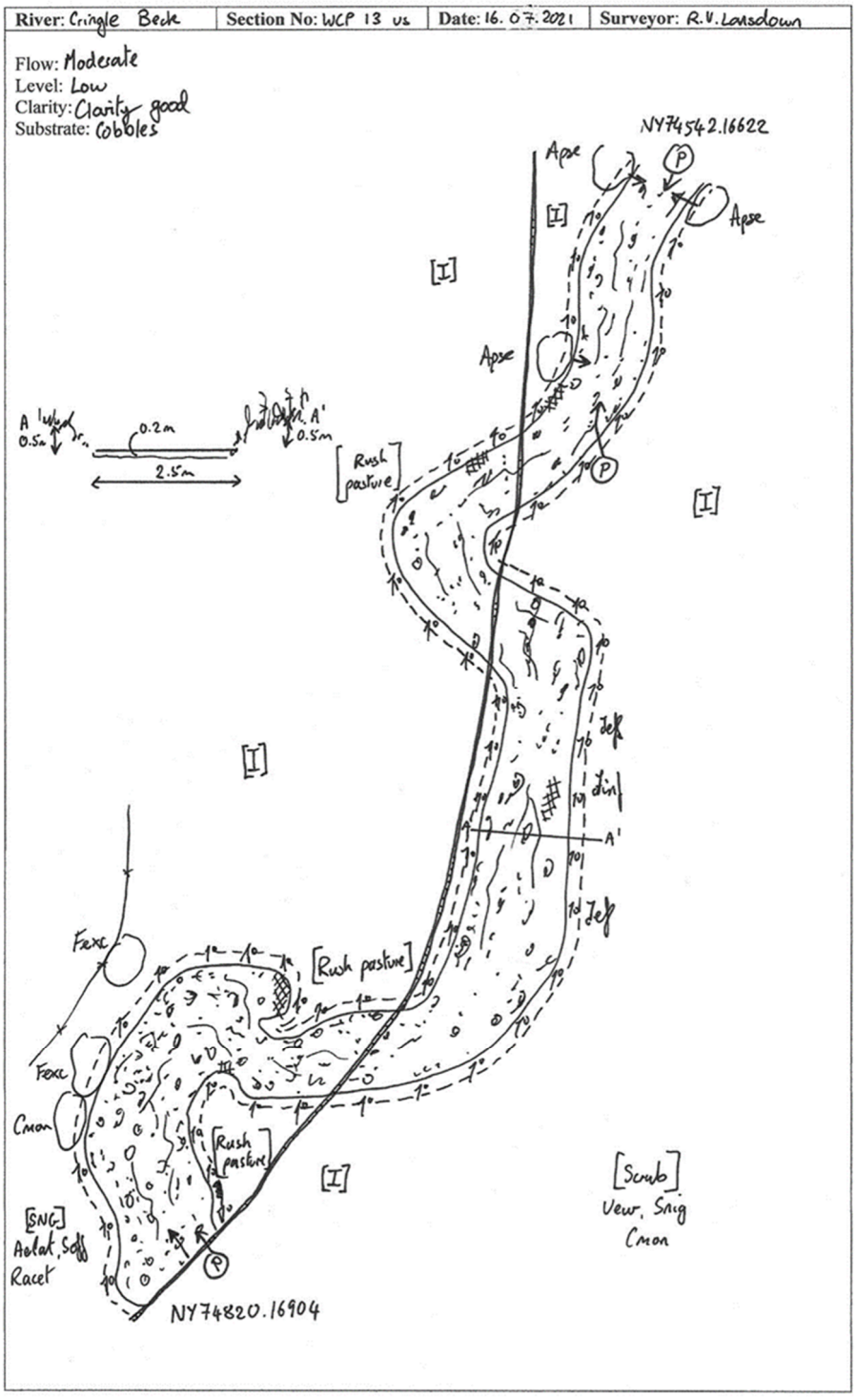

Plate 16: Cringle Beck (WCP_13_U/S) RCS map

Moor Beck (WCP_15_D/S) RCS

6.20.5.111 Site overview: The RCS map for this site is shown in Plate 17. The survey length was 500 m, the channel width was 2.00 - 3.00 m and

the depth was 0.30 - 0.20 m. The survey reach was a largely straightened section which was trapezoid in cross-section through the middle reach, but with strong meanders in the upstream and downstream ends. The bank type was earth throughout but with degraded bank protection in the upstream third. Banks were actively eroding in places due to the straightening of the middle part. The substrate was mainly gravel, with some boulders and local silt deposits. The only sign of recreational use of the section was the playing field on the left bank. The main feature of this section was the minor road crossing near the downstream end of the section.

6.20.5.112 Adjacent land use: Both banks flowed alongside improved grassland throughout. There was a playing field in the centre of the section on the left bank and the rest involved cattle- and sheep-grazed swards.

6.20.5.113 Vegetation: Both banks supported rank coarse grasses with tall herbs such as false oat-grass (*Arrhenatherum elatius*), hairy sedge (*Carex hirta*), cock's-foot (*Dactylis glomerata*), Yorkshire-fog (*Holcus lanatus*) and brambles (*Rubus* sp.) throughout the central, straightened reach. Elsewhere, the banks supported a range of species including elements of the adjacent vegetation and creeping thistle (*Cirsium arvense*), meadowsweet (*Filipendula ulmaria*), marsh bedstraw (*Galium palustre*), hard rush (*Juncus inflexus*), greater bird's-foot trefoil (*Lotus pedunculatus*) and marsh woundwort (*Stachys palustris*). There was also scattered ash *(Fraxinus excelsior*), hawthorn (*Crataegus monogyna*) and sycamore (*Acer pseudoplatanus*) throughout much of the section.

6.20.5.114 Marginal vegetation was restricted to backwaters and bars, except in the central, straightened reach where there were stands of butterbur (*Petasites hybridus*) and reed canary-grass (*Phalaris arundinacea*). Elsewhere, there were patches of species such as creeping bent (*Agrostis stolonifera*), great willowherb (*Epilobium hirsutum*), floating sweet-grass (*Glyceria fluitans*), plicate sweet-grass (*G. notata*), jointed rush (*Juncus articulatus*) and spearmint (*Mentha spicata*).

6.20.5.115 The upstream half of the section had only scattered channel vegetation mainly involving lower plants such as *Brachythecium rivulare*, *Cinclidotus fontinaloides*, *Fontinalis antipyretica*, *Hygroamblystegium tenax* and lichens of the genus *Verrucaria*. However, from the mid-section downstream common water-crowfoot *(Ranunculus aquatilis*) became frequent.

6.20.5.116 Additional information: Oystercatchers were roosting on the playing field.

6.20.5.117 Threats, potential and evaluation: There are no obvious threats to this section, cattle have access to the channel and may facilitate structural diversity. The channel is diverse in the upstream third of the section but otherwise the section has low conservation potential from a botanical perspective.

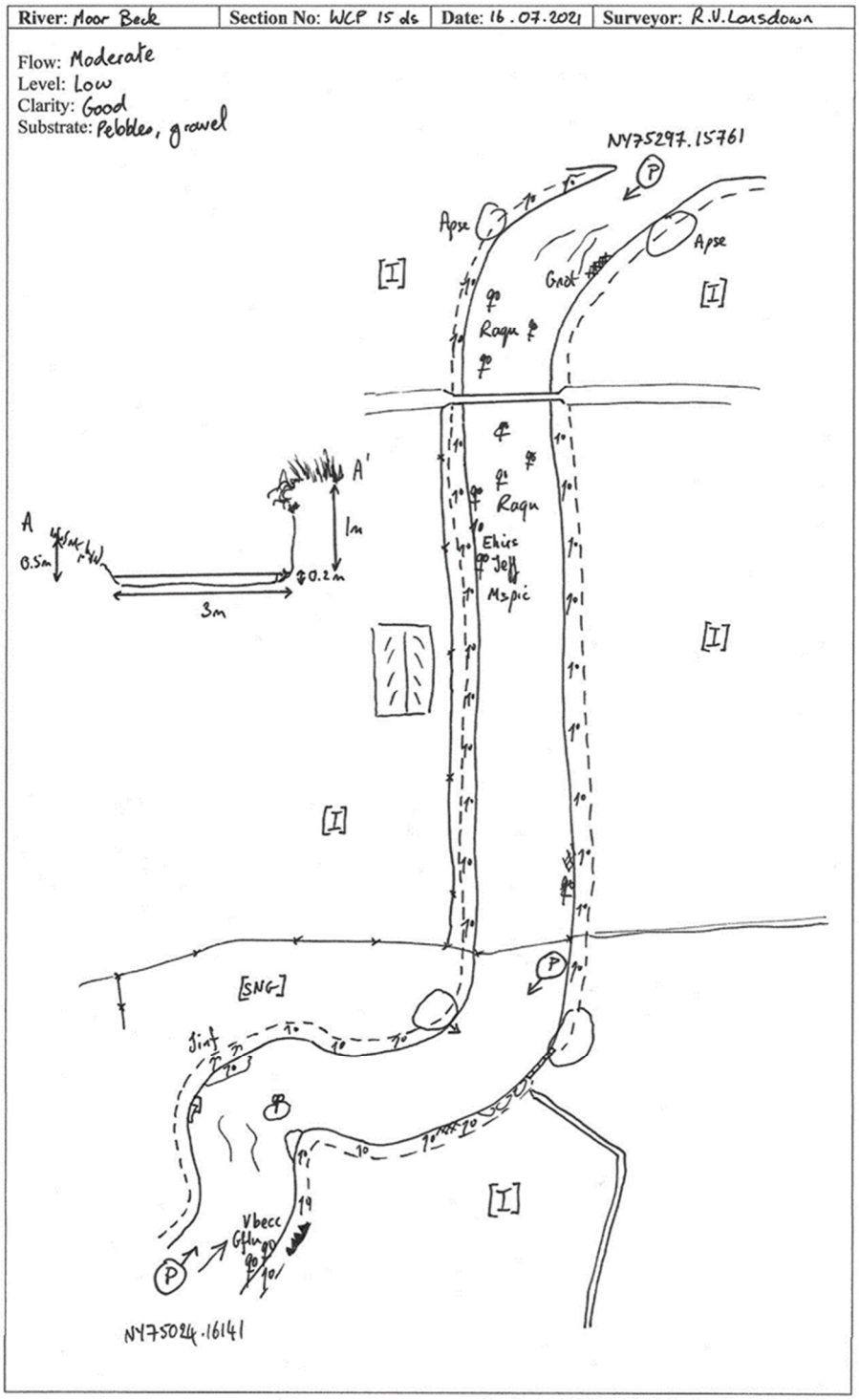

Plate 17: Moor Beck (WCP_15_D/S) RCS map

Moor Beck (WCP_15_U/S) RCS

6.20.5.118 Site overview: The RCS map for this site is shown in Plate 18. The survey length was 500 m, the width was 3.00 - 4.00 and the bank

height was 1.00 - 3.00 m. The survey reach was a very complex, tightly meandering section flowing mainly through woodland shade with little sign of modification except around the road crossing. The banks were earth throughout and very variable from gently sloping through steep to overhanging where the banks are actively eroding. The substrate was variable, mainly gravel but with localised bedrock exposures, some boulders and cobbles, as well as local sand and silt deposits. The Haybergill Centre is near the upstream end of the section and there may be some recreational use of the section from residents, otherwise there was no evidence of recreational use of the section. The main feature of the section was the minor road crossing toward the upstream end.

6.20.5.119 Adjacent land use: Both banks had a mixture of open fen or bracken (*Pteridium aquilinum*) dominated habitats and broadleaved woodland dominated by sessile oak (*Quercus petraea*) with other species such as silver birch (*Betula pendula*), beech (*Fagus sylvatica*) and sycamore (*Acer pseudoplatanus*), with an understorey of hazel (*Corylus avellana*) with some blackthorn (*Prunus spinosa*). The open areas varied depending on how wet they were, but supported a range of species such as yarrow (*Achillea millefolium*), false oat-grass (*Arrhenatherum elatius*), harebell (*Campanula rotundifolia*), hairy sedge (*Carex hirta*), common sedge (*C. nigra*), common knapweed (*Centaurea nigra*), creeping thistle (Cirsium arvense), pignut (*Conopodium majus*), crossword (*Cruciata laevipes*), field horsetail (*Equisetum arvense*), meadowsweet (*Filipendula ulmaria*), hedge bedstraw (*Galium album*), lady's bedstraw (G. verum), water avens (*Geum rivale*), hogweed (*Heracleum sphondylium*), Yorkshire-fog (*Holcus lanatus*), sharp-flowered rush (*Juncus acutiflorus*), hard rush (*J. inflexus*), meadow vetchling (*Lathyrus pratensis*), tormentil (*Potentilla reptans*), betony (*Stachys betonica*) and the mosses *Pseudoscleropodium purum* and *Rhytidiadelphus squarrosus*.

6.20.5.120 Vegetation: The banks typically supported elements of the adjacent vegetation, with occasional diversity such as a seepage zone with hairy sedge, field horsetail, sharp-flowered rush, soft rush (*Juncus effusus*), hard rush, spearmint *(Mentha spicata*) and brooklime (*Veronica beccabunga*), as well as a fallen almond willow (*Salix triandra*) in mid-section. Other seepages and humid areas have species such as *Brachythecium rivulare, Collema sp., Conocephalum conicum, Cratoneuron filicinum, Dicranella palustre, Marchantia polymorpha* subsp. *polymorpha* and *Pellia endiviifolia*.

6.20.5.121 The marginal vegetation typically reflected the character and species of the vegetation on the banks, except that there was frequent spearmint, together with occasional fool's-watercress (*Apium nodiflorum*), floating sweet-grass (*Glyceria fluitans*), plicate sweet-grass (*G. notata*) and marsh woundwort (*Stachys palustris*).

6.20.5.122 The channel vegetation was mainly characterised by species occurring on the margins, with a higher representation of lower plants, including the mosses *Fontinalis antipyretica*, *Hygroamblystegium*

fluitans and *Hygroamblystegium tenax*, the algae *Cladophora glomerata, Hildenbrandia rivularis* and *Vaucheria* sp. and lichens of the genus *Verrucaria*.

6.20.5.123 Threats, potential and evaluation: There are no obvious threats to this section. The adjacent habitats include reasonable species diversity and the woodland is mature, with potential for a rich fungus flora. However, this section is considered of medium conservation value because it supports no features or species of note, and the habitats represented are not excessively modified or disturbed.

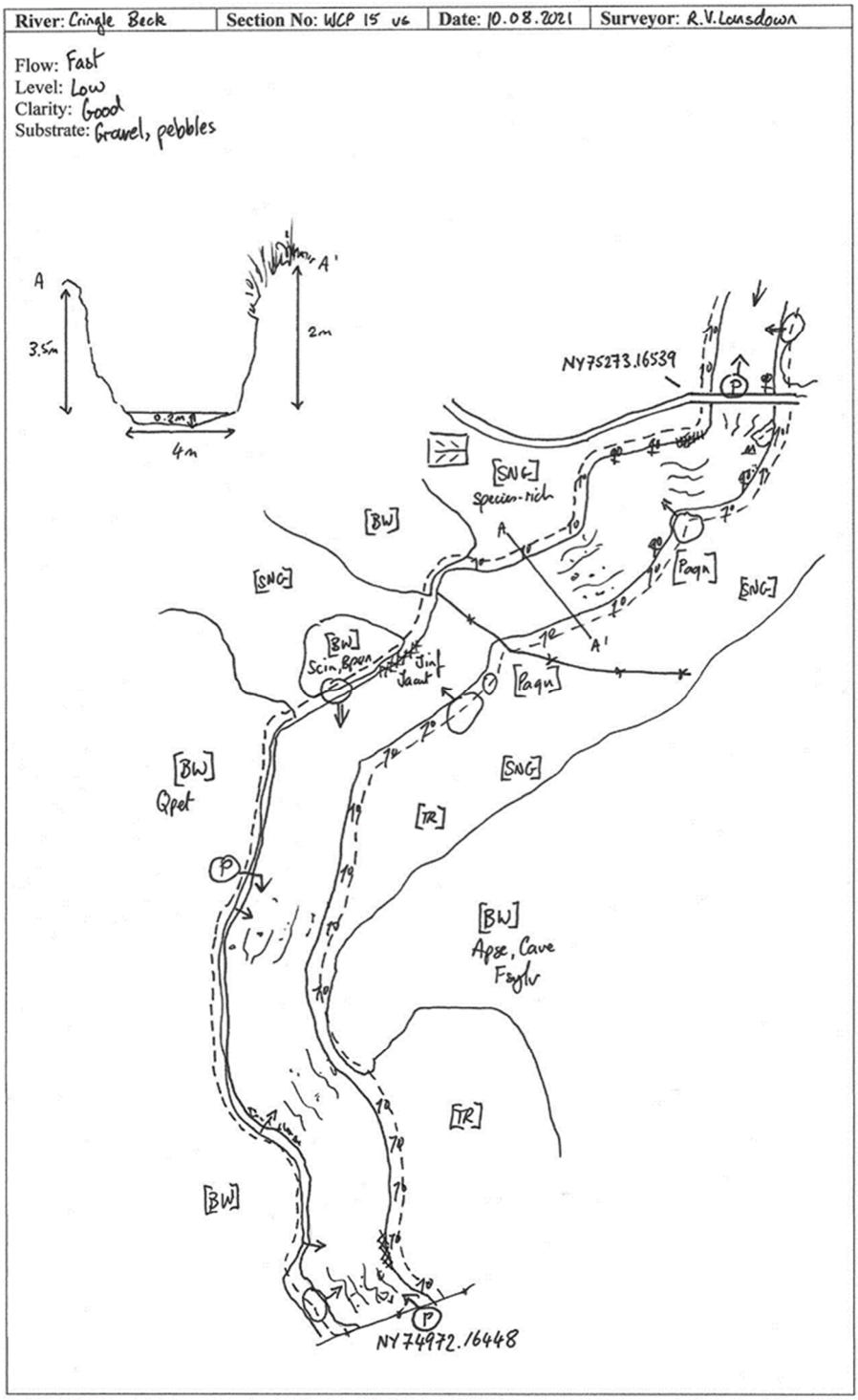

Plate 18: Moor Beck (WCP_15_U/S) RCS map

Eastfield Sike / Crooks Beck (WCP_17_D/S) RCS

6.20.5.124 Site overview: The RCS map for this site is shown in Plate 19. The survey reach was 500 m in length, the channel width was 1.00 - 3.00 m, and the bank height was 0.50 - 0.20 m. The upstream part of the section was shallow and narrow with sloping margins. From the

railway bridge downstream, the stream was mainly shaded by woodland with steeper banks. The banks were earth throughout. There was no evidence of recreation on this section. The main features on this section was the railway crossing, road crossing and footbridge.

6.20.5.125 Adjacent land use: On the right bank, upstream of the railway bridge the channel ran through improved, sheep-grazed pasture. Downstream of the railway bridge there was a patch of scrubby grey willow (*Salix cinerea*) and common osier (*S. viminalis*) woodland, then the channel runs alongside the road form much of the rest of the section. The downstream extreme of the right bank was a garden.

6.20.5.126 On the left bank, upstream of the railway bridge, the channel ran through improved, sheep-grazed grassland. Downstream of the railway bridge there was a narrow field of improved grassland, then a long stand of alder (*Alnus glutinosa*) woodland with lady fern (*Athyrium felix-femina*), lesser pond-sedge (*Carex acutiformis*), narrow buckler-fern (*Dryopteris carthusiana*), broad buckler-fern (*D. dilatata*), male fern (*D. filix-mas*), a hybrid fern (*D.* × *deweveri*), meadowsweet (*Filipendula ulmaria*), soft rush (*Juncus effusus*), dog's-mercury (*Mercurialis perennis*), blackcurrant (*Ribes nigrum*), raspberry (*Rubus idaeus*), bramble (*Rubus* sp.), hedge woundwort (*Stachys sylvatica*) and common valerian (*Valeriana officinalis*). The downstream end of the section flowed past an area of species-rich marshy ground with brown bent (*Agrostis capillaris*), creeping bent (*A. stolonifera*), marsh foxtail (*Alopecurus geniculatus*), marsh marigold (*Caltha palustris*), brown sedge (*Carex disticha*), hairy sedge (*Carex hirta*), common sedge (*Carex nigra*), common knapweed (*Centaurea nigra*), marsh thistle (*Cirsium palustre*), marsh cinquefoil (*Comarum palustre*), crested dog's-tail (*Cynosurus cristatus*), broad-leaved willowherb (*Epilobium montanum*), marsh willowherb (*E. palustre*), hoary willowherb (*E. parviflorum*), hybrid willowherb (*E.* ×*montaniforme*), field horsetail (*Equisetum arvense*), marsh horsetail (*E. palustre*), marsh bedstraw (*Galium palustre*), Yorkshire-fog (*Holcus lanatus*), sharp-flowered rush (*Juncus acutiflorus*), toad rush (*J. bufonius*), soft rush (*J. effusus*), hard rush (*J. inflexus*), hybrid rush (*J.* × *surrejanus*), greater bird's-foot trefoil *(Lotus pedunculatus*), amphibious bistort (*Persicaria amphibia*), self-heal (*Prunella vulgaris*), meadow buttercup (*Ranunculus acris*), lesser spearwort (*R. flammula*), creeping buttercup (R. repens), common sorrel (*Rumex acetosa*), autumnal hawkbit *(Scorzoneroides autumnalis*), marsh ragwort (Senecio aquaticus), lesser stitchwort (*Stellaria graminea*), red clover (*Trifolium pratense*), white clover (*T. repens*) and marsh arrowgrass (*Triglochin palustre*).

6.20.5.127 Vegetation: The bank vegetation throughout was mainly represented by elements of the adjacent vegetation, except alongside the road where the right bank supported a dense stand of butterbur (*Petasites hybridus*) and male-fern. There was a line of coppiced alder along both banks downstream of the road bridge and dense snowberry

(*Symphoricapus albus*) at the extreme downstream end of the section.

6.20.5.128 Marginal vegetation was sparse and generally represented by elements of the bank vegetation, apart from occasional stands of species such as plicate sweet-grass (*Glyceria notata*) spearmint (*Mentha spicata*), watercress (*Nasturtium officinale* agg.), branched bur-reed (*Sparganium erectum*) and brooklime (*Veronica beccabunga*).

Channel vegetation was sparse throughout the shaded section, apart from lichens of the genus *Verrucaria* and the alga *Hildenbrandia rivularis* on stones throughout, as well as patches of *Fontinalis antipyretica, Hygroamblystegium tenax* and *Hygrohypnum luridum*.

6.20.5.129 Threats, potential and evaluation: There are no obvious threats to this section. This section includes two areas of habitat of high conservation value. Even though it occupies only a small area, the marshy ground on the left bank, toward the downstream end is very diverse, while the block of woodland at NY750156 conforms with the class 91E0 Alluvial forests with Alnus *glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*). Both of these areas have high conservation value and with appropriate management this value could be further enhanced.

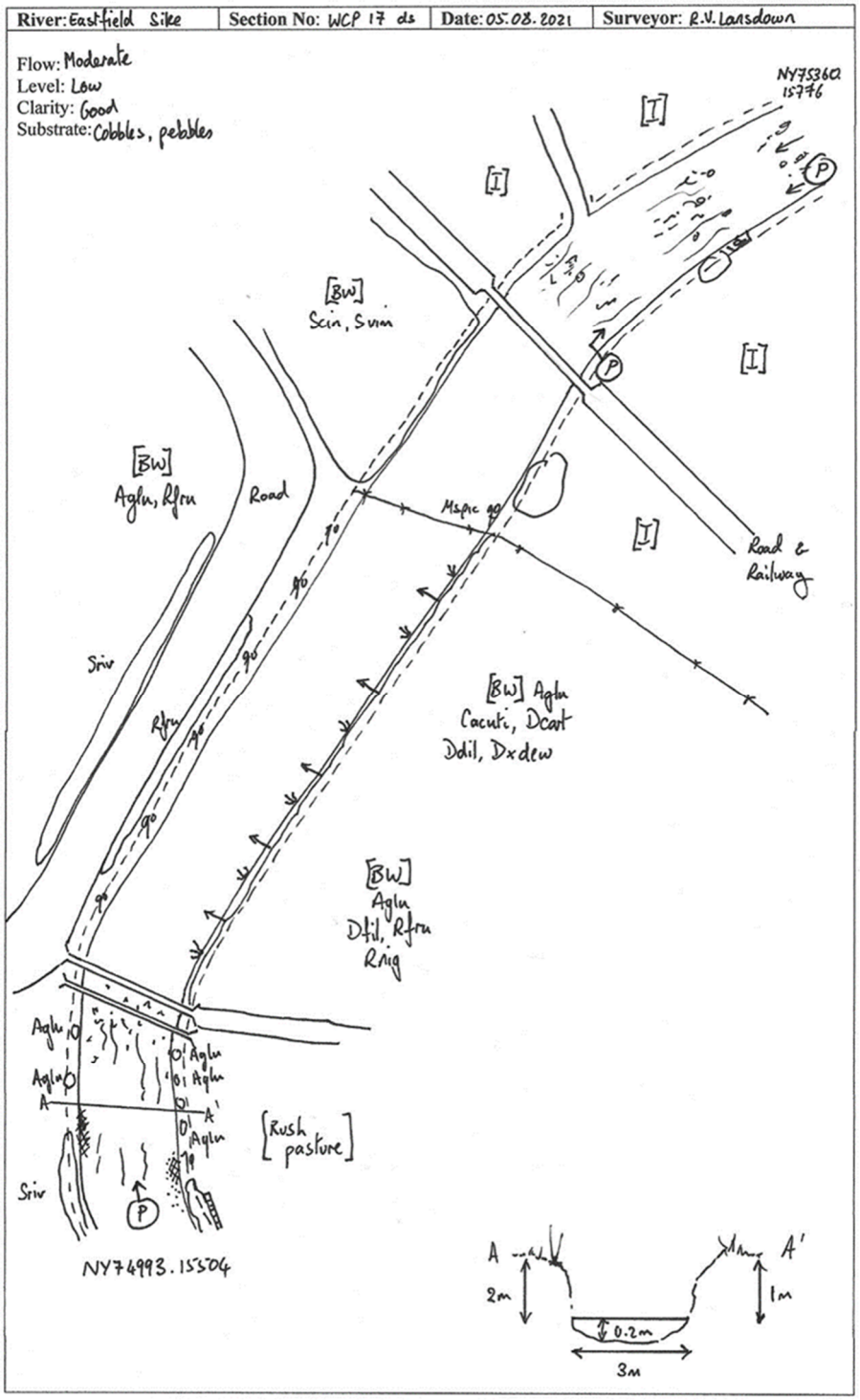

Plate 19: Eastfield Sike / Crooks Beck (WCP_17_D/S) RCS map

Eastfield Sike (WCP_17_U/S) RCS

6.20.5.130 Site overview: The RCS map for this site is shown in Plate 20. The survey reach was 500 m in length, the channel width was 1.00 - 2.00

m and the bank height was 1.00 - 1.50 m. Both banks were earth throughout, were steep to vertical and overshadowing the channel. The substrate was mainly gravel with some pebbles and local sand deposits. There was no sign of recreation on this section which is on MoD land. The main features on this section were a minor road bridge and disused farm track bridge toward the downstream end of the section, there was a footbridge in the mid-section and a barbed wire fence crossing in the upstream part of the section.

6.20.5.131 Adjacent land use: In the upstream part, the right bank had species-poor rush pasture with brown bent (*Agrostis capillaris*), sweet vernal-grass (*Anthoxanthum odoratum*), marsh thistle (*Cirsium palustre*), crossword (*Cruciata laevipes*), tufted hair-grass (*Deschampsia cespitosa*), Yorkshire-fog (*Holcus lanatus*), soft rush (*Juncus effusus*), greater bird's-foot trefoil (*Lotus pedunculatus*), greater stitchwort (*Stellaria holostea*) and common valerian (*Valeriana officinalis*). Downstream of this, there was an almost monospecific stand of lesser pond-sedge (*Carex acutiformis*) and in the central part of the section there is extensive wet fen with slender tufted-sedge (*Carex acuta*) marsh thistle (*Cirsium palustre*), meadowsweet (*Filipendula ulmaria*), Yorkshire-fog, clustered rush (*Juncus conglomeratus*), tormentil (*Potentilla erecta*) and marsh woundwort (*Stachys palustre*). At the downstream end of the section there was an area of improved grassland with a small building.

6.20.5.132 The left bank mainly ran past acid grassland with patchy gorse (*Ulex europaeus*) and some sycamore (*Acer pseudoplatanus*), silver birch (*Betula pendula*), ash (*Fraxinus excelsior*), pedunculate oak (*Quercus robur*), grey willow (*Salix cinerea*) and rowan (*Sorbus aucuparia*).

6.20.5.133 Vegetation: Bank vegetation throughout the section involved species which occurred in adjacent habitats. Marginal vegetation was sparse due to the steep banks, with occasional stands of species such as marsh bedstraw (*Galium palustre*), yellow-flag (*Iris pseudacorus*), water mint (*Mentha aquatica*), reed canary-grass (*Phalaris arundinacea*) and marsh woundwort (*Stachys palustris*). Channel vegetation was very sparse due to the steep banks and involved occasional patches of *Chiloscyphus polyanthus*, *Cladophora glomerata*, *Fontinalis antipyretica* with lichens of the genus *Verrucaria* on stones.

6.20.5.134 Threats, potential and evaluation: There are no obvious threats to this section, although habitats represented are quite degraded and species-poor. The channel has no features of note. This section has low conservation potential and is of low conservation value from a botanical perspective.

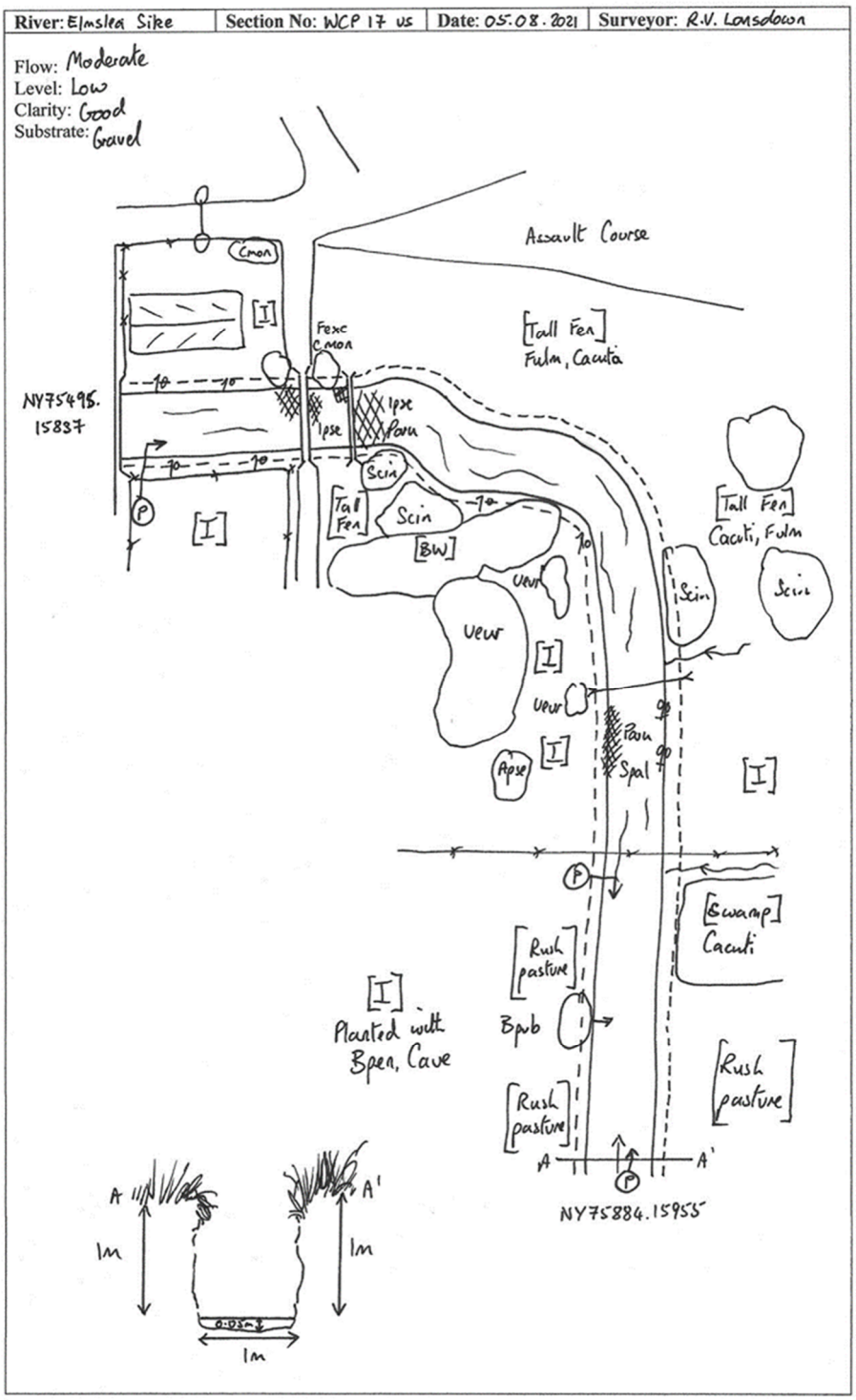

Plate 20: Eastfield Sike (WCP_17_U/S RCS map

Unnamed Tributary of Lowgill Beck 6.1 / Lowgill Beck (WCP_18_D/S) RCS

6.20.5.135 Site overview: The RCS map for this site is shown in Plate 21. The survey length was 500 m, the channel width was 1.00 - 2.00 m and the bank height was 1.00 - 2.00 m. The survey reach was a much-modified section, more or less trapezoid in outline throughout, except for downstream of the farm track bridge where it had a more natural form. The upstream part is unnamed and enters Lowgill Beck in the mid-section of the survey stretch. The bank types were earth throughout, were steep except downstream of the farm track bridge where they grade up from the channel with occasional low earth cliffs. The substrate was mainly silt except downstream of the farm track bridge where it is mainly gravel. There was no sign of recreational use of this section. The main features on this section were where the unnamed stream enters the Lowgill Beck and the farm track crossing the channel toward the downstream end.

6.20.5.136 Adjacent land use: The stream flowed through improved grassland throughout. There was a small copse of rowan (*Sorbus aucuparia*) and almond willow (*Salix triandra*) at the confluence with the Lowgill Beck.

6.20.5.137 Vegetation: Upstream of the farm track, the banks were fenced from the adjacent pasture and supported either a low hawthorn (*Crataegus monogyna*) hedge or rank grasses and tall herbs including false oat-grass (*Arrhenatherum elatius*), creeping thistle (*Cirsium arvense*), cock's-foot (*Dactylis glomerata*), field horsetail (*Equisetum arvense*), meadowsweet (*Filipendula ulmaria*), hogweed (*Heracleum sphondylium*), soft rush (*Juncus effusus*) and common nettle (*Urtica dioica*). Downstream of the farm track, the banks supported sheep-grazed improved grassland which extends to the channel from the adjacent field.

6.20.5.138 Upstream of the farm track, there was little or no marginal vegetation apart from occasional patches of great willowherb (*Epilobium hirsutum*) and marsh marigold (*Caltha palustris*), due to shade from overhanging grasses and tall herbs. Downstream of this, there was a discontinuous fringe of floating sweet-grass (*Glyceria fluitans*) along the margin.

6.20.5.139 There was no channel vegetation upstream of the farm track, downstream of this there was 100 % cover of diatoms with *Cladophora glomerata* and *Vaucheria* sp.

6.20.5.140 Threats, potential and evaluation: It is clear that nutrients are entering the water near or at the point where the farm track crosses the channel. The channel and adjacent habitats have been heavily modified and have little or no conservation value from a botanical perspective.

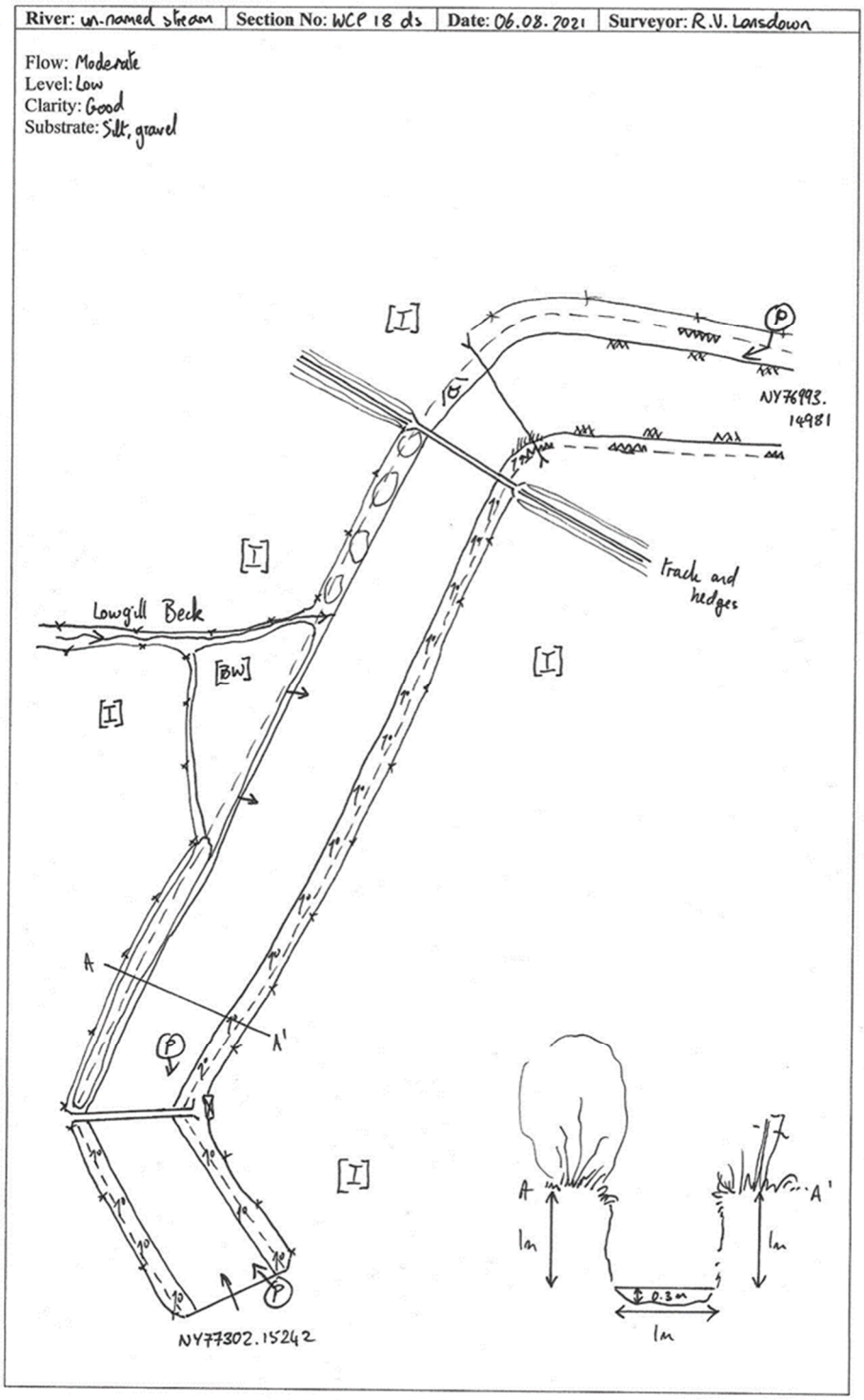

Plate 21: Unnamed Tributary of Lowgill Beck 6.1 / Lowgill Beck (WCP_18_D/S) RCS map

Unnamed Tributary of Lowgill Beck 6.1 (WCP_18_U/S) RCS

6.20.5.141 Site overview: The RCS map for this site is shown in Plate 22. The survey reach was 500 m in length, the channel width was 1.00 - 2.00 m and the bank height was 0.30 - 2.00 m. The survey reach was a much-modified section, effectively a linear ditch leading through rush pasture and then canalised through woodland to a culvert under the A66. The bank type was earth throughout, and were variable through the rush pasture, from low and gently sloping or even barely distinguished from the channel, but high and steep downstream of the farm track bridge. The substrate was peaty silt throughout most of the section, with some gravel, particularly at the downstream end. There was a public footpath crossing the section by the farm track bridge. The main feature on this section was the farm track bridge.

6.20.5.142 Adjacent land use: In the upstream two thirds of the section, the stream flowed through rush pasture with marsh marigold (*Caltha palustris*), tufted-sedge (*Carex* elata), common sedge (*C. nigra*), common mouse-ear (*Cerastium fontanum*), marsh cinquefoil (*Comarum palustre*), meadowsweet (*Filipendula ulmaria*), marsh pennywort (*Hydrocotyle vulgaris*), sharp-flowered rush (*Juncus acutiflorus*), blunt-flowered rush (*J. subnodulosus*), water mint (*Mentha aquatica*), tufted forget-me-not (*Myosotis laxa*) and common valerian (*Valeriana officinalis*). Downstream of this, the stream flowed through sparse broadleaved woodland with pedunculate oak (*Quercus robur*) with some scrubby silver birch (*Betula pendula*) and grey willow (*Salix cinerea*) over grassy ruderals, including tufted hair-grass (*Deschampsia cespitosa*) and common nettle (*Urtica dioica*).

6.20.5.143 Vegetation: The bank vegetation involved species from the adjacent habitats. Marginal vegetation involved species from the adjacent habitats extending into the margins. Throughout the rush pasture, the species forming adjacent habitats extended into the channel, but there were a number of additional species such as bottle sedge (*Carex rostrata*), compact rush (*Juncus conglomeratus*), soft rush (*J. effusus*), ragged robin (*Lychnis flos-cuculi*), amphibious bistort (*Persicaria amphibia*), lesser spearwort (*Ranunculus flammula*), branched bur-reed (*Sparganium erectum*) and the moss *Bryum pseudotriquetrum*.

6.20.5.144 Additional information: Abundant iron ochre deposits were present throughout the rush pasture.

6.20.5.145 Threats, potential and evaluation: The main threat to this section is ongoing drainage of the rush pasture. The site has high local conservation value due to the presence (and abundance) of blunt-flowered rush and tufted sedge, neither of which has recently been recorded in the area. However, the ditching of this stream will ultimately lead to drying out of the rush pasture and eventually, loss of the notable species. A number of small ponds have been created within the rush pasture, these too will contribute to the degradation of the habitat. This section has high local conservation value due to the

presence of the rush pasture dominated by blunt-fruited rush; however this is likely to be lost through drainage.

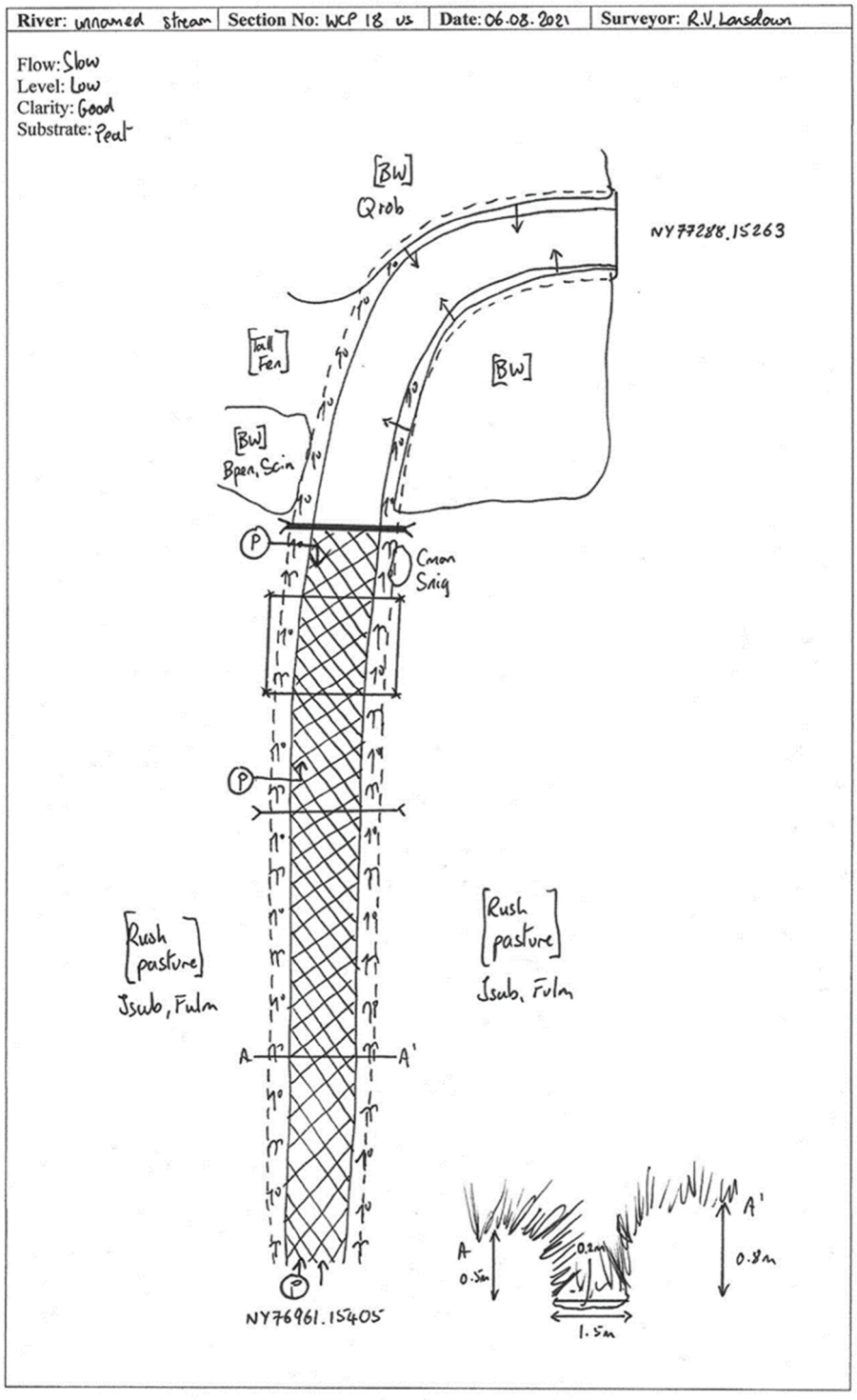

Plate 22: Unnamed Tributary of Lowgill Beck 6.1 (WCP_18_U/S) RCS map

Lowgill Beck (WCP_19_D/S) RCS

6.20.5.146 Site overview: The RCS map for this site is shown in Plate 23. The survey reach was 500 m in length, the channel width was 2.00 - 3.00 m and the bank height was 1.00 - 2.00 m. The survey reach was a tightly meandering section, constrained in the upstream half by the A66 embankment. Both banks were earth throughout, generally fairly steep but the left bank was grading into hillslope in parts of downstream section. There was no evidence of recreational use of the section. The main features of this section were the culvert under the A66 and the farm track crossing the channel.

6.20.5.147 Adjacent land use: On the right bank, upstream of the farm track, there was a narrow band of woodland dominated by pedunculate oak (*Quercus robur*) with sycamore (*Acer pseudoplatanus*) and rowan (*Sorbus aucuparia*) which graded up onto the A66 embankment. Downstream of this, there was a broad area of tall ruderals and planted trees, including wild angelica (*Angelica sylvestris*), false oat-grass (*Arrhenatherum elatius*), silver birch (*Betula pendula*), hazel (*Corylus avellana*), cock's-foot (*Dactylis glomerata*), hard rush (*Juncus inflexus*), meadow vetchling (*Lathyrus pratensis*), hybrid poplar (*Populus × c anadensis*), redcurrant (*Ribes rubrum*) and a rose (*Rosa* sp.).

6.20.5.148 On the left bank, upstream of the farm track, the stream flowed alongside sheep-grazed improved grassland. Downstream of the track, there was a fairly steeply sloping bank with areas of beech (*Fagus sylvatica*) woodland and tall herbs. The woodland ground flora includes opposite-leaved golden-saxifrage (*Chrysosplenium oppositifolium*) and melancholy thistle (*Cirsium heterophyllum*). The open areas supported similar species to those on the opposite bank but included a large stand of wood horsetail (*Equisetum sylvaticum*).

6.20.5.149 Vegetation: The banks supported trees throughout much of the length of the section, ether extending from adjacent woodland or as a narrow line of species such as silver birch (*Betula pendula*), hawthorn (*Crataegus monogyna*) and grey willow (*Salix cinerea*) between a barbed-wire fence and the channel alongside the improved pasture field. There were areas of eroding and short-term stable cliff on the left bank downstream of the farm track which support a range of bryophytes, including *Atrichum undulatum*, *Pogonatum urnigerum* and *Pseudephemerum nitidum.*

6.20.5.150 Marginal vegetation occurred as scattered stands, including a patch of reed canary-grass (*Phalaris arundinacea*) and common valerian (*Valeriana officinalis*) near the upstream end and scattered stands of species such as meadowsweet (*Filipendula ulmaria*), plicate sweet-grass (*Glyceria notata*), watercress (*Nasturtium officinale* agg.) and brooklime (*Veronica beccabunga*), as well as bryophytes such as *Cinclidotus fontinaloides, Cratoneuron filicinum, Hygroamblystegium tenax* and *Leptodictyum riparium* on boulders.

6.20.5.151 There was very little vegetation in the channels apart from abundant *Cladophora glomerata*, as well as lichens of the genus *Verrucaria* on stones and boulders.

6.20.5.152 Additional information: Melancholy thistle appears to be a new record for the 10 km square and wood horsetail the first record for some time.

6.20.5.153 Threats, potential and evaluation: There is a slurry seepage entering the channel from the left bank at the upstream end. Most of the section and associated habitats have limited conservation potential, however the ground flora of the wood on the left bank includes two notable species but there is little potential to increase the conservation value of the section.

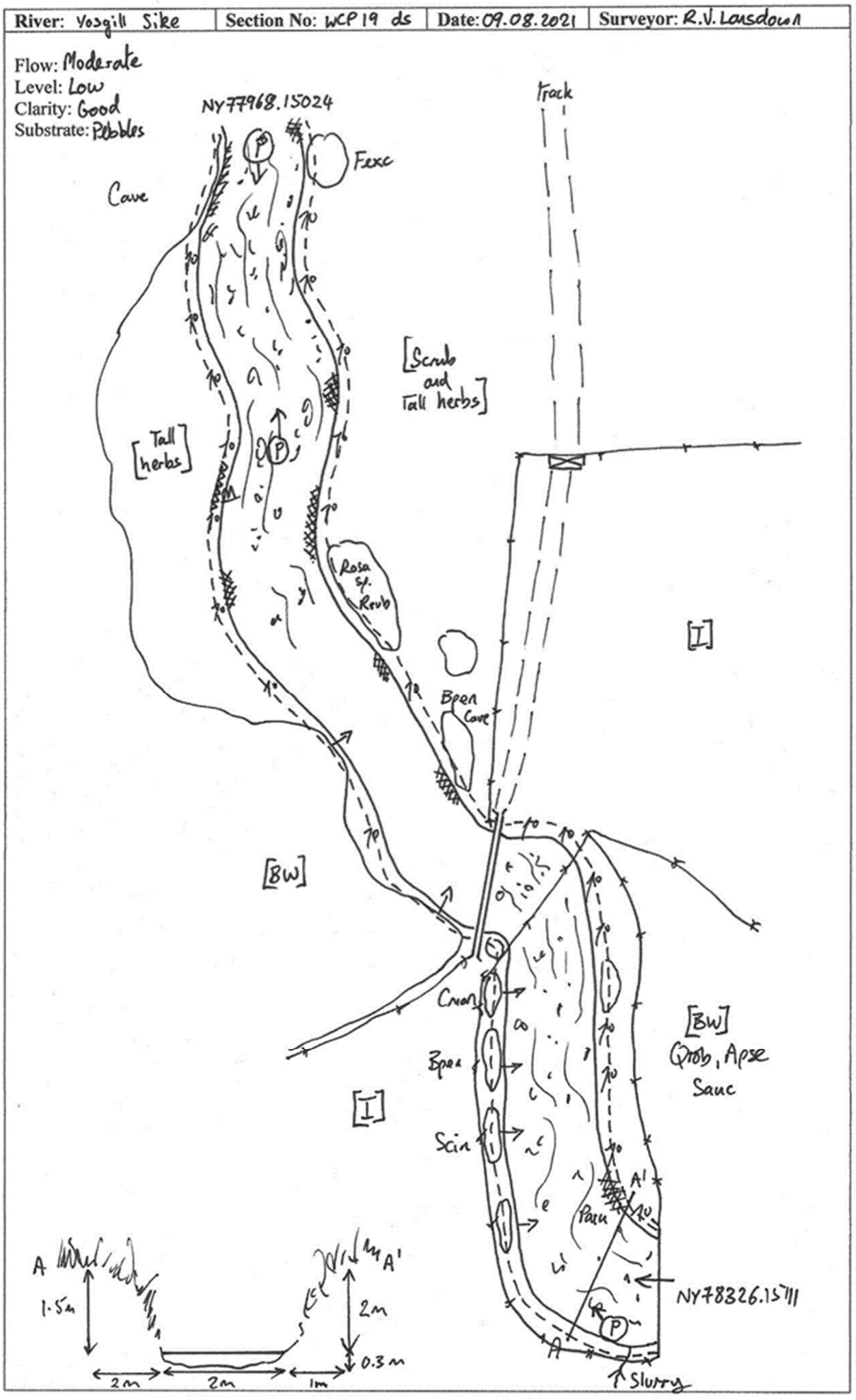

Plate 23: Lowgill Beck (WCP_19_D/S) RCS map

Yosgill Sike (WCP_19_Upstream RCS

6.20.5.154 Site overview: The RCS map for this site is shown in Plate 24. The survey length was 500 m in length, the channel width was 1.50 - 2.50 m and the bank height was 1.00 - 2.00 m. The survey reach was a broad, shallow, tightly meandering section, somewhat modified around farm buildings. The substrate was mainly gravel with some silt deposits. There was no evidence of recreational use of the section. The main features were fences and a farm track crossing the channel.

6.20.5.155 Adjacent land use: The stream ran through sheep-grazed improved grassland throughout with one arable field south of the farm buildings. The area between the wall alongside the arable field and the channel had a more diverse sward and could be considered semi-improved, with brown bent (*Agrostis capillaris*), smooth lady's-mantle (*Alchemilla glabra*), hairy sedge (*Carex hirta*), cock's-foot (*Dactylis glomerata*), Yorkshire-fog (*Holcus lanatus*), hard rush (*Juncus inflexus*), timothy (*Phleum pratense*), common sorrel (*Rumex acetosa*) and lesser stitchwort (*Stellaria graminea*).

6.20.5.156 Vegetation: The banks generally supported elements of the adjacent improved grassland with very low species diversity. There are two mature sycamore (*Acer pseudoplatanus*) trees toward the downstream end of the section.

6.20.5.157 There were scattered patches of marginal vegetation downstream of the farm buildings, with species such as creeping bent (*Agrostis stolonifera*), floating sweet-grass (*Glyceria fluitans*), sharp-flowered rush (*Juncus acutiflorus*) and butterbur (*Petasites hybridus*). Upstream of the farm there was an almost continuous stand of floating sweet-grass with lesser pond-sedge (*Carex acutiformis*), hairy sedge, marsh thistle (*Cirsium palustre*), field horsetail (*Equisetum arvense*), plicate sweet-grass (*Glyceria notata*), soft rush (*Juncus effusus*), hard rush, water mint (*Mentha aquatica*), greater bird's-foot trefoil (*Lotus pedunculatus*), watercress (*Nasturtium officinale* agg.) and brooklime (*Veronica beccabunga*) on soil and a range of bryophytes including *Calliergonella cuspidata, Cratoneuron filicinum, Hygroamblystegium tenax, Lunularia cruciata* and *Pellia endiviifolia* on boulders and bare cliffs.

6.20.5.158 There was very little vegetation in the channel, apart from lichens of the genus *Verrucaria* on stones and the algae *Cladophora glomerata* and *Vaucheria*.

6.20.5.159 Threats, potential and evaluation: There are no obvious threats to this section. Floristically, the section has low conservation value and little potential, supporting no species of note and with a highly modified form.

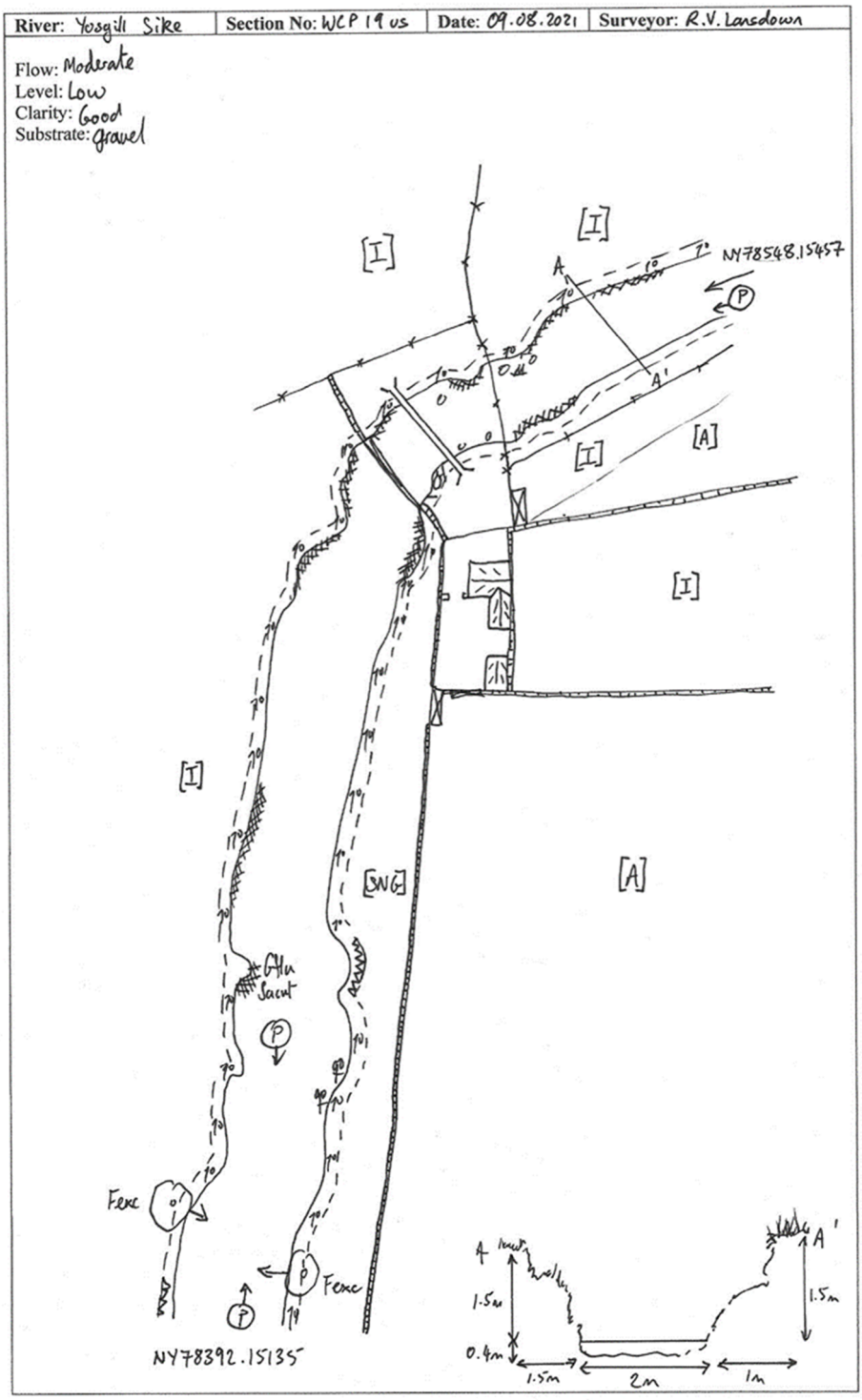

Plate 24: Yosgill Sike (WCP_19_U/S) RCS map

Cross Lanes to Rokeby

Tutta Beck (WCP_24_D/S) RCS

6.20.5.160 Site overview: The RCS map for this site is shown in Plate 25. The survey reach was 500 m in length, the channel width was 1.00 - 2.00 m, the bank height was 1.00 - 2.00 m. The survey reach was a narrow, steep-sided channel meandering within a very narrow corridor. Both banks were earth throughout, vertical and locally eroding. The channel was narrow enough and the banks high enough that the channel was shaded throughout much of the section. The substrate was mainly gravel and pebbles, with some cobbles and local silt deposits. There was no sign of recreational use of this section. There were no features of note on this section.

6.20.5.161 Adjacent land use: The right bank ran alongside a large steep arable field, with a short length of a field of sheep-grazed improved grassland at the downstream end, the left bank runs alongside sheep-grazed improved grassland throughout. On both sides of the channel there was a corridor of unmanaged tall herbs and coarse grasses dominated by species such as false oat-grass (*Arrhenatherum elatius*), creeping thistle (*Cirsium arvense*), hogweed (*Heracleum sphondylium*), common ragwort (*Senecio jacobaea*) and common nettles (*Urtica dioica*). Toward the upstream end this is replaced by a small stand of woodland dominated by alder (*Alnus glutinosa*) with some ash (*Fraxinus excelsior*), grey willow (*Salix cinerea*) and crack willow (*S.* ×*fragilis*).

6.20.5.162 Vegetation: The banks supported species from the adjacent habitats throughout, with small patches of bryophytes such as *Lunularia cruciata* and *Pohlia carnea* on otherwise bare clays.

6.20.5.163 There was very little marginal vegetation through most of the section, with only a few stands of species such as marsh marigold (*Caltha palustris*), great willowherb (*Epilobium hirsutum*), peppermint (*Mentha* × *piperita*), rough meadow-grass (*Poa trivialis*), branched bur-reed (*Sparganium erectum*), common valerian (*Valeriana officinalis*) and brooklime (*Veronica beccabunga*). Boulders and cobbles in the side of the channel support a range of bryophytes such as *Conocephalum conicum*, *Cratoneuron filicinum*, *Leptodictyum riparium*, *Pellia endiviifolia* and *Platyhypnidium riparioides*.

6.20.5.164 Channel vegetation throughout the section was limited to occasional stands of species which also occur on the margins and algae such as *Cladophora glomerata*, a *Rivularia* sp. and *Vaucheria* sp.

6.20.5.165 Threats, potential and evaluation: There are no obvious threats to this section. Floristically, the section has low conservation value and low potential.

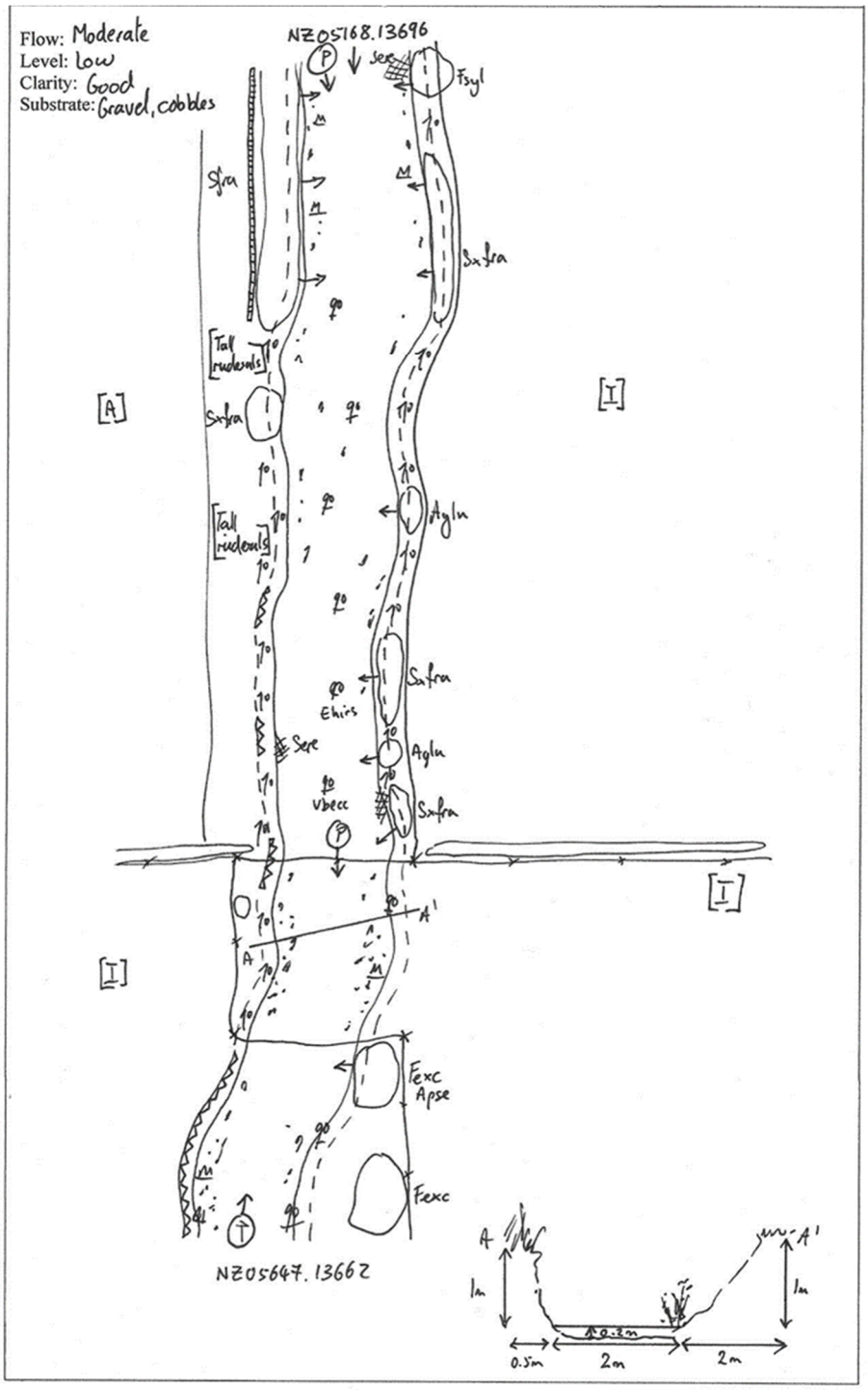

Plate 25: Tutta Beck (WCP_24_D/S) RCS map

Tutta Beck / Punder Gill (WCP_24_BLUE_D/S and WCP_24_U/S) RCS

6.20.5.166 Site overview: The RCS map for this site is shown in Plate 26. Site WCP_24_U/S overlaps with site WCP_24_BLUE_D/S. The survey reach was 500 m in length, the channel width was 1.50 - 2.00 m and the bank height was 0.50 - 2.00 m. The survey reach was a narrow channel meandering slightly within a narrowly defined area between pasture fields. Both banks were earth throughout and gently sloping but higher and steeper in the downstream half. The substrate was mainly gravel, pebbles and cobbles, with some boulders and silt deposits. There was no evidence of recreational use of this section. There were no notable features on this section.

6.20.5.167 Adjacent land use: The upstream part of both banks was sheep-grazed, improved grassland and this continued on the right bank to the downstream end of the section. The downstream end of the left bank had a series of narrow fields with pigs, where the ground was largely bare due to their rooting.

6.20.5.168 Vegetation: The bank vegetation was mainly rank grasses, bramble (*Rubus* sp.) scrub and some low hawthorn (*Crataegus monogyna*) hedges, except where it was grazed by sheep. In places where there are stable cliffs which remain humid due to tree shade, there was a range of bryophytes including *Conocephalum conicum, C. salebrosum, Lunularia cruciata* and *Pellia endiviifolia*.

6.20.5.169 Marginal vegetation was scattered mainly in the centre of the section, where there were a few stands of species such as creeping bent (*Agrostis stolonifera*), plicate sweet-grass (*Glyceria notata*), yellow-flag (*Iris pseudacorus*) and branched bur-reed (*Sparganium erectum*). Larges stones in the margins also supported bryophytes including *Cratoneuron filicinum* and *Leptodictyum riparium*.

6.20.5.170 There was very little vegetation in the channel, except for stands of the species recorded in the margins and the algae *Cladophora glomerata* and *Vaucheria* sp.

6.20.5.171 Threats, potential and evaluation: With the exception of pollution associated with livestock (pigs) in the adjacent fields, there are no known threats to this section. The channel, banks and adjacent habitats have been modified and intensified to the extent that they have low conservation and little potential for restoration.

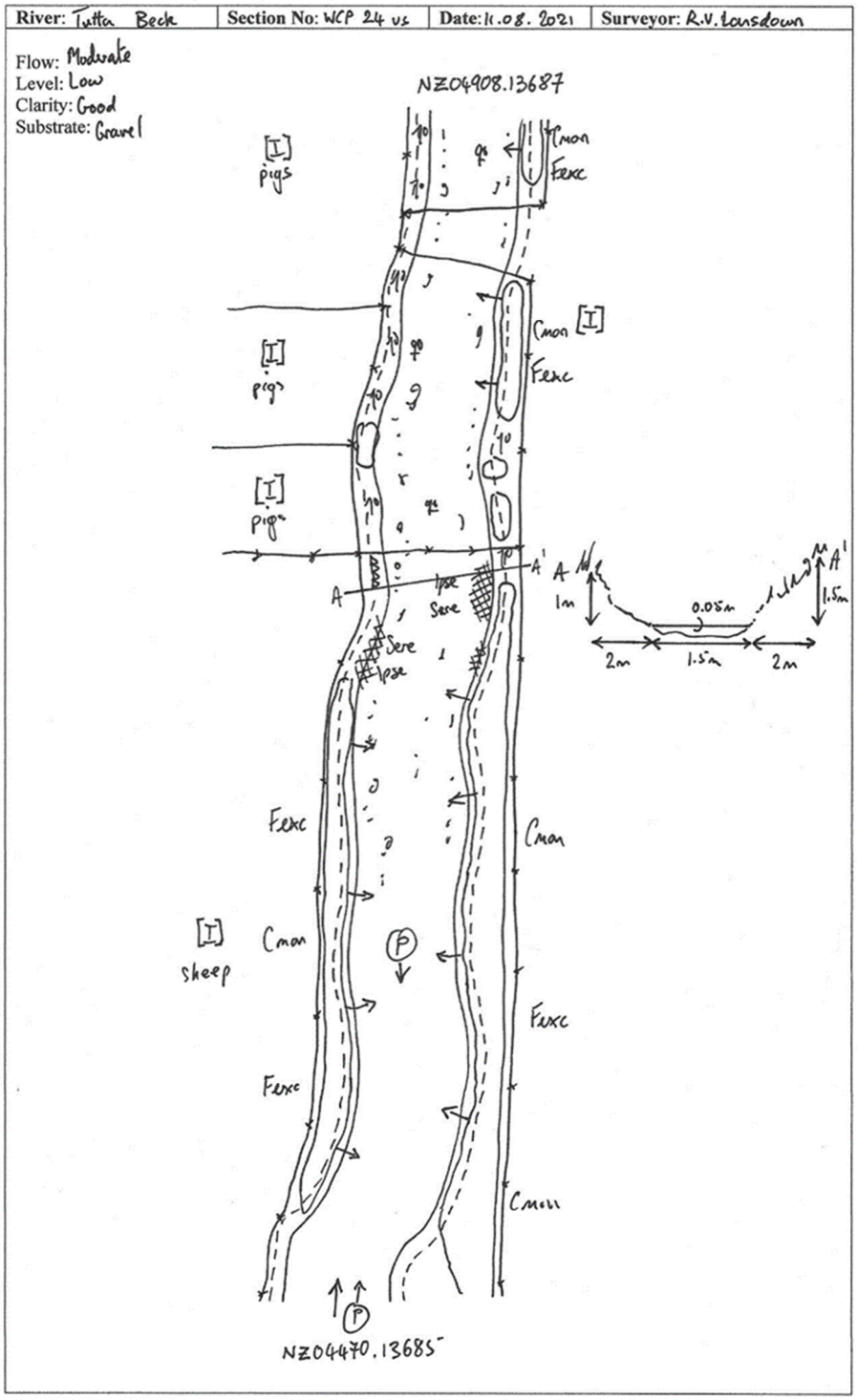

Plate 26: Tutta Beck / Punder Gill (WCP_24_BLUE_D/S and WCP_24_U/S) RCS

Stephen Bank to Carkin Moor

Unnamed Tributary of Holme Beck 9.2 (WCP_33_D/S) RCS

6.20.5.172 Site overview: The RCS map for this site is shown in Plate 2. The survey reach was 500 m in length, the channel width was 1.00 m and the bank height was 3.00 - 4.00. The survey reach was a straight, over-deepened, highly modified trapezoid section. Both banks were earth throughout, and were very steep and high. The substrate was mainly gravel, with some sand and silt deposits. There was no evidence of recreational use of this section. The main feature present was a farm track bridge over the centre of the section.

6.20.5.173 Adjacent land use: The stream flowed through arable fields, with a narrow un-ploughed field margin of species-poor grassland.

6.20.5.174 Vegetation: The banks supported tall herbs and coarse grasses, with false oat-grass (*Arrhenatherum elatius*), cock's-foot (*Dactylis glomerata*), meadowsweet (*Filipendula ulmaria*), hedge bedstraw (*Galium album*), hogweed (*Heracleum sphondylium*), red campion (*Silene dioica*) and common nettle (*Urtica dioica*). There are also patchy hawthorn (*Crataegus monogyna*) hedges on both sides but better developed on the left bank. The left bank also had occasional other tree species in the downstream part, including blackthorn (*Prunus spinosa*), elder (*Sambucus nigra*) and a large wych elm (*Ulmus glabra*), with abundant ivy *(Hedera helix*).

6.20.5.175 Marginal vegetation was sparse apart from abundant fool's-watercress (*Apium nodiflorum*) with sparse great willowherb (*Epilobium hirsutum*) and meadowsweet.

6.20.5.176 The channel was dominated by fool's-watercress with patchy *Leptodictyum riparium*.

6.20.5.177 Threats, potential and conservation: This section is so heavily modified that there are few threats which could affect it. It is species poor, has low potential and low conservation value from a botanical perspective.

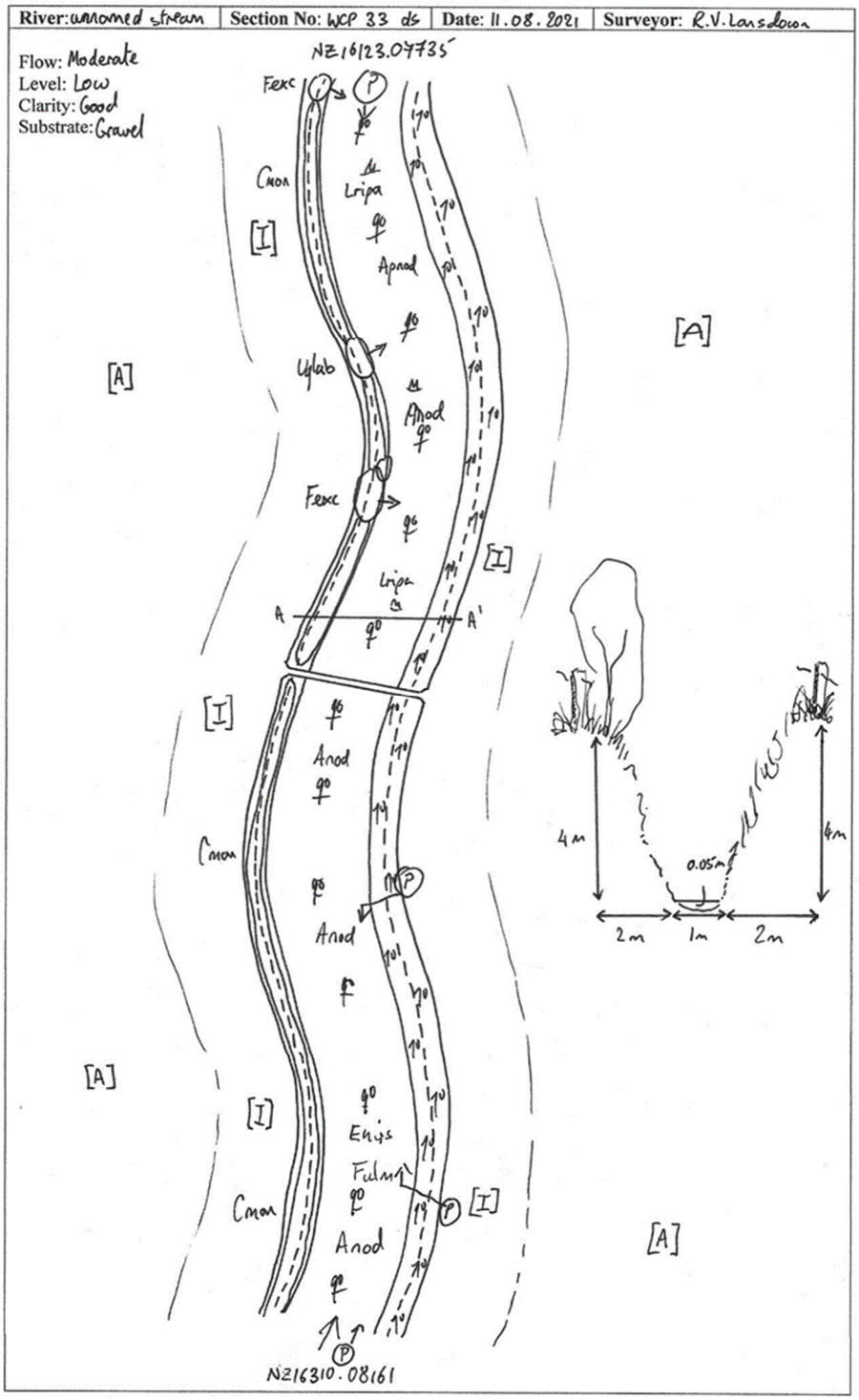

Plate 27: Unnamed Tributary of Holme Beck 9.2 (WCP_33_D/S) RCS map

6.20.6 Discussion

6.20.6.1 There were five sites where features associated with the watercourse categorise the site as being of high conservation value; impacts to these features and should be avoided or mitigated as appropriate.

6.20.6.2 Light Water (Penrith to Temple Sowerby), downstream of the existing A66 (WCP_03_DS) conforms to the Annex I habitat: 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation and is considered linked to the River Eamont, which form part of the River Eden SAC.

6.20.6.3 Areas of woodland adjacent to Light Water both upstream (WCP_03_U/S) and downstream (WCP_03_D/S) of the existing A66 conform to the Annex I habitat: 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*.

6.20.6.4 Trout Beck (Temple Sowerby to Appleby) forms part of the River Eden SAC and all surveyed reaches of Trout Beck conform to the Annex I habitat types: 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation habitat, a qualifying feature of the SAC.

6.20.6.5 The upper section of the surveyed reach of the Trout Beck (WCP_08_US-RED_US) is considered of high conservation value. Whilst the other sites on Trout Beck conform to the 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation habitat, their conservation value is severely limited by the steep banks and almost continuous shade from bankside trees. Their conservation value could be increased through removal of bank protection and allowing the channel to move through erosion and deposition.

6.20.6.6 Riparian woodland recorded adjacent to Crooks Beck (WCP_17_D/S) in the Appleby to Brough scheme, conforms to the 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior.*

6.20.6.7 Species found that are listed on the England Red List but not on the UK Red List (*Hydrocotyle vulgaris*, *Lychnis flos-cuculi*, *Valeriana officinalis*) are common in the north and west but are declining in the south and east.

6.20.6.8 The invasive non-native riparian plant Himalayan balsam (*Impatiens glandulifera*) was recorded at a number of sites. Mitigation will need to be in place during construction to minimise the spread of this species where it currently occurs and the risk of introducing the species to new sites: Himalayan balsam was recorded at the following sites:

- Unnamed Tributary of River Eamont 3.3 (WCP_04_D/S)
- All sites on Trout Beck, with the exception of WCP_08_D/S-4.

6.20.7 References

Environment Agency (2021) Ecology and Fish Data Explorer

Environment Agency (2021). Water Quality Archive.

JNCC (2020) Conservation Designations for UK Taxa 2020.

National Rivers Authority (1992) River Corridor Surveys. Conservation Technical Handbook 1. Bristol.

River LEAFPACS 2: WFD-UKTAG, 2014. UKTAG River Assessment Method Macrophytes and Phytobenthos. Macrophytes (River LEAFPACS2). A report by the Water Framework Directive – United Kingdom Technical Advisory Group.

UK Biodiversity Action Plan Priority Habitat Descriptions "Rivers" (ver. 2011).

LEAFPACS2 surveys and associated EQR values were obtained from adjacent sites in Trout Beck.

6.20.8 Survey locations

Table 7: Upstream and downstream NGRs for RCS and macrophyte surveys

Site	RCS		Macrophyte	
	U/S NGR	D/S NGR	U/S NGR	D/S NGR
Thacka Beck (WCP_01_D/S)	NY 52699 29224	NY 52795 29187	NY 52699 29224	NY 52795 29187
Thacka Beck (WCP_01_U/S	NY 52051 29587	NY52359 29341	NY 52281 29383	NY 52359 29341
Light Water (WCP_03_D/S)	NY 54888 29077	NY 55193 29388	NY 55098 29332	NY 55193 29388
Light Water (WCP_03_U/S)	NY 55105 28551	NY 54924 28946	NY 54962 28796	NY 54934 28905
Unnamed Tributary of River Eamont 3.3 (WCP_04_D/S)	NY 55604 28949	NY 5570629314	N/A	N/A
Trout Beck (WCP_08_D/S-1)	NY 64893 24420	NY 64586 24628	NY 64893 24420	NY 64873 24386
Trout Beck (WCP_08_D/S-2)	NY 64541 24664	NY 64324 24944	N/A	N/A
Trout Beck (WCP_08_D/S-3)	NY 64541 24664	NY 64059 25340	N/A	N/A
Trout Beck (WCP_08_D/S-4)	NY 64059 25340	NY 63546 25211	N/A	N/A
Trout Beck (WCP_08_D/S-5)	NY 63546 25211	NY 63330 25142	N/A	N/A
Trout Beck (WCP_08_U/S)	NY 65217 24377	NY 64405 24433	NY 65217 24377	NY 65133 24397
Trout Beck (WCP_08_US-RED_U/S)	NY 66057 24071	NY 63960 24043	NY 66057 24071	NY 65960 24043
Keld Sike (WCP_08_US-RED_KS_D/S)	N/A	N/A	NY 65391 24605	NY 65389 24682
Unnamed Tributary of Mire Sike 6.12 (WCP_11_D/S)	NY 73556 16984	NY 73287 16754	NY 73561 16968	NY 73542 16872
Unnamed Tributary of Mire Sike 6.12 (WCP_11_U/S)	NY 73678 17227	NY 7358817042	NY 73608 17114	NY73588 17043
Cringle Beck (WCP_13_D/S)	NY 74438 16459	NY 74344 16233	NY 74438 16459	NY 74470 16542

Site	RCS		Macrophyte	
	U/S NGR	D/S NGR	U/S NGR	D/S NGR
Cringle Beck (WCP_13_U/S)	NY 74820 16904	NY 74542 16622	NY 74598 16692	NY 74542 16622
Moor Beck (WCP_15_D/S)	NY 75024 16141	NY 75297 15761	NY 75244 15852	NY 75297 15761
Moor Beck (WCP_15_U/S)	NY 75273 16539	NY 74972 16448	NY 74999 16522	NY 74977 16426
Eastfield Sike/Crooks Beck (WCP_17_D/S)	NY 75360 15776	NY 74993 15504	NY75360 15776	NY 75238 15735
Eastfield Sike (WCP_17_U/S)	NY 75884 15955	NY 75495 15837	NY 75824 15955	NY 75749 15976
Unnamed Tributary of Lowgill Beck 6.1 (WCP_18_D/S)	NY 77302 15242	NY 76993 14981	NY 77302 15243	NY 77329 15176
Unnamed Tributary of Lowgill Beck 6.1 (WCP_18_U/S)	NY 76961 15405	NY 77288 15263	NY 77030 15390	NY 77120 15353
Lowgill Beck (WCP_19_D/S)	NY 78326 15111	NY 77968 15024	NY 77968 15024	NY 77875 14995
Yosgill Sike (WCP_19_U/S)	NY 78548 15457	NY 78392 15135	NY 78409 15292	NY 78392 15135
Unnamed Tributary of River Greta 7.3 (WCP_20_D/S)	N/A	N/A	NY 99765 13458	NY 99874 13450
Punder Gill (WCP_24_BLUE_ D/S)	NZ 04470 13685	NZ 04908 13687	NZ 04470 13685	NZ 04571 13677
Tutta Beck (WCP_24_D/S)	NZ 05168 13696	NZ 05647 13662	NZ 05359 13687	NZ 05647 13668
Tutta Beck WCP_24_U/S	NZ 04470 13685	NZ 04908 13687	NZ 04470 13685	NZ 04571 13677
Mains Gill (WCP_30_U/S)	N/A	N/A	NZ 15704 08737	NZ 15684 08662
Unnamed Tributary of Holme Beck 9.2 (WCP_33_D/S)	NZ 16310 08161	NZ 16123 07735	NZ 16310 08161	NZ 16150 07884