Physical and biological monitoring of STREAM restoration projects

Annual Report – Year 2

Natural England

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Final Report
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A COMPANY OF

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APPENDIX A: REACH SCALE MAPPING*

APPENDIX B: PHOTOGRAPHIC RECORDS*

(*All appendices are designed to be inserted into a ringbinder that accompanies this report and will be updated on an annual basis)

1 INTRODUCTION

1.1 The STREAM Restoration Project

Demonstrating Strategic Restoration and Management (STREAM) is funded jointly by the European Commission's LIFE-Nature programme, Natural England, Environment Agency, Wiltshire Wildlife Trust, Hampshire and Isle of Wight Wildlife Trust, and Wessex Water to improve river habitat conditions along a number of reaches of the River Avon Special Area of Conservation identified in **Table 1.1** and **Figure 1.1**.

Table 1.1 Location of river restoration sites within the Avon catchment

Site name	Watercourse	Upstream limit	Downstream limit
1.1 Upper Woodford	River Avon	SU 13183755	SU 12603723
1.2 Fovant	River Nadder	SU 00213059	SU 00663072
1.3 Seven hatches	River Wylye	SU 09243304	SU 09833178
1.4 Amesbury	River Avon	SU 15834257	SU 15624195
1.5 Hale	River Avon	SU 17401889	SU 16351791
1.6 Blashford	Dockens Water	SU 15410828	SU15300826

Further details about the project and outline design of the restoration works to be undertaken are contained within the original LIFE bid document (English Nature, 2005).

1.2 Physical and Biological Monitoring

As part of the STREAM project, Royal Haskoning has been commissioned by Natural England to undertake physical and biological monitoring at each of the six restoration sites.

Monitoring will involve one pre-restoration and one post-restoration survey at each site. These surveys will be used to document the restoration works and to identify the possible influence of the works on ecology within the reach. Reach-scale mapping and repeat photography techniques will be used to monitor change at all restoration sites. It is not possible to undertake detailed survey at all sites due to resource constraints and practical limitations. Therefore two of the sites will also be subject to more detailed survey and the use of control sites.

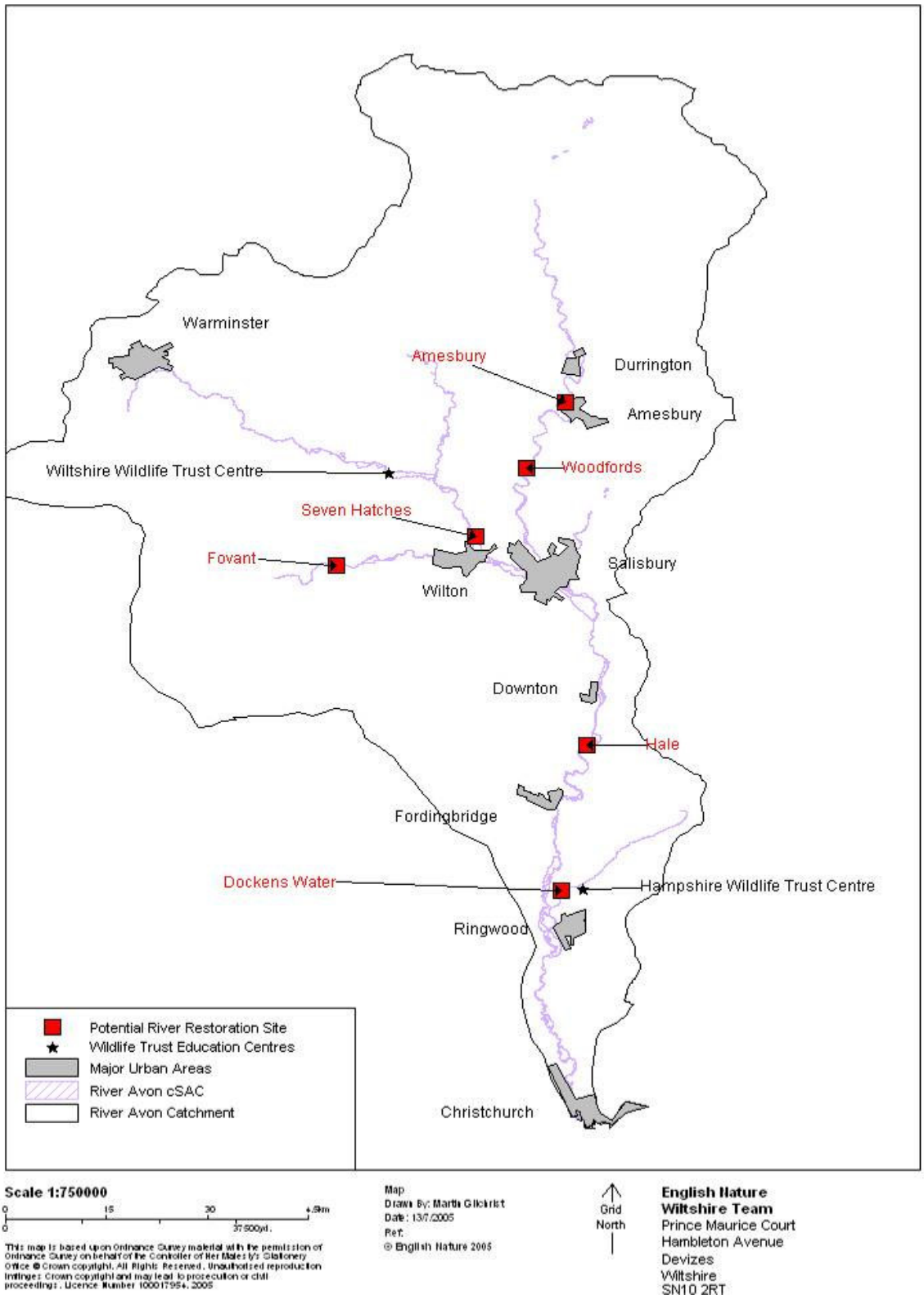
1.3 Reporting format

The findings of the monitoring project will be reported at the end of each of the four years of the project. This document reports on the findings of the second year's baseline monitoring surveys undertaken in 2007 at the following sites:

Detailed survey
None undertaken this year

Rapid assessment
- Hale Restoration Site (HAR)
- Dockens Water Restoration Site (DOR)

Figure 1.1 Location of STREAM restoration sites within the Avon Catchment



The purpose of this report is to present the data that has been collected this year and summarise any initial findings in relation to the physical and biological characteristics of the sites surveyed.

The primary data is contained within the appendices that accompany this report within a ringbinder. This ringbinder will be updated following subsequent annual reports in order to collate all of the data gathered over the four year period in one place.

2 METHOD

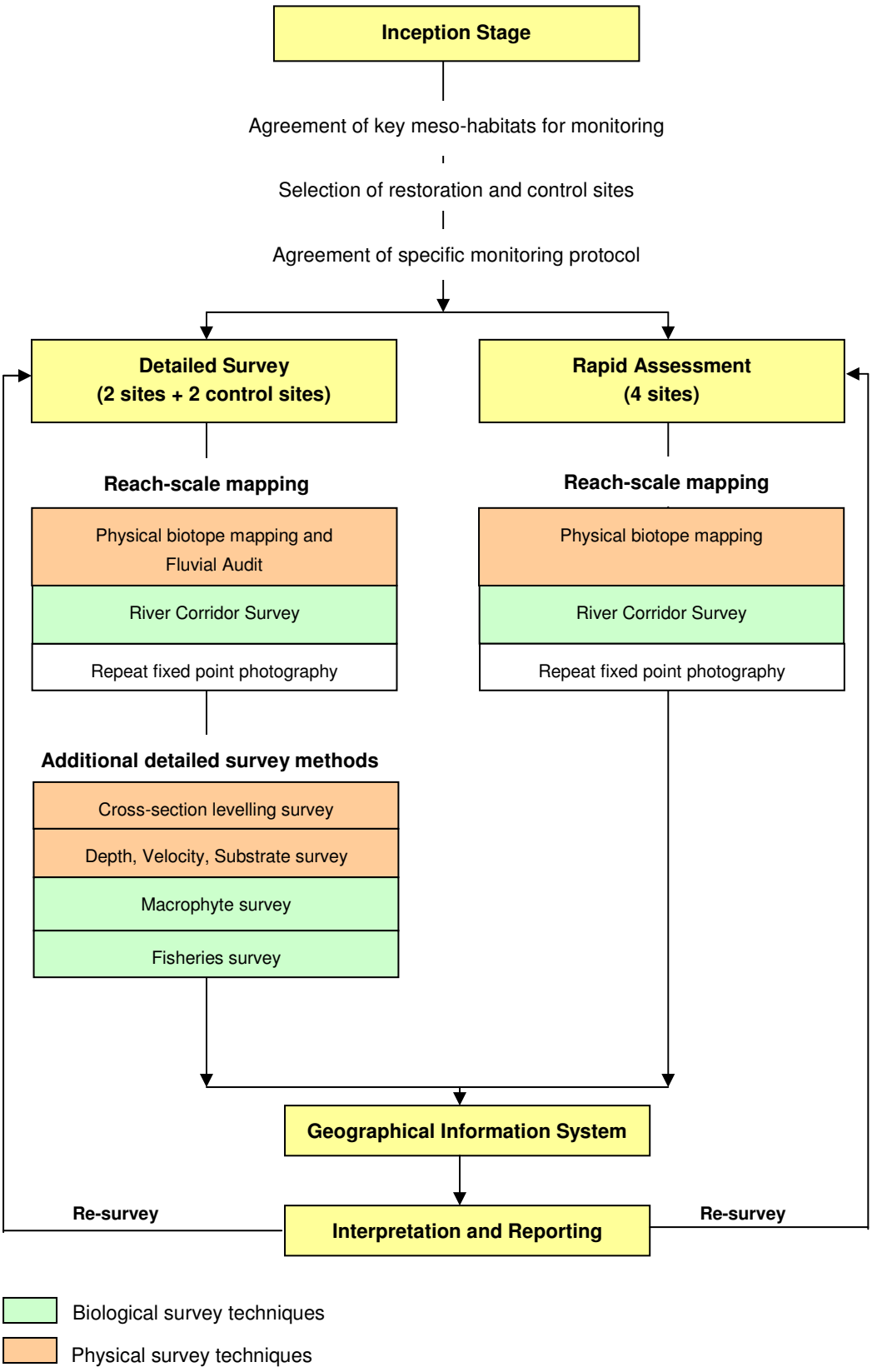
2.1 Monitoring Protocol

The methods used in gathering the physical and biological survey data presented in this report are based on those agreed with Natural England in developing the River Avon STREAM Monitoring Project – Monitoring Protocol (Royal Haskoning, 2006). The monitoring protocol describes how the monitoring sites were selected and the monitoring framework (**Figure 2.1**) together with the rationale underlying the project and should be read in conjunction with this report.

The following statements define the purpose and limitations of the monitoring framework.

- The pre-restoration survey will establish a record of biological and physical conditions at the site prior to restoration.
- The post-restoration survey will record modifications to the channel after restoration.
- The surveys will both provide snapshots pre- and post-restoration. It is important to recognise that there is a limitation to the comparisons that can be made over this short duration and it will not be possible to draw any conclusions regarding changes in conditions at a site pre / post-restoration.
- The relationship between physical and biological conditions will be analysed at each site. Comparisons will be drawn concerning the relationships identified at each site at the time of survey, taking into account other factors and processes that may influence relationships.
- The limitations of the control sites will prevent direct comparison of the restoration reaches with the control sites. The purpose of using the control site is to compare the relationship between physical and biological conditions recorded at both sites on a given day rather than to compare the magnitude of change of either physical or biological parameters between sites. Comparisons will therefore be made between pre-restoration and post-restoration surveys at each individual site. Inference may be drawn about changes in each parameter and in the relationship between physical and biological character.
- This monitoring framework will establish a documented baseline in order that repeat surveys of both physical and biological conditions can be made over longer time periods.

Figure 2.1 **Monitoring framework for the Avon STREAM Monitoring Project**



2.2 Realisation of the Monitoring Protocol

2.2.1 Reach-scale mapping

Reach-scale mapping of all sites was undertaking according to the monitoring protocol using Fluvial Audit, Physical Biotope Mapping, River Corridor Survey and repeat photography. Fluvial Audit sheets, Physical Biotope maps and River Corridor Survey maps have been prepared for each site and are presented in **Appendix A**. Definitions of the physical biotopes that were used during Physical Biotope Mapping are provided in Table 2.1. These definitions are consistent with those used during River Habitat Survey (RHS).

Table 2.1 Physical biotope definitions

Physical Biotope	Definition
Rapid	Boulder/cobble substrate with stepped profile. Associated with 'white water' from broken standing waves
Riffle	Shallow, fast flowing, discrete section of up to 5 channel widths in length. Unconsolidated gravel substrate with 'bubbling' unbroken standing waves.
Run	Shallow, fast flowing section, similar in character to a riffle but not a discrete feature.
Boil	Associated with upwelling flow, typically found on the outside of tight meander bends, behind structures, d/s of waterfalls
Glide	Section of smooth or rippled flow, deeper flow than a run.
Pool	Sections of deeper flow of up to 3 channel widths in length that are sustained by scour. Typically located on the outside of meander bends, downstream from bedrock outcrops (plunge pools) and weirs. Does not include impounded sections.
Ponded reach	Sections of no perceptible flow where water is impounded upstream of natural bedrock controls and weirs.
Marginal deadwater	Margins of the main channel where there is no perceptible flow.

For definitions of other terms used in the Fluvial Audit and River Corridor Survey please refer to the relevant reference sheets within **Appendix A**.

Photographic survey records are contained within **Appendix B.**

No additional detailed survey techniques were undertaken in 2007.

3 RAPID ASSESSMENT RESULTS

3.1 Hale

Upstream limit: 416352 117930
Downstream limit: 417703 118644
Length of site: 1940m

Location:
This site is located on the River Avon near Hale and Breamore. The upstream boundary of the site is located at the bridge between Church Copse and the adjacent water meadows. The downstream boundary of the site is near St Michael's Priory just upstream of the weir and near the Mill pond (Figures 3.1a, 3.1b and 3.1c)

Typical photographs:

Photo HAR01-e:
Looking downstream along the glide with broadleaved woodland along the left hand bank.

Photo HAR02-f:
Looking upstream along the glide from the downstream boundary.

3.1.1 Physical Characteristics

Physical biotopes

The main physical biotope present is glide, with a deeper and faster flowing section towards the downstream limit. Within this, on the outside of the start of the last meander bend of the section, a deep pool was observed (Figure 3.1c).

Sediment regime

The river has a low gradient[1], meandering planform and uniform flow velocities. Previous channel modification through dredging has made the channel over-wide and over-deep, which is associated with slow, uniform flow and a lack of hydrological transition zone at the channel margin. The dominant bed material is fine gravel but there are areas where silt, sand and coarse gravel are present. The bank material is predominantly cohesive and consists of silts and sand.

For the purposes of Fluvial Audit the site was divided into two reaches (HAR01 and HAR02). The downstream reach (HAR02) exhibits deeper and faster flows in comparison with the upper reach (HAR01).The channel is also embanked towards the downstream limit.

Localised sourcing of fine sediment to the channel is occurring throughout the study reach from field ditches, poaching due to livestock and fishing access. Natural bank erosion in the form of eroding cliffs on the outside of meander bends is also sourcing fine sediment to the channel. On the inside of the penultimate meander a vegetated berm was identified.

The predominant morphological processes are bank erosion associated with lateral adjustment of planform and localised deposition of silt. There was no evidence of unstable banks or erosion associated to potentially destabilising phenomenon.

3.1.2 Biological characteristics

In-channel vegetation occurs intermittently along the channel and includes water-crowfoot (*Ranunculus penicillatus*) and horned pondweed (*Zannichellia palustris).*

At the upstream end of the site, the left hand bank is wooded and dominated by sycamore (*Acer pseudoplatanus*) and ash (*Fraxinus excelsior*), with occasional willow (*Salix sp.)* and English oak (*Quercus robur*). The right hand bank is predominantly reeds and the dominant species are reed sweet grass (*Glyceria maxima*) and common reed (*Phragmites australis*). Also present are various herbs, grasses and emergent dicots including water forget-me-not (*Myosotis scorpioides*), amphibious bistort (*Persicaria maculosa*) and meadowsweet (*Filipendula ulmaria*). There are also occasional willow trees (*Salix sp.*), hawthorn (*Crataegus.monogyna*) and areas of bramble (*Rubus fruticosus* agg.).

Further downstream the vegetation is similar in nature on both banks. The dominant species are reed sweet grass (*Glyceria maxima*), branched bur-reed (*Sparganium emersum*) and common nettle (*Urtica dioica*) and other species present include fool's

[1] As defined under the Fluvial Audit methodology – "Looking back over the reach there is no obvious flow or slope"

water cress (*Apium nodiflorum*), common club-rush (*Schoenoplectus lacustris*), yellow water-lily (*Nuphar lutea*) and occasional alders (*Alnus glutinosa).*

The riparian buffer zone is continuous but narrow on the left hand bank and land use varies between tall ruderal plants, broadleaved woodland, and semi improved grassland. Along the right hand bank the dominant landuse is semi improved grassland which supports sheep and cattle grazing. The riparian zone is consequently limited and in places non-existent. The ditch system within the fields on the right hand bank contains common reed (*Phragmites australis*) and reed sweet grass (*Glyceria maxima).*

3.1.3 Summary of physical and biological relationships

- The cross-sectional profile of the channel is over sized due to past dredging, resulting in deep, slow and uniform flow conditions.
- The depth of the channel and the lack of a hydrological transition zone at the channel margins, between the channel and the banks, is restricting the coverage of emergent and in-channel vegetation.
- LIvestock poaching and depositional features (vegetated berm) are providing diversity in habitat through changing the profile of channel margin and water depths in places and are associated with establishment of marginal vegetation species.
- Landuse practices are limiting the width of the riparian zone and allowing livestock access to the channel increasing fine sediment supply.
- The fluvial bank erosion observed is localised and reflects lateral planform change through meander development.

3.2 Dockens Water

Upstream limit: 415142 108146
Downstream limit: 415513 108293
Length of site: 433m

Location:
The site is located to the south west of Ellingham Harbridge and Ibsley and runs parallel to Ellingham Drove. The upstream boundary of the site is the bridge between the sand and gravel pit and the water treatment works. The downstream boundary of the site is where the track meets Ellingham Drove (Figure 3.2)

Typical photographs:

Photo DOR01-n:
Looking downstream with vegetated bar in the foreground.

Photo DOR01-i:
Looking downstream with a point bar on the inside of the meander.

3.2.1 Physical Characteristics

Physical biotopes
The channel is morphologically diverse and characterised by a number of different physical biotopes; glides, riffles, runs and pools were observed in sequence throughout the reach (Figure 3.2).

Sediment regime
The dominant bed materials at the site are fine gravel and sand. The bank material varies but is predominantly earth comprising silt and sand which is subject to fluvial scour in places. Flow velocities are locally variable influenced by the irregularly meandering planfrom, though the average reach gradient is low.

Evidence of erosion was found at the upstream limit with both scour and bank erosion occurring on the left hand bank. A number of depositional features were observed throughout the study reach, including point bars and side bars composed of gravels and silts. The majority of the depositional features were unvegetated, indicating temporary storage and potential for transport downstream in periods of increased flow. However some bars have vegetated forming more permanent and semi-permanent features. Tree roots and fallen trees are also creating temporary silt bars upstream in places.

The planform of the river and confined nature of the channel suggests that the river has been historically realigned. At the upstream end of the site there is evidence of dredging, which appears to have been used to embank the channel at several locations throughout the study reach. The embankments are currently limiting the interaction of the river with the floodplain thus limiting potential for sediment transfer to the floodplain. A fallen bridge near the downstream limit is acting as a local grade control limiting channel bed adjustment at and upstream of this location.

The dominant sediment processes at the site are the transport and localised deposition of sediment occurring as a result of varied flow velocities throughout the reach. Previous modification is limiting the transfer of sediment to the floodplain in high flow conditions.

3.2.2 Biological characteristics

The site is heavily wooded on both banks with broadleaved trees creating a continuous riparian buffer. In channel vegetation is sparse and dominated by a few mosses and liverworts and there is no emergent vegetation present. This is likely to be due to overshading and the shallow flow conditions in the channel.

Land use on both the right and left hand banks is broadleaved woodland. The dominant species are pendunculate oak (*Quercus robur*), common beech (*Fagus sylvatica*), sycamore (*Acer pseudoplatanus*) and ash (*Fraxinus excelsior*) many of which overhang and shade the channel. Beneath the woodland, the ground is predominantly bare with some leaf litter.

The riparian buffer zone is a continuous but narrow strip on both the left and right banks and is dominated by the common nettle (*Urtica dioica*). Himalayan balsam (*Impatiens glandulifera*), an invasive non-native species is present on both banks although Hampshire and Isle of Wight Wildlife Trust volunteers are currently removing it from the riparian zone.

3.2.3 Physical and biological relationships

- The channel is morphologically diverse displaying both erosional and depositional l features.
- The channel is disconnected from the floodplain due to previous channel modifications, including dredging and embankment.
- There is little in-channel or riparian vegetation likely to be due to overshading of the channel by woodland. Shallow water depths are also likely to be limiting emergent vegetation.
- Himalayan balsam is currently present at a level that can be controlled but requires continual monitoring and control to ensure that this species does not establish further and spread at this site.

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Appendix A: Reach-Scale Mapping

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Appendix B: Photographic Records