SEPA
Scottish Environment Protection Agency

Working together

To improve our water environment

Glazert Water

Potential options for river restoration and natural flood management in the Glazert catchment
Draft summary report

Report produced by:

Further information about this management plan can be obtained from:

SEPA
Balloch Office
Carrochan
Carrochan Road
Balloch
G83 8EG
Email: ClydeAAG@sepa.org.uk
Telephone: 01389 727770

1.0 Introduction

Our changing climate and recent wet weather highlights the importance of understanding and improving the way river catchments are managed. To help inform this, the Scottish Environment Protection Agency (SEPA) is running pilot projects in four catchment areas across Scotland. The pilot project is seeking to:

- improve the physical condition of Scotland's water environment;
- demonstrate options for the coordinated delivery of river basin planning and flood risk management objectives;
- develop a catchment approach for both river basin management and flood risk management.

The project is delivered in four phases.

Table 1.1 Project phases

Project Phase	Summary
Pre-work	Catchment Selection
Phase 1	Scoping opportunities for measures delivery
Phase 2	Detailed design of measures and preparation for Phase 3
Phase 3	Implementation of measures

This report seeks to summarise the approach, findings and recommendations of Phase 1 of the project.

1.1 The Glazert Water

The Glazert Water rises in the Campsie Fells and drains a catchment area of over 53km². The bulk of the upper catchment is rural in its nature, but the river runs through two main settlements, Lennoxtown and Milton of Campsie before joining the River Kelvin at Kirkintilloch. Approximately half of the Glazert Water catchment is located within a potentially vulnerable area (PVA). From a river basin planning perspective, the Glazert Water is currently classified at bad ecological potential and has point source pollution pressures and multiple morphological pressures, the most significant of which are embankments (with and without reinforcement), high impact channel realignment, low impact channel realignment and set back embankments / floodwalls.

The morphology of the river system refers to the relationship between forms (or the shape of the channel) and the processes that form them. The most significant morphological changes are channel realignment (straightening) and flood embankments or flood walls. These changes to the river, together with changing land use and development on the floodplain have increased the vulnerability of communities to flooding.

The Glazert Water has been selected as a pilot catchment because:

- there are numerous morphological pressures e.g. embankments, realignment, instream structures;
- exacerbated flooding and identified flood risk areas (PVAs) are present along its length;
- it is a small semi-urbanised catchment that has the beginnings of a morphological restoration plan part way developed, but not implemented;
- it was identified as having potential opportunities to combine in-river habitat improvements with wider scale river and floodplain restoration works by the Clyde pilot study which investigated the delivery of multiple benefits through river basin planning;
- a steering group including East Dunbartonshire Council, Central Scotland Green Network support unit, Glasgow and Clyde Valley Green Network Partnership, and Clyde River Foundation already exists.

1.2 Aims and objectives

The aim of this project is to develop a range of sustainable land and river management strategies that will significantly improve morphological status and reduce flood risk.

It will be important to take into account the way that the land and channels have been managed in the past as well as the current and future needs of land managers and river users. Any proposed options will also need to be designed to tackle the source(s) of problems rather than the impact.

Key objectives are to:

- investigate the current situation and understand the physical nature of the Glazert catchment;
- explore the relationship between land use, flood risk management and morphology;
- identify the pressures within the catchment, particularly those causing low morphological quality and increased flood risk:
- propose a prioritised range of options that could be put in place by land and river managers;
- use a multi-critera analysis to develop a short list of management options to show how morphological restoration and natural flood management can work together to achieve multiple benefits e.g. access and biodiversity benefits;
- make recommendations for Phase 2, during which land managers will be invited to become actively involved in the implementation of measures.

1.3 Methodology

SEPA commissioned EnviroCentre to undertake this first phase of the project and the approach the project team took is outlined in Table 1.2. Throughout the process the project team have engaged and consulted with a range of stakeholders including SEPA, East Dunbartonshire Council, Forestry Commission, Scottish Natural Heritage and Campsie Angling Association. Partnership with these stakeholders has ensured that this first phase of the project reflects what is realistic and achievable. Continued engagement will also be required throughout future phases.

Table 1.2 Methodology

Phase	Tasks
Characterisation	Desktop research - a number of environmental maps and databases were compiled and analysed to provide a comprehensive understanding of the dynamics of the Glazert catchment. Sources of information included flood records, flood mapping, river engineering databases and land use maps.
	Catchment walkover - The entire length of the Glazert was walked, together with important tributaries and features e.g. floodplain areas, reservoirs, wetlands, culverts.
	Interpret dynamics of the catchment, particularly in terms of relationships between land use, hydrology and morphology.
	Divide catchment into sub-catchments with distinct issues, opportunities and constraints
	Divide main river into reaches with distinct issues, opportunities and constraints
Identify pressures	GIS-based analysis to map survey findings together with existing data e.g. SEPA morphological pressures database, Indicative flood map and Council flood records
Identify potential management measures	Range of restoration and management activities at various spatial scales, nested within the catchment
Target opportunities	GIS-based analysis to prioritise and target critical areas for management actions, e.g.: • Highlight areas of high runoff generation potential and important areas of floodplain or bottlenecks in the system. • Highlight morphological pressures which exert significant control on morphological capacity classification. • Determine potential synergies between natural flood management and morphological opportunities.
Exclude constraints	Discount unrealistic options on the basis of e.g. conflicting land use, potential negative impacts on flood risk
Produce initial options list	Development of potential options and consultation with the Steering Group
Multi-criteria analysis (MCA)	Iterative process to establish template for MCA which prioritises options which may offer multiple benefits in a proportionate manner, with particular focus on flood risk and morphology
Produce short-list of options	Rank options and highlight options considered to provide optimum benefit
Make recommendations for next phase of work	Outline requirements for further assessment at next phase
	Stakeholder engagement
	Implementation

2.0 Catchment description

The project team used desktop analysis, targeted site visits, analysis and discussions with stakeholders to create an overview of the Glazert Water catchment. This process was critical to understanding key environmental characteristics and land use pressures within the catchment.

The catchment has a rich agricultural and industrial history and over time land use has changed for a variety of reasons including construction of factories and houses. Physical changes have been made to the Glazert Water to supply water to industrial processes and protect properties from flooding.

2.1 Hydrology and flood risk

Hydrology is a science which explores the properties of the earth's water, particularly its movement in relation to land. The hydrological character of the Glazert catchment is dictated by a range of factors including local climate, topography and geology.

The team have found little evidence of historic flood events in the Glazert catchment prior to recent decades, but the presence of embankments suggest flooding must have been a key driver for the many modifications seen today including the two formal flood prevention schemes within the catchment at Lennoxtown and Glazertbank.

There are two river gauging stations on the Glazert Water and the information from these has been used to gain a better understanding of the hydrology of the catchment.

Studying this data, together with land use and the rainfall characteristics of the catchment, helped the team to understand the causes of flooding and the likelihood of risk, could then be considered options for reducing flood risk in the future.

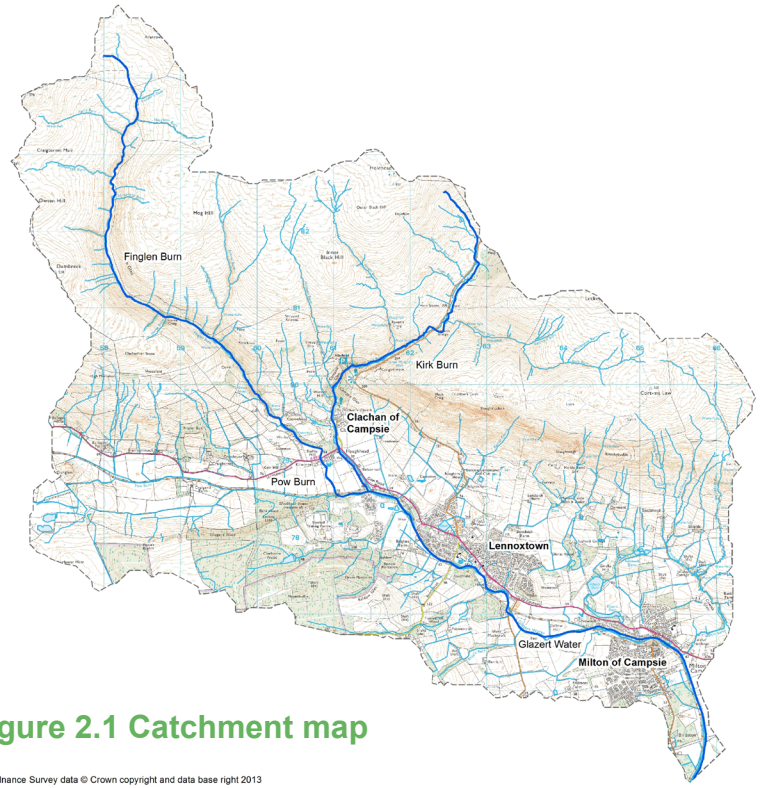

Figure 2.1 Catchment map

In the Glazert catchment, most flooding appears to be associated with small, highly modified burns around urbanised areas. There are relatively few records of flooding from the main river, suggesting that the embankments have been performing relatively well in recent decades.

However, in many instances the embankments are not being maintained, and with climate change expected to increase flooding in future decades, communities are likely to become more vulnerable.

To protect future communities there is a need to reduce our reliance on embankments and promote more sustainable and natural means of flood management.

2.2 Morphology

The bad morphological status of the Glazert Water is a result of extensive embankments, including the former railway embankment, and historic realignment and re-shaping of the channel. These human modifications separate the channel from its floodplain and can result in sediment and water being transported more quickly.

The uniformity and static nature of the river has a negative impact on river habitats and the ability of the river to adjust naturally to any future changes in flow or sediment load.

Engineered bank protection and in-channel structures such as weirs or bridge piers also affect the natural shape of the channel and the natural movement of sediment and water through the system.

In order to plan for the future, the team has worked to understand the current morphology of the catchment as well as how changes over time are affecting the Glazert Water and the wider area.

2.3 Pressures

The sources of morphological problems and flood risk were identified to allow the project team to target management options, which will relieve these pressures in a sustainable way. Table 2.1 shows an overview of key pressures using photographs taken during the catchment walkover.

Table 2.1 Pressures

Flood Risk Pressures		Morphological Pressures	
Grazing and deforestation			Habitat loss and morphological implications associated with engineered bank protection
Artificial drainage of wetlands			Artificial bed substrates
Floodplains disconnected by embankments			Embankments and setback embankments
Floodplain functionality reduced by drainage and loss of 'roughness' e.g. woodland and wetland			High impact realignment , often associated with straightening, regrading, re-profiling , bank protection / embankments.
Floodplain connectivity reduced by channel modifications e.g. straightened and incised channel			Hydraulic, sedimentary and habitat continuity affected by weirs and other impoundments
Localised flood risk associated with hydraulic constrictions e.g. culverts and bridges			Morphological impacts of redundant / unsuitable structures, e.g. localised scouring and deposition.
Development on functional floodplain			Loss of riparian tree cover, exposing banks to increased erosion

3.0 Identification of potential opportunities

3.1 Options appraisal

In order to implement successful changes in the future it is important to identify the root cause of problems, rather than the symptoms. Our approach for reducing the impact of pressures includes changing the management of land and rivers to work with, rather than against, natural process wherever possible and removing structures that are no longer needed.

The team identified and considered the root of the problems to develop a list of options which could deliver morphological improvements and reduced flood risk.

This process was about identifying all the potential ways of achieving the aims of the project, further work with landowners and project partners will be needed before these opportunities become work on the ground.

3.2 Long list

The options appraisal resulted in a long list of opportunities, that have been divided into two categories landscape scale and site specific. In some cases a combination of options will be required to deliver change. In total 49 options have been included on the long list.

3.3 Multi-critera analysis

Multi-critera analysis is a process by which the long list of options can be prioritised in order to achieve maximise multiple benefits. This process meant the longlist was assessed on a number of factors including the key project drivers of morphological improvement and natural flood management, as well as a range of wider benefits including potential for wider habitat improvements and opportunities for recreational and access benefits.

The multi-criteria analysis process enabled the team to score each option and identify a top ten options.

3.4 Top ten

The top ten identified by the team is a list of priortised sites that will deliver the most benefit for the catchment, however, this is just a first step and more investigation work will need happen in the next phase.

Appendix A uses a map and table to provide summary details of the short list.

4.0 Next steps

Moving forward with the project it is important to understand if it possible to turn the identified opportunities into on the ground reality. To do this SEPA will be engaging with stakeholders and landowners and this process will help shape the future direction of the project.

4.1 Stakeholder engagement

Working in partnership with stakeholders, including landowners and land managers, will be critical to the success of the project. This engagement will provide local knowledge and perspective which will give an idea of how the proposed land and management options would impact on the ground. Future engagement is likely to include:

- continued working with the established Steering Group;
- an engagement programme of workshops; one-to-ones and discussion sessions to determine attitudes and willingness; and to ask for opinions on options and any other ideas;
- communication with land managers focusing on the tangible benefits (e.g. improved drainage behind embankments or shelterbelt planting) as well as secondary benefits (e.g. improved aesthetic or habitat value);
- developing a system to encourage; collect and review feedback from the engagement;
- building on previous engagement and communication; landowners and other stakeholders will be regularly contacted and updated throughout the duration of the process to ensure sustained interest.

4.2 Developing the restoration project

Once landowners and stakeholders have indicated their support or interest in taking forward a restoration option, the next step is to undertake a detailed study- scoping and modelling to ensure that what is proposed is appropriate and will not have a negative impact on the land / landowner. Restoration and re-engineering rivers can be complex and it is important that the right checks have been undertaken before progressing.

To ensure that options are achievable and realistic consideration will be given to a range of factors including land take and costs, with a cost-benefit analysis undertaken as a means of comparing options against each other.

The delivery and implementation of these measures will require the commitment of individual landowners and land managers. To enable this, a support framework will be established to encourage collaboration between landowners, land managers, the community and agencies to take recommendations forward.

The successful outcome of this process will be the implementation of measures that will be integrated with the day to day needs of land managers and communities.

5.0 Measuring success

This work is driven by the European Water Framework Directive (WFD) and Floods Directive and the associated domestic legislation (Water Environment and Water Services (Scotland) Act 2003 and Flood Risk Management (Scotland) Act 2009.

In terms of the statutory requirements associated with the project, it will be considered to be a success if it delivers measures on the ground that will help to meet Water Framework Directive and flood risk management targets, through improved morphology and reduced flood risk.

However, the project aims to deliver multiple benefits and this is only possible with a continued partnership between land managers, communities and responsible authorities. It is hoped that this will encourage the implementation of sustainable management systems that will support farming practices, maintain the value of the land and safeguard people and their properties.

6.0 Getting involved

The future design, delivery and implementation phases of this project depend on partnership working between SEPA, stakeholders, land owners and land managers living and working across the catchment and the wider community.

If you would like to find out more information or get involved in future phases of the project please contact us by:

Email: ClydeAAG@sepa.org.uk
Telephone: 01389 727770

Appendix A. Short List of Options

Appendix A.

Table 1. Top Ten

For site locations please refer to the map provided overleaf.

Site ID	Morphology opportunities	Natural flood management opportunities	Focus
FIN02_S04 Finglen / Kirk confluence	Riparian planting (Right Hand Bank) Remove bank reinforcement (Right Hand Bank) Remove set-back embankment (Left Hand Bank Remove embankment (Right Hand Bank	Reconnect floodplain (Left Hand Bank) Leaky barrier planting Drainage management	Combined
LAND_NW_01 Upper catchment	N/A	Native woodland planting	Natural Flood Management
LAND_WE_01 Upper catchment	N/A	Wetland restoration / creation	Natural Flood Management
GLZ02_S01 Lennoxtown	Remove bank reinforcement (both banks) Remove embankment (Right Hand Bank) Address high impact realignment	Reconnect floodplain (Right Hand Bank) Leaky barrier planting Drainage management	Combined
GLZ01_S01 Lennox Castle	Remove embankments and set-back embankment (both banks) (note this does not include the flood preventions works on Right Hand Bank) Address low impact realignment	Reconnect floodplain (Left Hand Bank and Right Hand Bank) Leaky barrier planting Drainage management	Combined
GLZ03_S01 Between Lennoxtown and Milton of Campsie	Riparian planting (Right Hand Bank) Remove bank reinforcement (both banks) Remove embankments (both banks) and set-back embankments (Left Hand Bank) Address low impact realignment	Reconnect floodplain (Left Hand Bank and Right Hand Bank) Leaky barrier planting Drainage management	Combined
GLZ05_S02 Adjacent to Birdston Community Woodland	Riparian planting (Left Hand Bank) Remove embankments (both banks) Address high impact realignment	Reconnect floodplain (Left Hand Bank and Right Hand Bank) Leaky barrier planting Drainage management	Combined
GLZ05_S03 Downstream of Birdston Farm	Remove bank reinforcement (Right Hand Bank) Remove embankments (both banks) Address high impact realignment Remove set-back embankment	Reconnect floodplain (Left Hand Bank and Right Hand Bank) Leaky barrier planting Drainage management	Combined
GLZ05_S01 Downstream of Milton of Campsie	Remove embankment (Right Hand Bank) Address high impact realignment	Reconnect floodplain (Right Hand Bank) Leaky barrier planting Drainage management	Combined
POW01_S01 Pow Burn	Remove embankment (Left Hand Bank) Address realignment	Reconnect floodplain (Left Hand Bank) Leaky barrier planting Drainage management	Combined

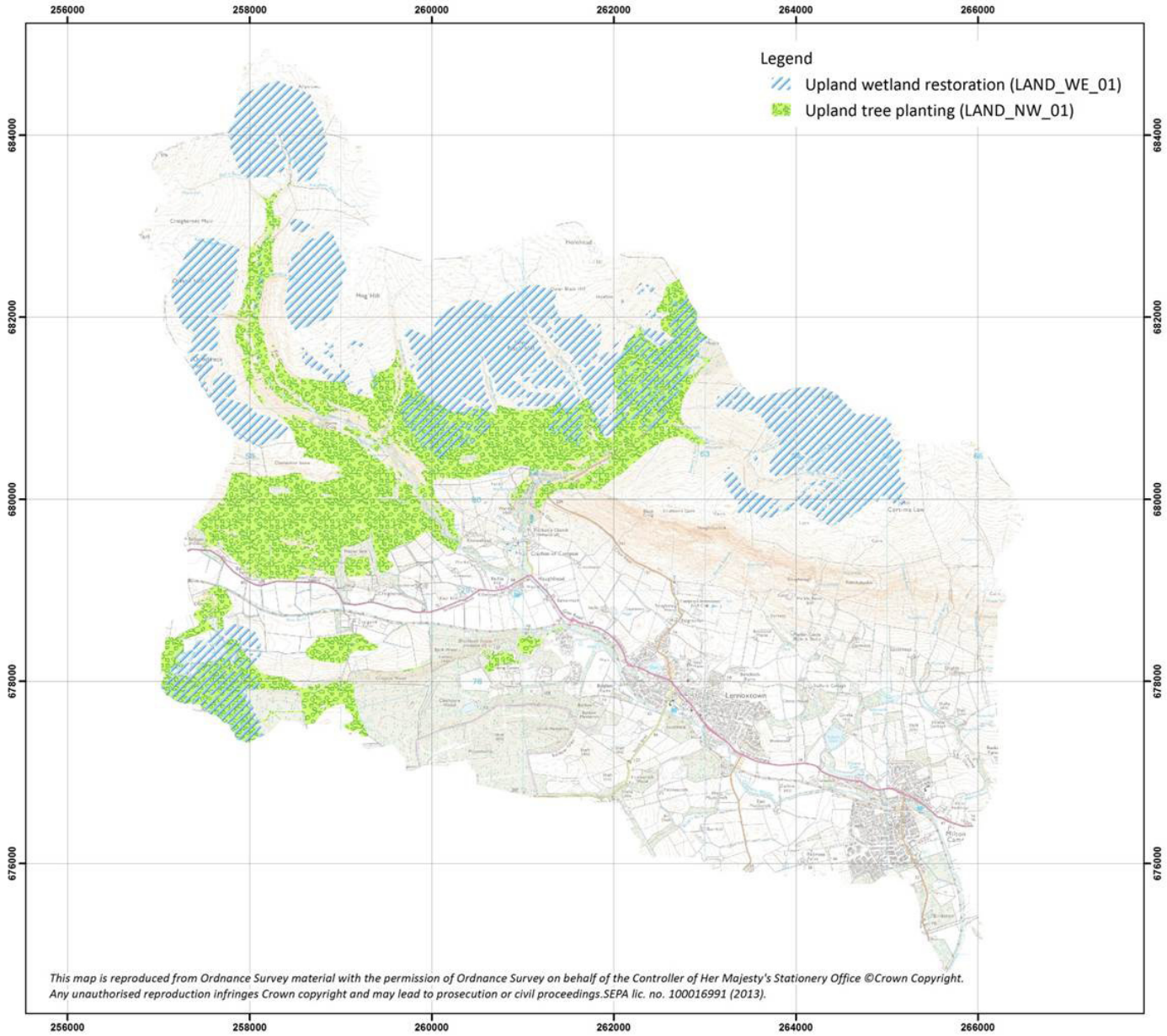

Figure 1.

Landscape Level Natural FloodManagment Options

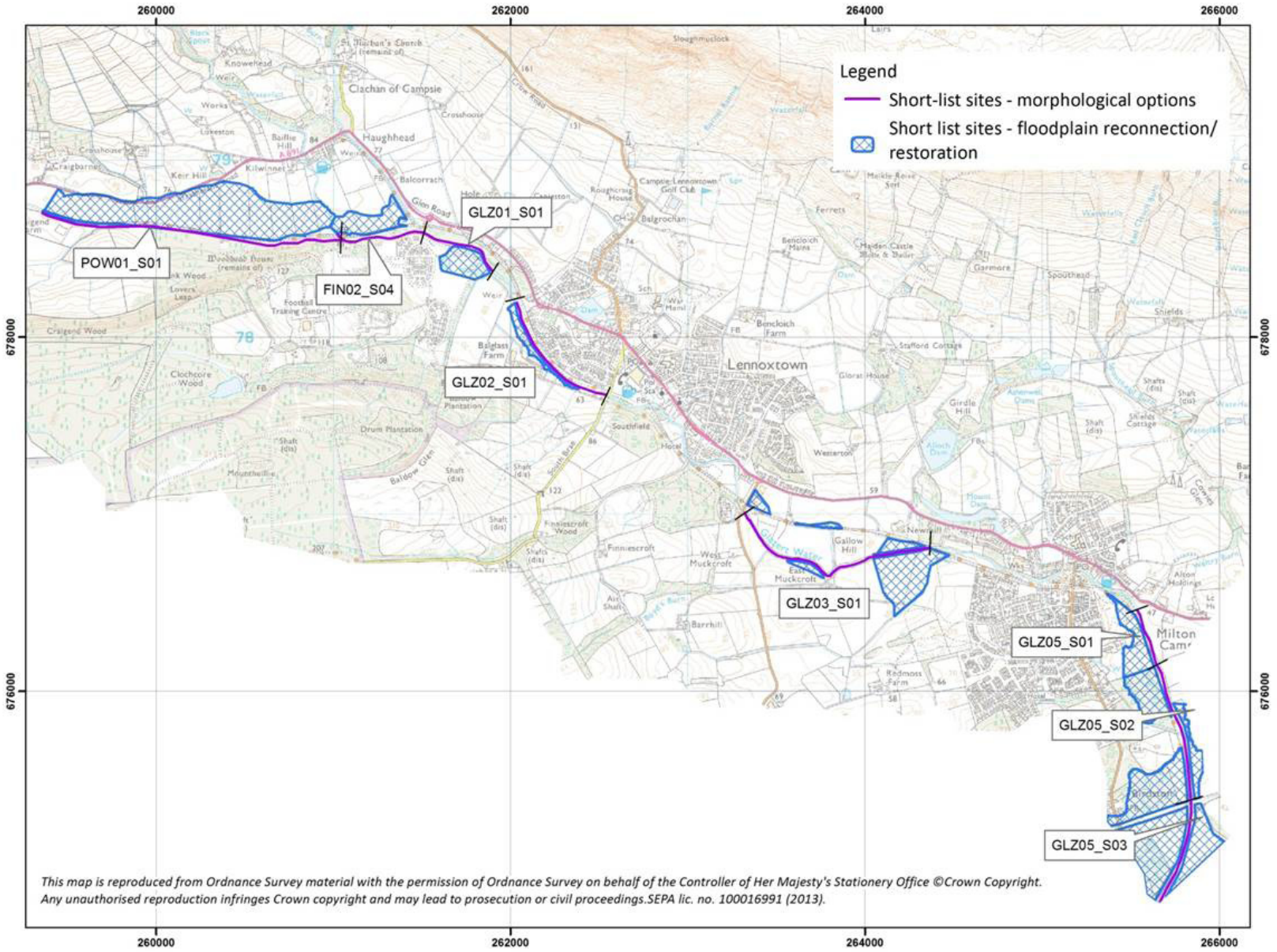

Figure 2.
Site Specific Options