

# Nant y Wedal Outline Design Report

## Draft Report

March 2025

Prepared for:  
Natural Resources Wales

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# Contract

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This report describes work commissioned by Natural Resources Wales, The Client's representative for the contract was Paul Isaac Client's Project Manager) of Natural Resources Wales. Siobhan Hansford and Rachel Rowlinson of JBA Consulting carried out this work.

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## Abbreviations

JBA	Jeremy Benn Associates
NGR	National Grid Reference
NRW	Natural Resources Wales
UXB	Unexploded bomb
UXO	Unexploded Ordnance



# Executive Summary

Natural Resources Wales (NRW) commissioned JBA Consulting in 2024 to undertake outline designs for river restoration proposals at:

- Nant y Wedal in Heath Park (Cardiff)
- Nant Glandulas in Peppermint Park (Cardiff)
- River Dare (west of Aberdare)
- Roath Brook (Cardiff)

This overall project ambition was to: contribute towards improved Water Framework Directive (WFD) status, but restoring and mitigating for physical modifications, improving in channel and riparian habitats through restoring natural hydromorphological processes by removing and mitigating physical modifications on the above watercourses in south central Wales.

Ultimately, the river restoration schemes will look to address physical modifications by removing hard engineering, where possible, and using nature-based solutions to replicate and reinstate natural channel dynamics and increase habitat diversity. The restoration will improve the resilience of habitats and increase biodiversity, as well as build and contribute to wider environmental resilience.

A key objective of this work that it benefits local communities and working with communities has been an important aspect of the project, to help transform the areas into more pleasant areas for improved amenity and wellbeing benefits.

This report outlines the methodology and outcomes of the Nant y Wedal outline design study. The study involved an appraisal of restoration options identified by Arup at an earlier feasibility stage, including an assessment of key benefits and site constraints. JBA Consulting worked in partnership with NRW to present the restoration options to the public via an online Citizen Space survey and a public consultation event, held in December 2024. The feedback gained from the public consultation was used to help refine the restoration options and develop an outline design for the restoration of the Nant y Wedal in Heath Park, Cardiff.

This report outlines the methodology and outcomes of the Nant y Wedal outline design study. The study involved an appraisal of restoration options identified by Arup at an earlier feasibility stage, including an assessment of key benefits and site constraints. JBA Consulting worked in partnership with NRW to present the restoration options to the public via an online Citizen Space survey and a public consultation event, held in December 2024. The feedback gained from the public consultation was used to help refine the restoration options and develop an outline design for the restoration of the Nant y Wedal in Heath Park, Cardiff.

The restoration options carried forward to outline design include:

- Channel shape restoration (two-stage channel)
- Channel re-meandering

- Riparian zone planting
- Natural woodland creation
- Removal of a twin culvert structure
- Woodland management
- Addition of in-channel woody material
- Set back or removal of surface water outflow
- Removal of a timber flume

Improvements to Heath Park carried forward to outline design include:

- Upgrade of two footbridges
- Formalisation of a riverside path with information boards and benches
- Upgrade of an existing footpath
- Installation of a boardwalk in the downstream woodland reach
- Installation of a culvert screen

## Introduction

### 1.1 Project summary

JBA Consulting was commissioned by Natural Resources Wales (NRW) in 2024 to undertake outline designs for river restoration proposals along the Nant y Wedal in Heath Park, Cardiff.

The aim of this study was to:

- complete any outstanding site investigations
- work in collaboration with Natural Resources Wales to undertake public consultation for all four sites
- develop an outline design for the restoration of the Nant y Wedal in Heath Park

### 1.2 Purpose of this report

This report outlines the methodology and outcomes of the Nant y Wedal outline design study. The key objectives of this report are to:

- provide an overview of baseline conditions of the Nant y Wedal at Heath Park
- summarise the outcomes of the options appraisal and public consultation
- explain the steps involved and decision process behind the Nant y Wedal outline design

### 1.3 Site location

The area of interest is a 420m-long reach of Nant y Wedal, a tributary of Roath Brook, which flows through Heath Park in Cardiff. The stream is culverted for much of its length but flows openly within the park. The study area is shown below in Figure 2-1.



Figure 2-1 Nant y Wedal project area

## 2 Desk-based assessment

### 2.1 Introduction

A desk-based assessment of the Nant y Wedal was completed by Arup in 2022 to support a feasibility assessment of restoration options identified by JBA in 2021. The key findings of the assessment are summarised below in Section 2.2.

### 2.2 Findings

The desk assessment concluded that:

- The Nant-y-Wedal has a gradient of approximately 1 in 100 through the site.
- The watercourse was straightened prior to historical mapping (~1900) and this will have increased the channel gradient.
- The channel is confined, with large, culverted sections and bank protection that influence the morphology.
- The watercourse is known to suffer from poor water quality related to upstream misconnections.
- The catchment area is estimated to be 1.67km<sup>2</sup>.

## 3 Site assessment

### 3.1 Introduction

A site assessment of the Nant y Wedal in Heath Park was undertaken by Geomorphologists Siobhan Hansford and Rebecca Thompson and Engineers Jon King and George Hellier on the 12 March 2024 to inform baseline conditions. The findings of the site assessment are summarised in a technical note shared with NRW in March 2024 (MKI-JBA-ZZ-ZZ-TN-EN-0002-S3-P01-Nant\_Y\_Wedal\_Technical\_Site\_Notes). The walkover allowed the identification of key pressures impacting upon the morphological character of the Nant y Wedal including physical modifications. The findings of the site assessment are summarised below.

### 3.2 Baseline conditions

- The upstream reach of the Nant y Wedal is incised and is poorly connected to the floodplain.
- The typical flow biotopes are riffles and glides.
- The typical bed substrate is gravel with some coarser cobble material, finer sand and silt.
- The bed is armoured in the upstream reach.
- Sediment is supplied to the channel from the riverbanks which are eroding in places.
- The upstream reach is lacking in morphological diversity, with little depositional features.
- In-channel woody material encourages sediment deposition in the downstream woodland reach.

### 3.3 Key pressures

- An extensive culvert network has resulted in poor sediment supply to the stream.
- The Nant y Wedal is artificially straight and lacks sinuosity. This has resulted in an artificially steep channel gradient and increased flow energy.
- Fine material has entered the channel in the downstream woodland reach, where the riverbanks are bare of vegetation due to a lack of management and heavy shading.
- Two footbridges cross the Nant y Wedal and are in poor condition.
- Poaching of the riverbanks and bank tops, by people and dogs, has resulted in bare soil in the vicinity of the footbridges which cross the channel.
- A concrete surface water outfall protrudes into the channel at NGR: ST 17569 79606.
- The channel is modified with a wooden flume at NGR: ST 17602 79573.
- A pipe culvert structure at NGR: ST 17641 79527 disrupts the longitudinal connectivity of flow and sediment downstream.

- The culvert inlet, at the downstream limit of the site, has no screen and this is a safety risk to the public.

# 4 Option development

## 4.1 Introduction

Following the site assessment, an appraisal of the restoration options identified by Arup in 2022 was undertaken. This chapter provides a summary of the outcome of the options appraisal.

## 4.2 Options appraisal

### 4.2.1 Key benefits

Table 4-1 provides a summary of the key benefits of the restoration options identified by Arup for the Nant y Wedal at Heath Park.

Table 4-1 Key benefits for each option

Option	Key benefits
Channel re-meandering	<p>Would restore natural meander bends and increase channel sinuosity, encouraging flow diversity and the establishment of in-channel features.</p> <p>The addition of point bars and riffles to the channel would create additional habitat for freshwater species.</p> <p>Could potentially slow the transportation of flow and pollutants downstream by increasing the length of the channel.</p>
Set back cherry trees	<p>Setting back cherry trees along the stream would provide more space for channel re-meandering and allow for habitat creation along the river corridor. The trees are of an age and condition that the transplanting is viable.</p>
Footbridge replacement	<p>Reduce erosion of the riverbanks and increase conveyance capacity beneath the footbridges.</p> <p>Re-naturalise the riverbanks.</p> <p>Maintain and improve access routes in the park.</p>
Riparian zone planting	<p>Would provide additional habitat features and connectivity for species.</p> <p>Riparian planting could improve species diversity and resilience on site, whilst providing improved bank stability, reducing soil erosion and fine sediment input into the river network and benefiting in-channel habitats and species.</p> <p>Marginal planting would act as a buffer to reduce urban run-off and other pollutants from entering the watercourse.</p> <p>Would help to limit the establishment of Himalayan Balsam along the re-meandered channel.</p>
Woodland management	<p>Tree canopy thinning and coppicing would encourage</p>

Option	Key benefits
	<p>riparian vegetation re-establishment and allow for additional planting or natural regeneration by allowing more light to reach the ground in the currently shaded locations.</p> <p>Riparian vegetation establishment would aid in reducing soil erosion and fine sediment input into the river network, benefitting in-channel habitats and species. The by-product material of woodland management could be retained on-site for the in-channel material and habitat creation within riparian areas.</p>
Addition of in-channel woody material	<p>Provides habitat and a food source for a variety of aquatic species.</p> <p>Diversifies flow and creates pockets of faster flow which could 'flush out' fine sediment, potentially restoring a clear gravel bed.</p> <p>Would encourage flow to spill into the floodplain at high flows; frequent wetting of the floodplain could result in wet woodland habitat further improving the diversity of habitat. This is a priority habitat.</p>
Removal of concrete surface water outfall	Removes hard engineering from the bank face, restoring a natural bank.
Removal or replacement of twin-culvert structure	Would improve the movement of flow downstream and reduce scour of the channel bed at high flows.
Remove timber flume and reprofile banks	<p>Would remove hard engineering from the watercourse.</p> <p>Would restore a natural channel width and shallow bank profile, improving connectivity between the channel and its floodplain.</p> <p>Would increase the ecological value of the watercourse by restoring marginal habitat.</p> <p>Would improve the visual amenity of the watercourse.</p>
Installation of a screen on the downstream culvert inlet	<p>The culvert opening is a hazard to the public. This could improve public safety.</p> <p>Would provide protection to the culvert system against blockage.</p>
Information boards and footpath upgrades	Could help to reconnect people to the local environment and encourage interaction with nature.

#### 4.2.2 Amendments to existing options

Following a review of the existing design, the restoration options were refined. Table 4-2 provides a summary of amendments made to Arup's 2022 restoration options.

Table 4-2 Amendments made to the Nant y Wedal restoration options

Option	Reason for amendment	Outcome
Channel re-	Arup's 2022 design avoids any	Proposed planform of

Option	Reason for amendment	Outcome
meandering	disturbance to existing vegetation. As such, the proposed planform is across the right bank floodplain and is relatively short in length. The left bank floodplain is at a lower elevation and is a more suitable location for the re-meandered channel.	the re-meandered channel changed and increased in length. Existing trees would need to be removed but they could be replaced by planting natural woodland (see Table 4-3). More cherry trees would need to be translocated.
Footbridge replacement	To avoid artificial structures along the re-meandered Nant y Wedal stream, the upstream footbridge could be removed instead of replaced. Removal would help to provide more space for the re-meandered channel and the establishment of riparian habitat.	Option changed to 'Footbridge removal or upgrade'. The downstream footbridge would be retained and upgraded to maintain an access route across the stream.
Removal of concrete surface water outfall	If removal is not possible setting back of the outfall would help to discharge flow into a vegetated area before entering the channel. This could help to filter pollutants and encourage deposition of fine material on the floodplain. This could improve water quality.	Option changed to 'Set back or removal of surface water outfall.'
Removal and replacement of twin-culvert structure	Arup's 2022 design suggests that the twin-culvert structure is replaced. Instead, JBA recommend that the structure is removed and the pathway is re-routed to the south of the culvert inlet. This would help to remove hard engineering from the channel and re-instate a natural riverbank and riverbed. This would help to add to the ecological value of the watercourse.	Option changed to 'Remove twin-culvert structure and upgrade footpath'.
Information boards and footpath upgrades	In addition to information boards and upgrading existing footpaths, a riverside path could be created with benches. This would help to reduce erosion of the ground and fine sediment input into the river network, benefiting in-channel habitats and aquatic species. This would also help to increase the	Option changed to 'Formalise a riverside path with information boards and benches'.

Option	Reason for amendment	Outcome
	amenity value of the area. This could reduce anti-social behaviour such as littering.	

#### 4.2.3 Additional options identified

Two additional restoration options were identified for the Nant y Wedal at Heath Park. They are summarised in Table 4-3 below.

Table 4-3 Additional restoration options identified by JBA

Option	Key benefits
Channel shape restoration (two-stage channel)	<p>Would help to create a more varied bank profile.</p> <p>Frequent wetting of the inset floodplain could allow marginal habitat to develop in the channel over time.</p> <p>Could reduce the impact of flood flows on the channel by encouraging water to dissipate across the inset floodplain.</p>
Natural Woodland Creation	<p>Mitigate tree loss from channel re-meandering.</p> <p>Facilitate natural regeneration and woodland succession for a more diverse woodland structure and improved habitat quality.</p> <p>Would help to increase biodiversity and provide additional habitat features for species, including refuge, nesting, and foraging opportunities.</p> <p>Habitat creation or enhancement has the potential to increase storage of flow in the catchment, and this could reduce surface water flood risk in urban areas.</p>

The woodland creation affords opportunity to plant species not currently found in the park or are only found in limited numbers as this would be within the riparian areas such species could include; Alder (*Alnus glutinosa*), Aspen (*Populus tremula*), Black Poplar (*Populus nigra*), Bird Cherry (*Prunus padus*), Dark-Leaved Willow (*Salix myrsinifolia*), Downy Birch (*Betula pubescens*), Eared Willow (*Salix aurita*), Grey Willow (*Salix cinerea*), Purple Willow (*Salix purpurea*), Silver birch (*Betula pendula*).

The use of species such as Black poplar could also be used to highlight the positives of planting species that have been in decline in Wales and much of the UK, due to the decline in the use of its timber or due to low genetic diversity in the gene stock. This is highly appropriate in an amenity park setting.

### 4.3 Outcome

Following the options appraisal, a concept restoration plan was developed for the Nant y Wedal site. The site was split into two reaches due to their distinct morphological character (features and processes) and pressures.

### 4.3.1 Upstream reach restoration options

The upstream reach is between NGR:ST 17384 79795 upstream and NGR: ST 17558 79622 downstream (Figure 4-1).

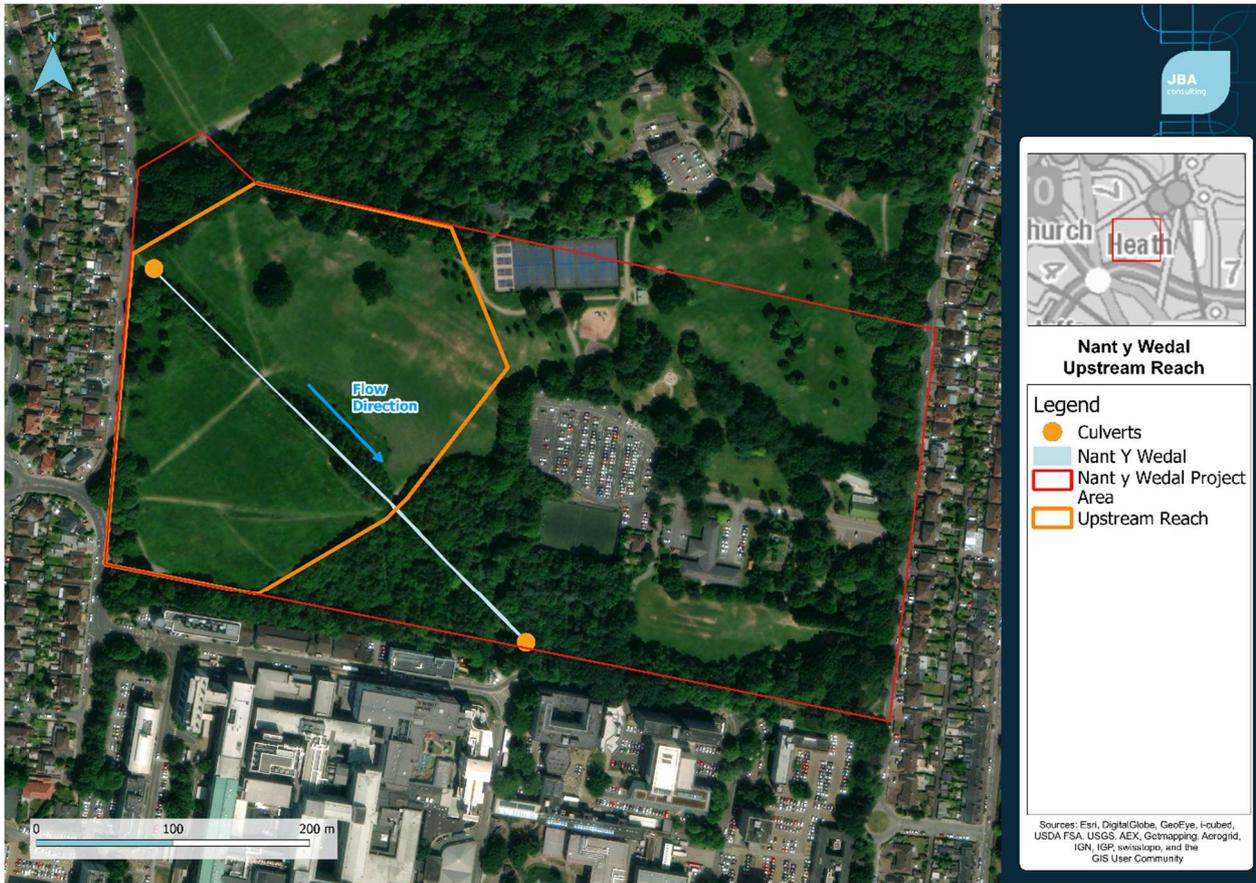


Figure 4-1 Nant y Wedal upstream reach

Here, the Nant y Wedal is incised and straight, with a lack of morphological diversity (Figure 4-2).



Figure 4-2 Upstream reach of the Nant y Wedal.  
Footbridge facing upstream. NGR: ST 17467 79714

Seven restoration options were identified for the upstream reach of the Nant y Wedal:

1. Channel re-meandering
2. Channel shape restoration (two-stage channel)
3. Footbridge removal or upgrade
4. Formalise a riverside path with information boards and benches
5. Riparian zone planting
6. Set back cherry trees
7. Natural woodland creation

The location of each opportunity is displayed in the concept restoration plan below (Figure 4-3).

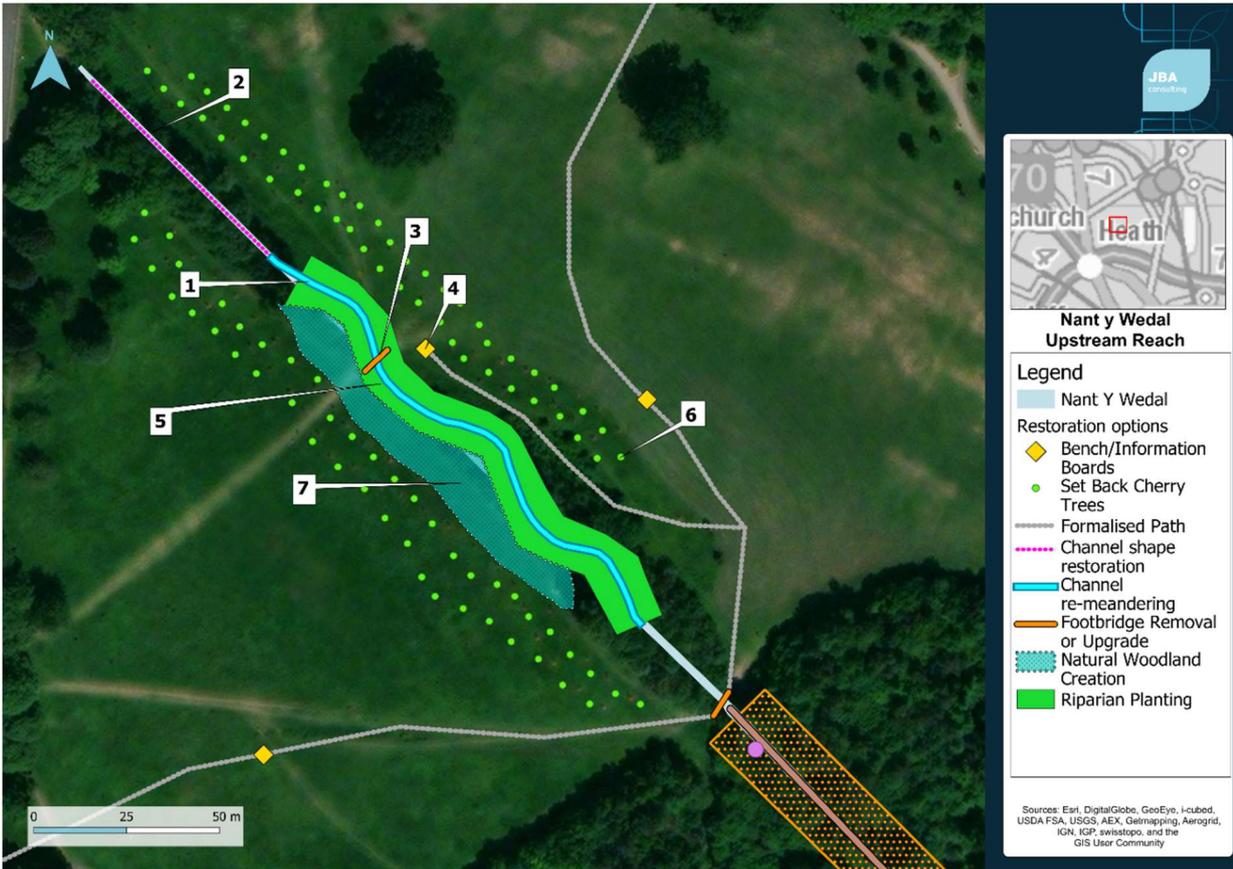


Figure 4-3 Upstream reach concept restoration plan

#### 4.3.2 Downstream reach restoration options

The downstream reach is between NGR: ST 17558 79622 upstream and NGR: ST 17658 79519 downstream (Figure 4-4).

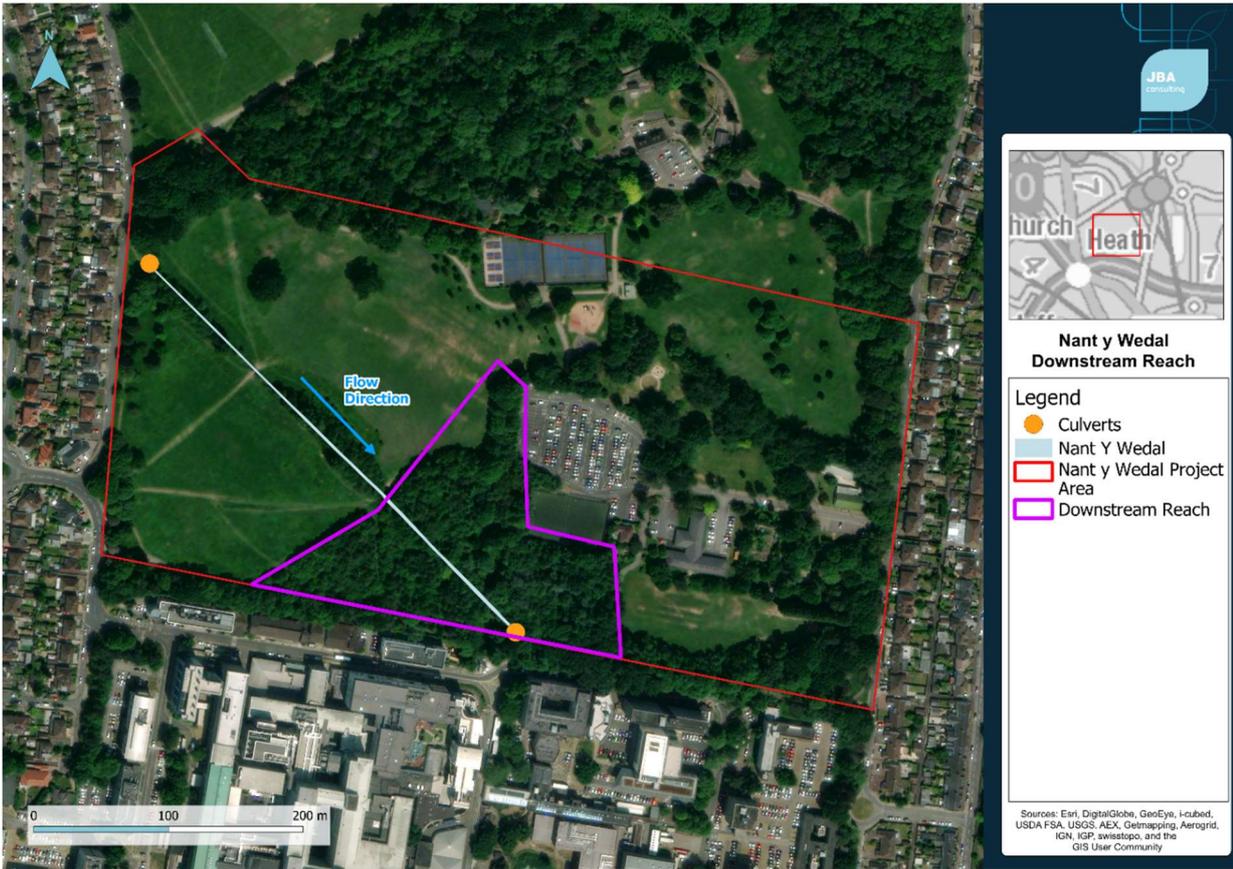


Figure 4-4 Nant y Wedal downstream reach

Here, the Nant y Wedal flows within woodland and is heavily shaded (Figure 4-5). This limits riparian vegetation growth and fine sediment is supplied to the channel from the bare riverbanks. In-channel woody material creates some variation in flow and encourages sediment deposition.



Figure 4-5 Downstream reach of the Nant y Wedal. Right bank facing downstream. NGR: ST 17597 79575

Six restoration options were identified for the downstream reach of the Nant y Wedal:

1. Woodland management
2. Addition of in-channel woody material
3. Set back or removal of surface water outfall
4. Remove timber flume and reprofile banks
5. Remove twin culvert and upgrade footpath
6. Install culvert screen

The location of each opportunity is displayed in the concept restoration plan below (Figure 4-6).



Figure 4-6 Downstream reach concept restoration plan

## 5 Public consultation

### 5.1 Introduction

Engaging and working with the Heath Park (Cardiff) community is essential to informing the outline design, identifying community-based improvements, putting them in place and ensuring they remain effective in the years to come. Following options development, the project progressed to public consultation. This section outlines the methodology and outcomes of the public consultation.

### 5.2 Methodology

#### 5.2.1 Objectives

The objectives of the public consultation were to:

- introduce the Nant y Wedal restoration project and its aims and objectives to the local community.
- have an open discussion about potential restoration options with the public and acquire local knowledge.
- gain and incorporate feedback to further refine the restoration options before progressing to outline design.

#### 5.2.2 Citizen Space survey

To gain feedback from the local community about the restoration options identified, an online survey was produced by JBA Consulting and NRW as part of this study. The survey was shared with the local community of Heath Park and Cardiff via social media platforms in December 2024 and was designed to gain knowledge of public opinions, experience and needs to help inform potential options for improvement in Heath Park. Within the survey, the benefits of each restoration option were shared. The schematic below is an example of information shared as part of the survey for the Riparian Zone Planting option (Figure 5-1).

### ▼ 5. Riparian zone planting

A riparian zone is the transitional area between a body of water and the surrounding land, as shown in the sketch below.



This opportunity involves planting native vegetation within the riparian zone of the re-meandered channel. This would add to the ecological value of Nant y Wedal by increasing habitat types.

Figure 5-1 Riparian zone planting schematic

#### 5.2.3 Public drop-in session

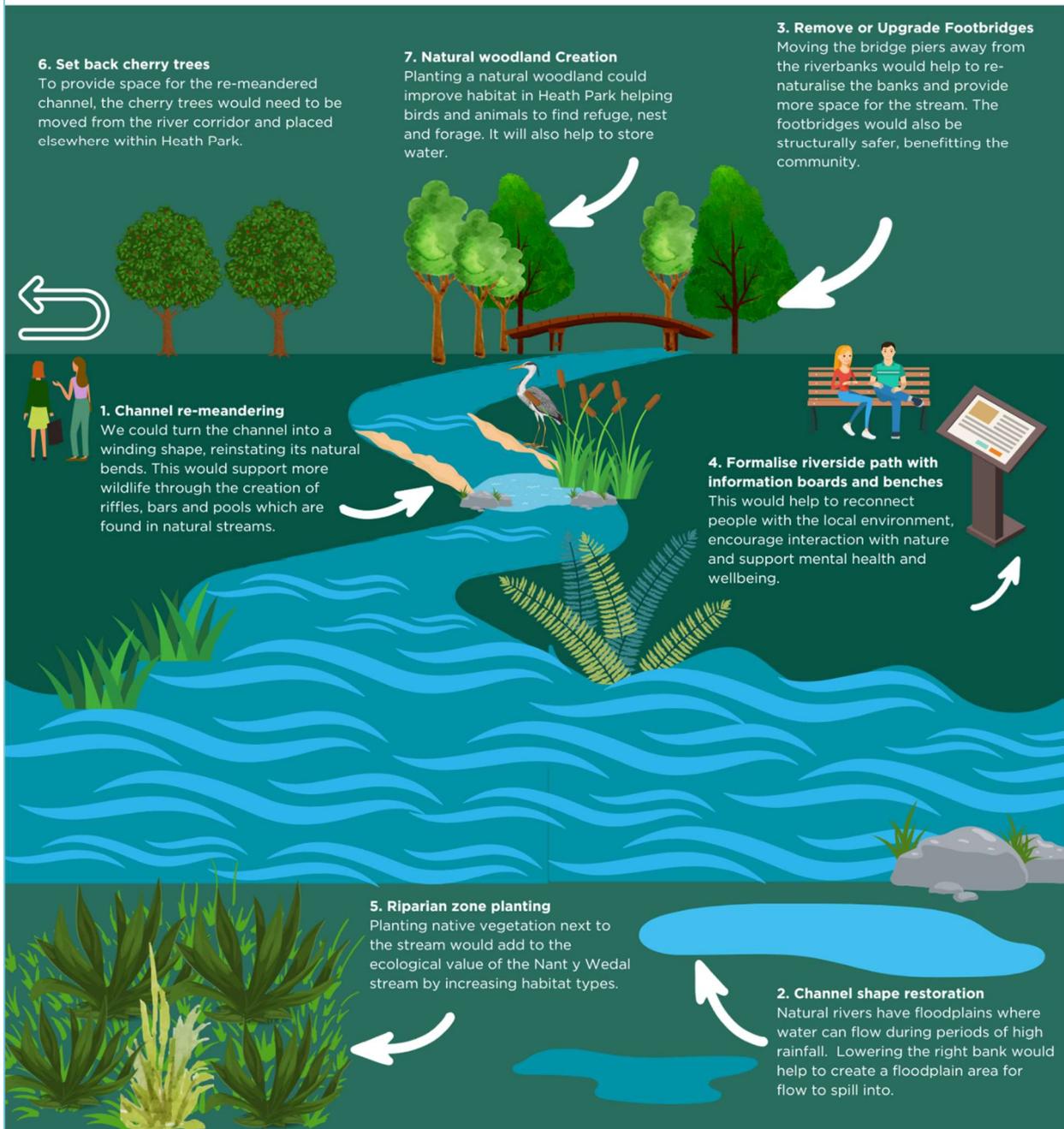
A public drop-in session was hosted by Natural Resources Wales, with support from JBA Consulting on Wednesday 18 December 2024 at the Cardiff Model Engineering Society in Heath Park. The session was an opportunity to explain the restoration options further and answer any queries from the public. The session involved an open discussion with members of the public and local organisations. The posters below were displayed during the event, in both English and Welsh (Figure 5-2 and Figure 5-3).

## Restoring the Nant y Wedal at Heath Park - Upstream Reach



Seven restoration opportunities have been identified for the upstream reach of the Nant y Wedal stream:

1. Channel re-meandering
2. Channel shape restoration
3. Remove or upgrade footbridges
4. Formalise riverside path with information boards and benches
5. Riparian zone planting
6. Set back cherry trees
7. Natural woodland creation



### 6. Set back cherry trees

To provide space for the re-meandered channel, the cherry trees would need to be moved from the river corridor and placed elsewhere within Heath Park.

### 7. Natural woodland Creation

Planting a natural woodland could improve habitat in Heath Park helping birds and animals to find refuge, nest and forage. It will also help to store water.

### 3. Remove or Upgrade Footbridges

Moving the bridge piers away from the riverbanks would help to re-naturalise the banks and provide more space for the stream. The footbridges would also be structurally safer, benefitting the community.

### 1. Channel re-meandering

We could turn the channel into a winding shape, reinstating its natural bends. This would support more wildlife through the creation of riffles, bars and pools which are found in natural streams.

### 4. Formalise riverside path with information boards and benches

This would help to reconnect people with the local environment, encourage interaction with nature and support mental health and wellbeing.

### 5. Riparian zone planting

Planting native vegetation next to the stream would add to the ecological value of the Nant y Wedal stream by increasing habitat types.

### 2. Channel shape restoration

Natural rivers have floodplains where water can flow during periods of high rainfall. Lowering the right bank would help to create a floodplain area for flow to spill into.

Figure 5-2 Public consultation poster - upstream reach

## Restoring the Nant y Wedal at Heath Park - Downstream



Six restoration opportunities have been identified for the downstream reach of the Nant y Wedal:

1. Woodland management
2. Add woody material
3. Set back or removal of surface water outflow
4. Remove timber flume and reprofile banks
5. Remove the twin culvert (footbridge)
6. Install culvert screen and upgrade footpath

### 1. Woodland management

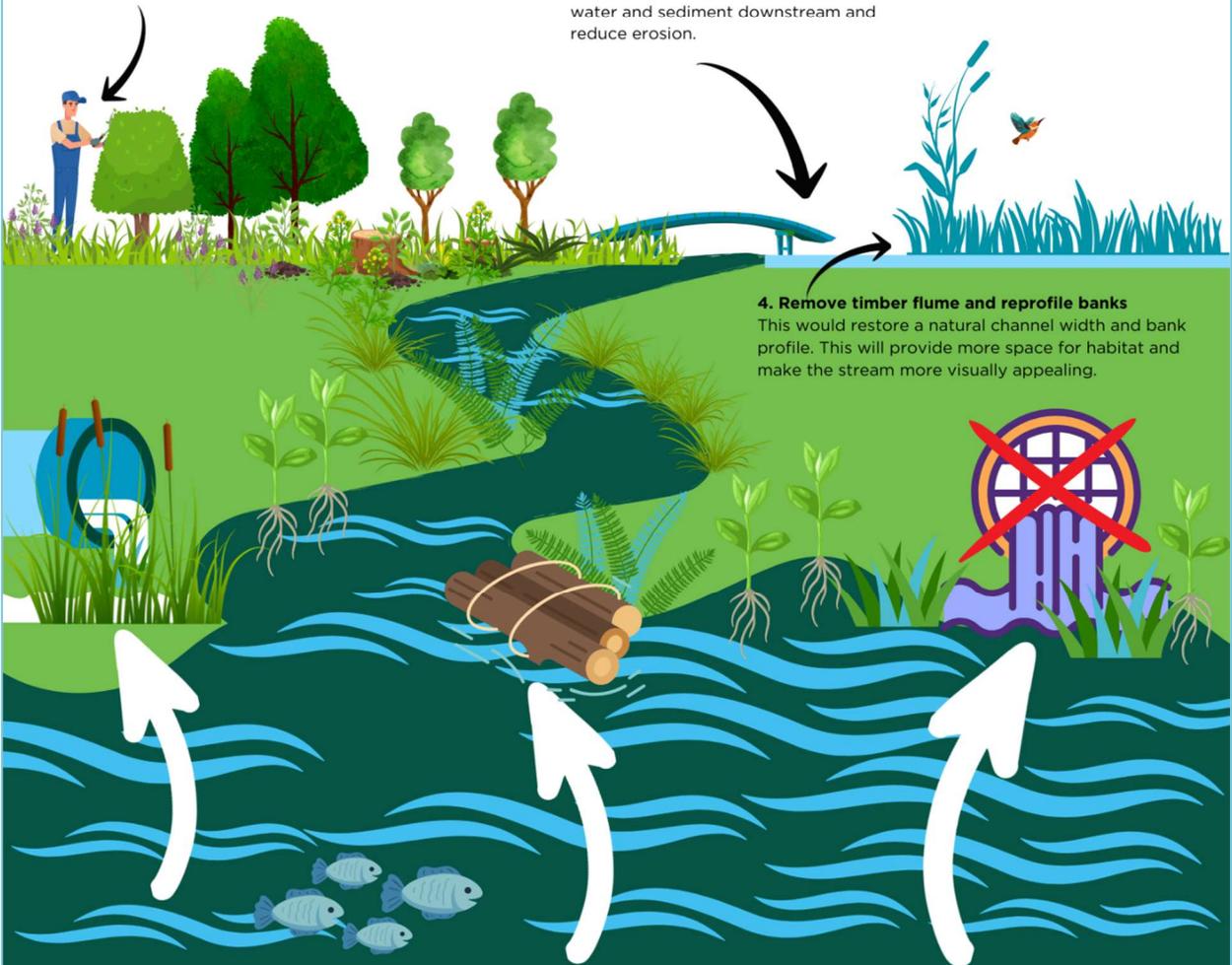
Woodland management is recommended to reduce shading of the stream. This would allow vegetation to grow along the riverbanks which would help to combine soils and reduce the amount of fine sediment entering the stream when it rains.

### 5. Remove the twin culvert (footbridge)

Removing the twin culvert (footbridge) would help to improve the movement of water and sediment downstream and reduce erosion.

### 4. Remove timber flume and reprofile banks

This would restore a natural channel width and bank profile. This will provide more space for habitat and make the stream more visually appealing.



### 3. Set back or removal of surface water outflow

This would re-instate a natural bank and could improve water quality by filtering flow of pollutants before it enters the stream.

### 2. Add woody material

The addition of woody material would help to create natural features in the stream, such as sediment bars, which are important habitats for wildlife.

### 6. Install culvert screen and upgrade footpath

The Nant y Wedal stream enters a culvert at the downstream point of the project area. Adding a screen to the culvert opening would enhance public safety and would help to prevent blockages in the culvert system.

Figure 5-3 Public consultation poster - downstream reach

## 5.3 Outcomes

### 5.3.1 Public drop-in session

The public drop-in session had good attendance from the public who showed a keen interest in plans for the park and the Nant y Wedal. Overall, the public showed a positive view towards the project and agreed with the ideas put forward, although they were keen to see all bridges retained. Some members of the public discussed their involvement with the Friends of Heath Park group and tree planting along the stream. Their main concern was a loss of tree cover at the site. The public also discussed concerns with water quality and pollution in the Nant y Wedal. Several people mentioned that the stream is often 'cloudy'. Several people attended the event with their dogs, highlighting that Heath Park is an important area for dog walkers.

### 5.3.2 Survey results

The findings of the Citizen Space survey are summarised below.

#### 5.3.2.1 Use of Heath Park

The first set of questions aimed to identify how and why the local community use Heath Park.

##### How often do you visit Heath Park?

70% of people who answered this question said that they visit Heath Park 'Very often' (once a week or more, see Figure 5-4). 22% said that they visit 'Often' (once a month or more, but less than weekly), and a smaller 8% answered that they visit 'Rarely' (less than once a month). This shows that Heath Park is utilised by the public regularly and is a good location for improvements.

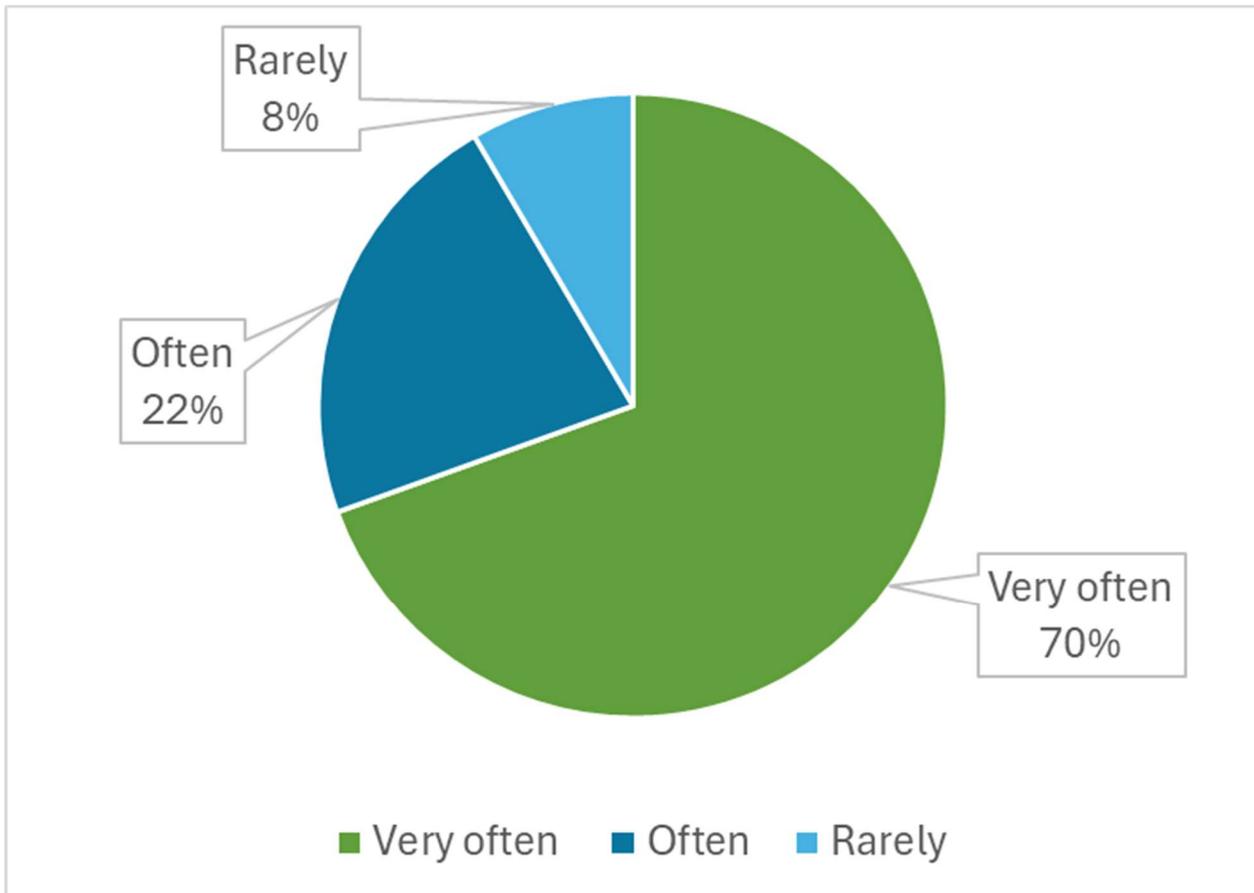


Figure 5-4 Pie chart to show responses to 'How often do you visit Heath Park?'

Which of the following best describes your reasons for using Heath Park?

The public were asked to share why they use Heath Park to gain an understanding of how people interact with the space. 81% of respondents answered that they use Heath Park 'To enjoy nature' (Figure 5-5). This was followed by 'To relax' at 63% and 'Sport and fitness' at 40%. Other reasons for using the park include to walk the dog (37%), for mental health benefits (36%), to socialise (26%) and for the facilities (26%), with a small percentage of people using the park to commute (4%). This suggests that people tend to visit the park to enjoy nature. This may be because the park is located within a heavily urbanised area. There were 12 'Other' responses which mentioned the following additional reasons for visiting Heath Park:

- Volunteering with Friends of Heath Park Woodland
- Litter picking
- To eat lunch when working at the nearby hospital

Several people mentioned being involved with volunteering at Heath Park. This indicates that the local community is invested in improving the park.

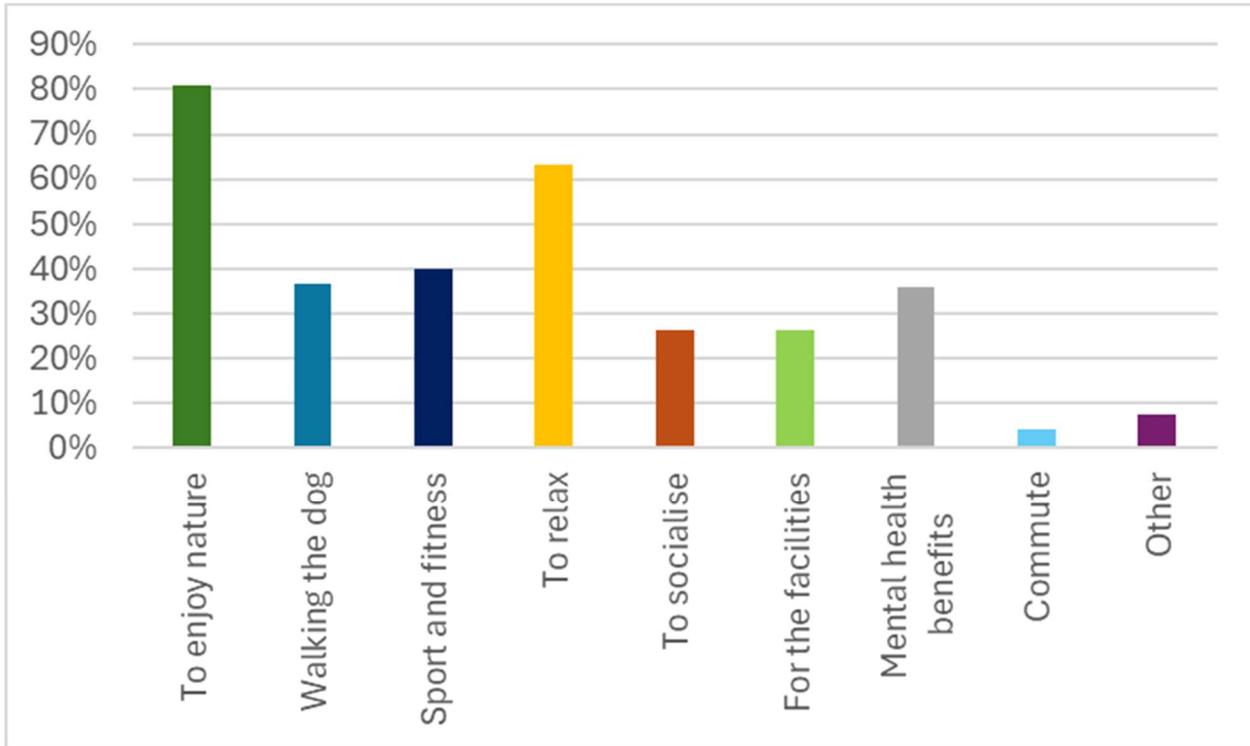


Figure 5-5 Bar chart to show responses to ' Which of the following best describes your reasons for using Heath Park?'

#### What aspects of Heath Park do you value most?

When asked what they valued most about Heath Park, a significant percentage of respondents answered 'Woodland' (92%, see Figure 5-6). Over the years, Friends of Heath Park Woodlands have planted trees in the park, and this habitat is valued by the local community. Another aspect of the park that the public value is the footpaths, with 76% of respondents choosing this option. 40% of respondents shared that they value watercourses, with a smaller percentage valuing benches (32%) and the play area (27%). Those who answered 'Other' discussed the value of having an open green space for activities and seeing wildlife.

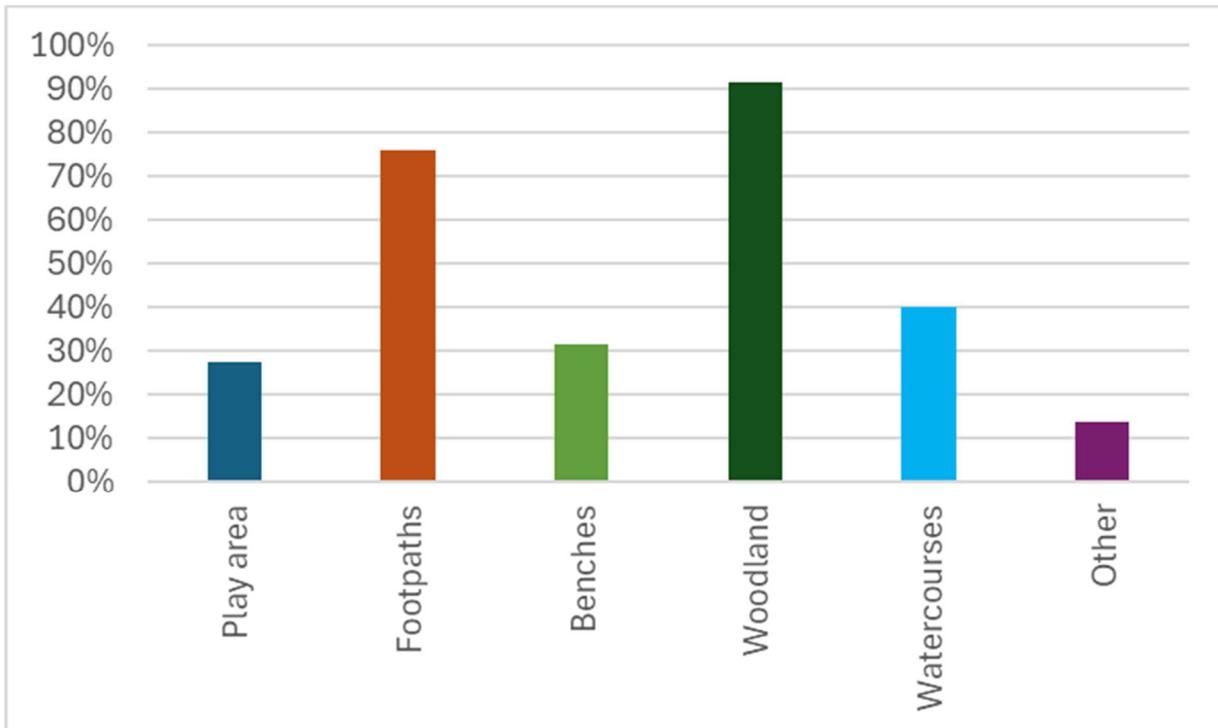


Figure 5-6 Bar chart to show responses to 'What aspects of Heath Park do you value most?'

### 5.3.2.2 Public awareness and perception

The public were then asked a series of questions relating to their awareness and perceptions of the Nant y Wedal in Heath Park.

Before this survey, were you aware of the Nant y Wedal in Heath Park?

93% of the people who answered this question said that they were aware of the Nant y Wedal in Heath Park prior to the survey (Figure 5-7). This shows that the public have an awareness of the Nant y Wedal, even though the stream is heavily culverted and hidden by trees in places. A small percentage of people (7%) answered 'No'. This suggests that there is an opportunity to improve knowledge of the stream in Heath Park.

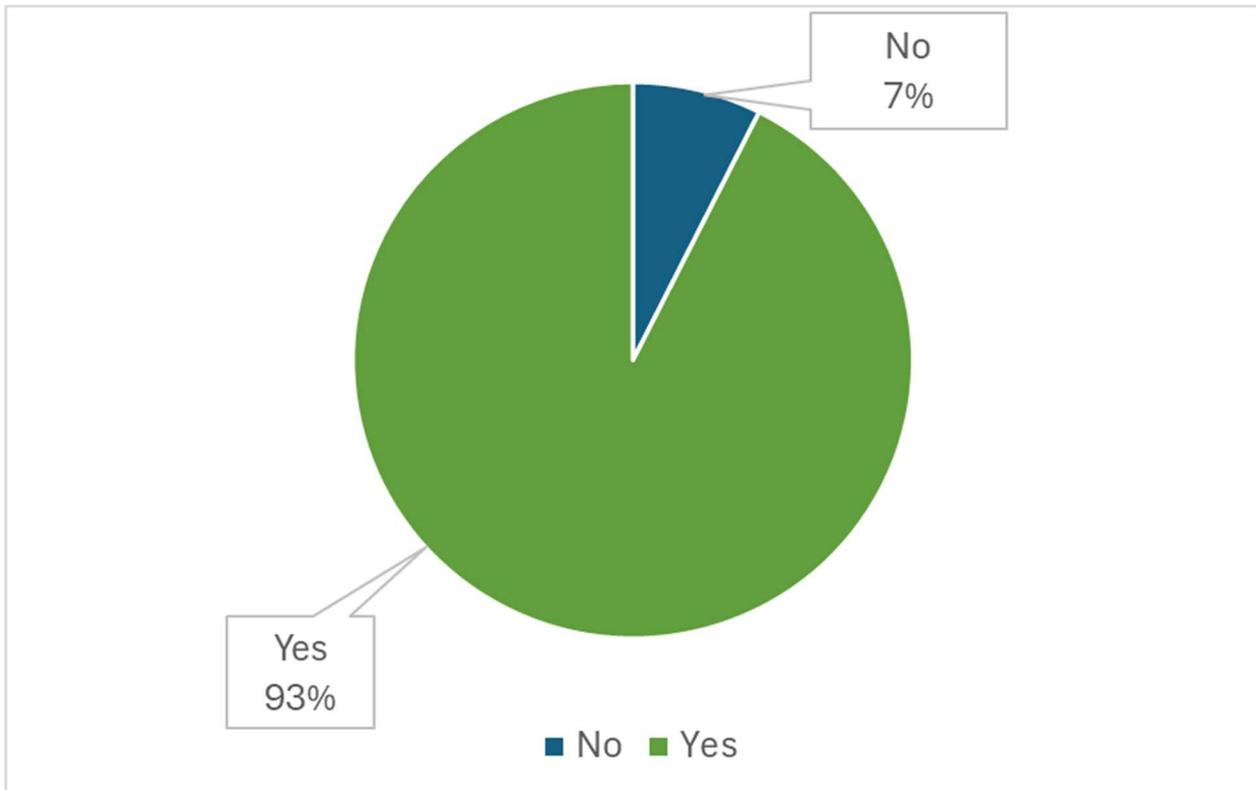
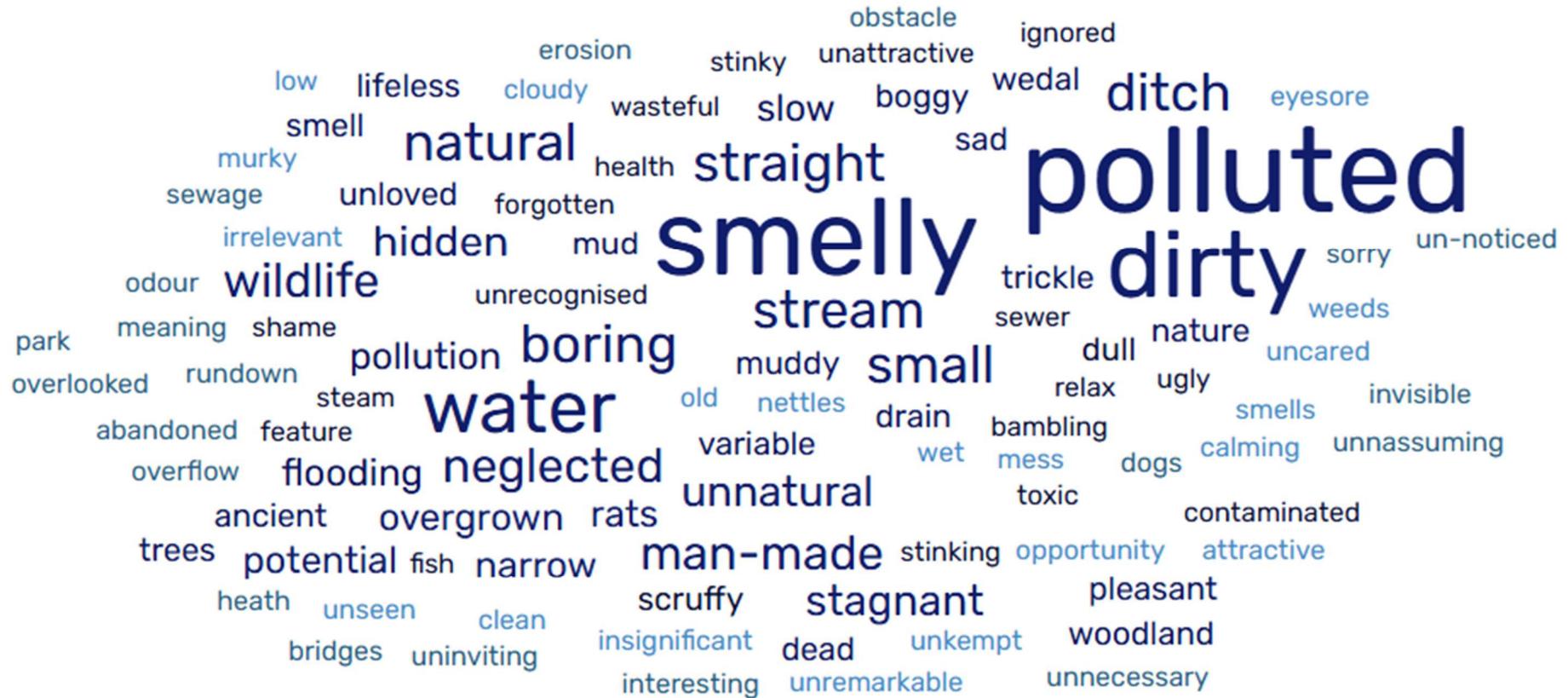


Figure 5-7 Pie chart to show responses to 'Before this survey, were you aware of the Nant y Wedal in Heath Park?'

What three words come to mind when you think of Nant y Wedal?

The public were asked to share three words that come to mind when they think of the Nant y Wedal. This was to gain an understanding of public perception of the watercourse. The words used to describe the Nant y Wedal are displayed in the word cloud below. Words which were repeated more than once are shown as larger. The words used to describe the Nant y Wedal have mainly negative connotations and suggest that the community view the watercourse as degraded and neglected, with words including 'abandoned', 'unloved', and 'ignored'. The top three words used by the public were 'smelly', 'polluted' and 'dirty', highlighting the issue of poor water quality in the stream. Although some positive words were used including 'pleasant', 'calming' and 'interesting', most of the responses suggest that public believe that the stream is in a poor condition. The word 'potential' was used several times, indicating that the public see an opportunity to improve the stream.

Word map to show responses to ' What three words come to mind when you think of Nant y Wedal?'



What three words come to mind when you think of a natural river (such as the one below)?

The photograph below is an example of a natural river (Figure 5-8). The photograph was shared with the public as part of the survey. The public were then asked to share three words that come to mind when they think of a natural river. This was to see whether there is a difference in words used to describe a natural river and the Nant y Wedal (a modified channel).



Figure 5-8 Example of a natural river system

The words used to describe the natural river shown are displayed in the word cloud below. The words used were more positive. The top three words used by the public were 'natural', 'wildlife' and 'clean'. The river was described as 'beautiful', 'picturesque' and 'pretty' whereas the Nant y Wedal was described as 'ugly', 'scruffy' and 'dull'. The natural river was seen as 'peaceful', 'calm' and 'uplifting'. This indicates that the local community value a more natural environment.



### Has your perception of Nant y Wedal changed over time?

The public were asked if their perception of the Nant y Wedal has changed over time, to capture any feelings of improvement or worsening. 62% of people who answered this question said 'No change', highlighting that for most people, the perception of the Nant y Wedal has remained the same (Figure 5-9). 26% answered 'Yes - it has improved' and a smaller 12% answered 'Yes - it has got worse'.

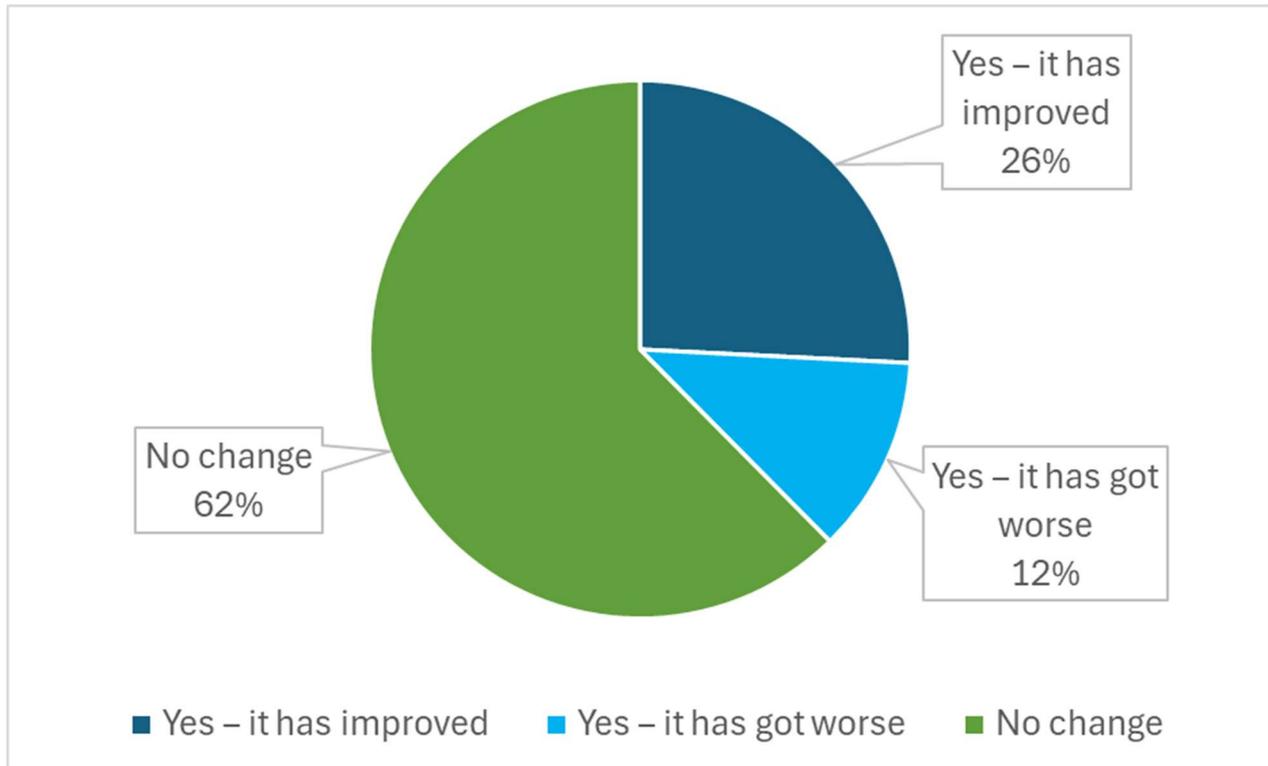


Figure 5-9 Pie chart to show the responses to 'Has your perception of Nant y Wedal changed over time?'

#### 5.3.2.3 Water quality

Although the water quality of the Nant y Wedal is not a focus of this study, it is an issue that Natural Resources Wales (NRW) are concerned about. The public were asked to share their views on poor water quality in the stream.

#### Nant y Wedal suffers from poor water quality. What do you think has contributed to this?

The public discussed the following factors that may be contributing to poor water quality in the Nant y Wedal:

- Discharge from house drains
- Sewage and misconnections to foul water systems
- Pollution upstream
- Industry/ businesses upstream
- Pollution incidents such as discharge from the bakery in Maes Y Coed Road

- Dogs using the stream
- Litter
- Incorrect disposal of pollutants
- Run off from roads and urban areas
- Culverting of the stream
- Outfall structures
- Stagnant flow

The public shared that the stream often has a foul smell (particularly in summer when flow levels are reduced) and is sometimes cloudy and grey in colour.

#### How concerned are you about water quality in Cardiff?

The public were asked how concerned they are about water quality. Most people who answered this question showed concern about water quality (Figure 5-10). 49% said that they are 'Very concerned' and 44% said that they are 'Somewhat concerned'. A small proportion of people (7%) answered that they are 'Unconcerned'. This highlights that poor water quality is a significant issue and concern for the people of Cardiff.

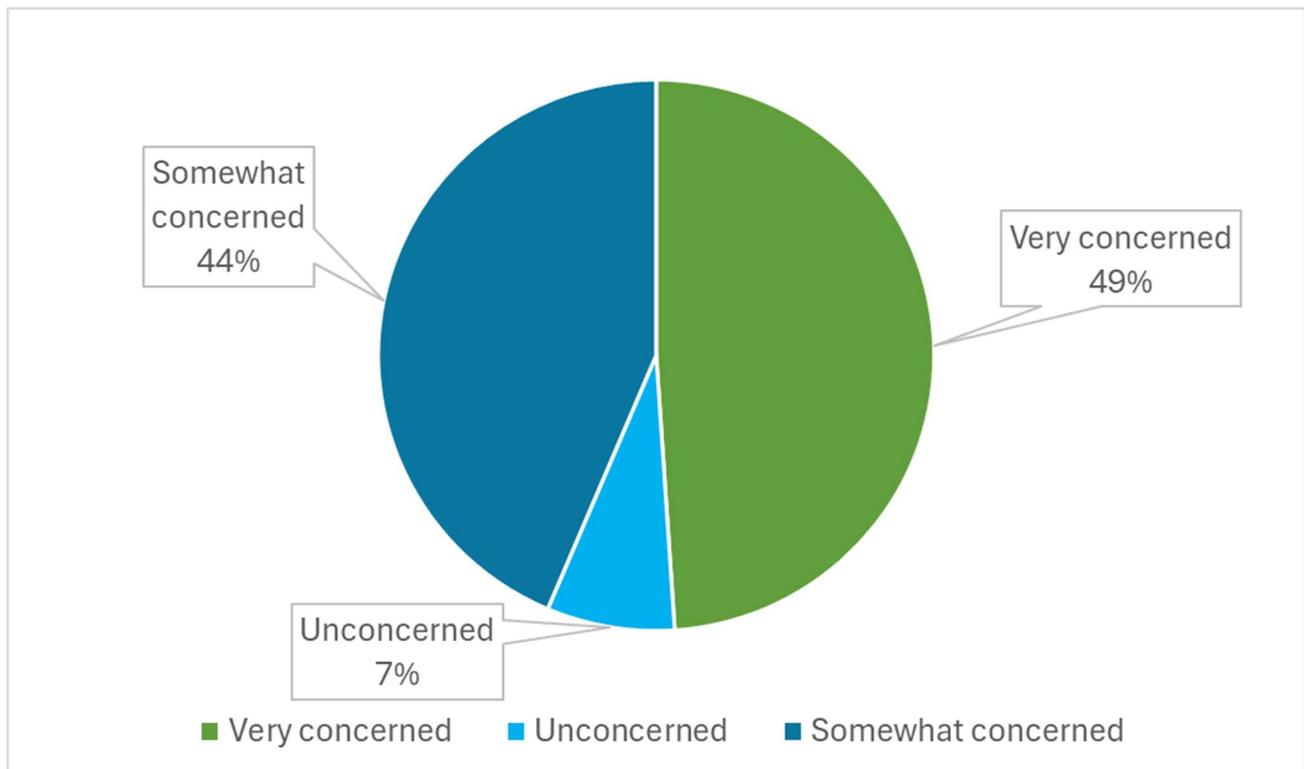


Figure 5-10 Pie chart to show the responses to ' How concerned are you about water quality in Cardiff?'

Some respondents expanded their answers. They shared that they are concerned about poor water quality being a health hazard to dogs and people and its impact on wildlife and river habitats.

#### 5.3.2.4 Public opinion and ideas

##### How important to you are the following?

To gain an understanding of what the public value most about the local environment, respondents were asked to answer how important ('Not important', 'Somewhat important' or 'Very Important') the following factors are to them:

- Biodiversity and habitats to wildlife
- Trees and woodland
- River health and water quality
- Reducing the risk/impact of climate change
- Recreational green spaces
- Public access to the river

The responses to this question are summarised in the pie charts below (see Figure 5-11 to Figure 5-16). Of the responses gathered, it appears that 'Trees and woodland' are most important to the public with 92% of respondents answering that they are 'Very important' and the remaining 8% answering 'Somewhat important'. This is followed by 'River health and Water quality' with 99% of respondents answering 'Very important' or 'Somewhat important'. This suggests that most people consider the health of rivers and water quality very important. Biodiversity and habitats for wildlife are also regarded as important with 86% of respondents answering 'Very important' and 14% answering 'Somewhat important'. For 'Recreational green spaces', 88% of respondents answered with 'Very important' with the remaining 12% responding with 'Somewhat important', highlighting the importance of recreational green spaces to the local community.

'Reducing the risk/impact of climate change' and 'Public access to the river' had the highest percentage of 'Not important' answers suggesting that the public is less concerned about these factors. The largest percentage of 'Not important' answers was 5%. This indicates that overall, the public consider each factor to be important. As such, they should all be considered in the restoration designs.

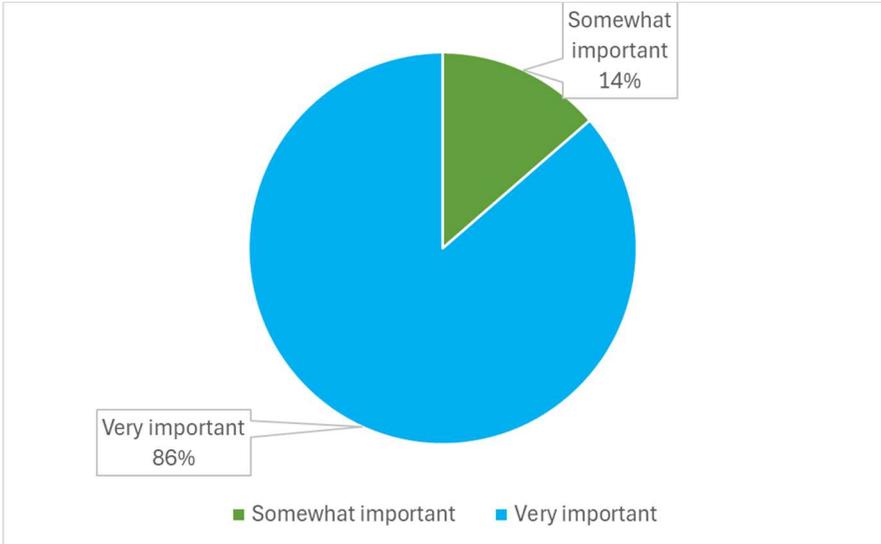


Figure 5-11 Pie chart to show the responses to show 'How important to you are the following? Biodiversity and habitats for wildlife'

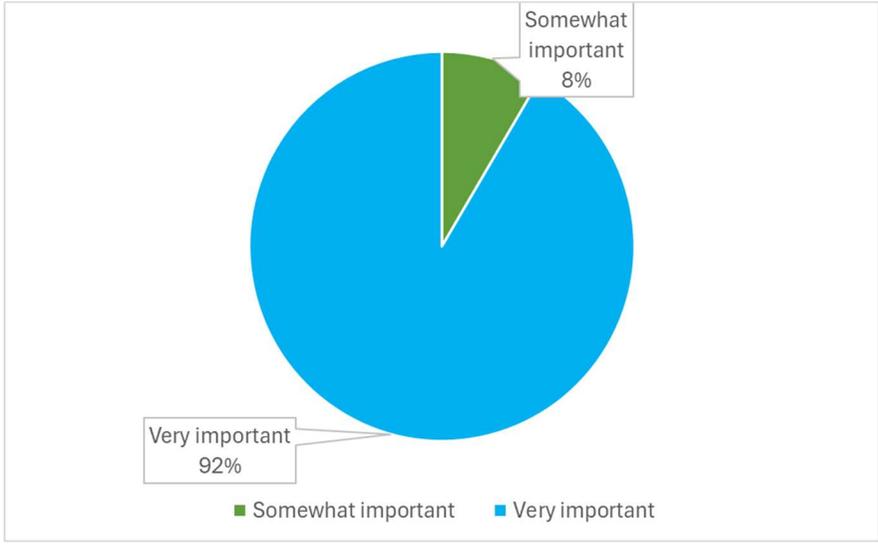


Figure 5-12 Pie chart to show the responses to show 'How important to you are the following? Trees and woodland'

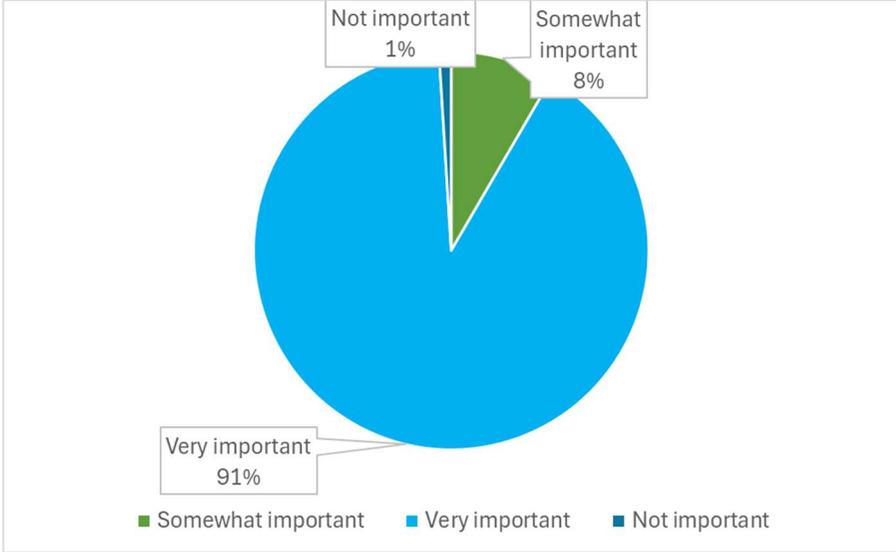


Figure 5-13 Pie chart to show the responses to show 'How important to you are the following? River health and water quality'

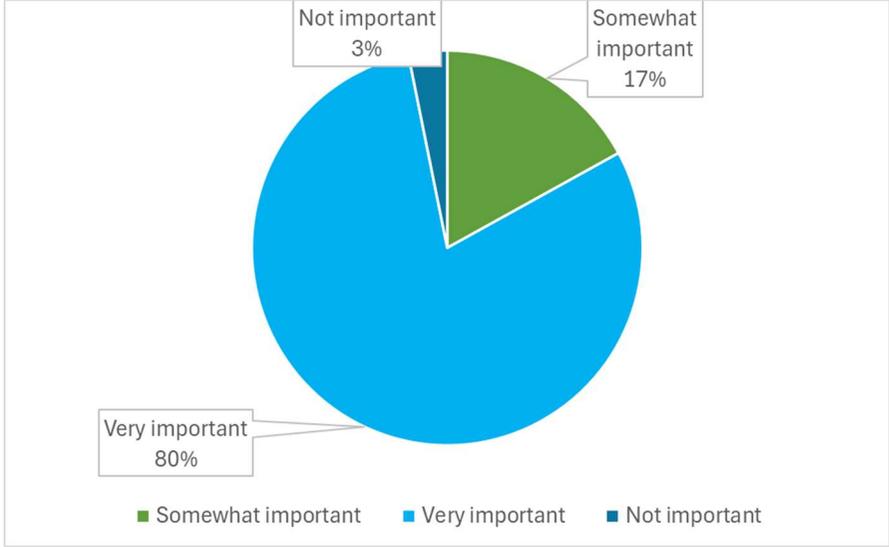


Figure 5-14 Pie chart to show the responses to show 'How important to you are the following? Reducing the risk/ impact of climate change'

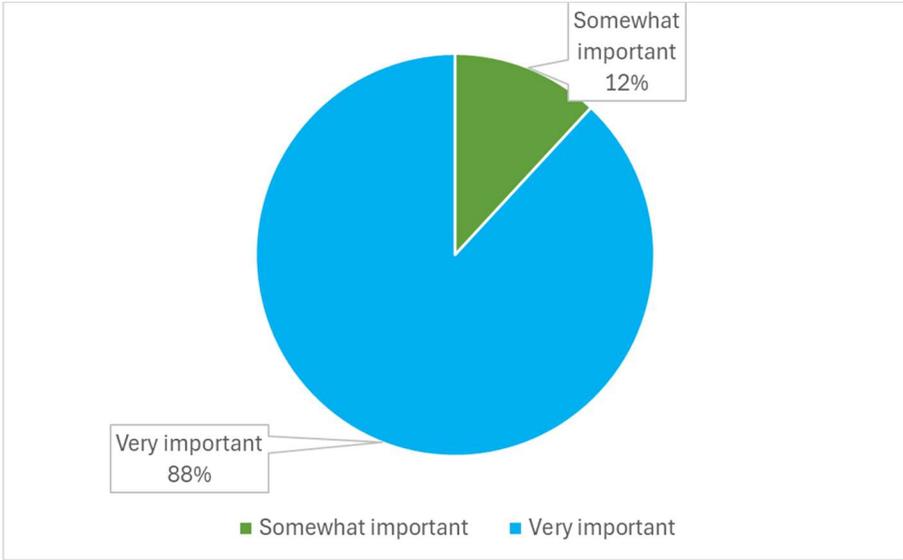


Figure 5-15 Pie chart to show the responses to show 'How important to you are the following? Recreational green spaces'

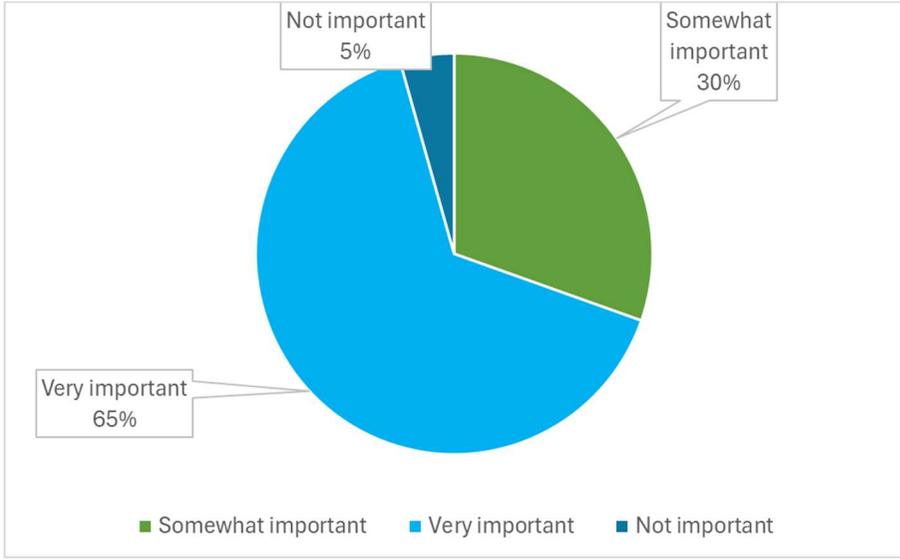


Figure 5-16 Pie chart to show the responses to show 'How important to you are the following? Public access to the river'

Out of the two photographs below, which channel do you prefer? Channel A or B

Respondents were shown two photographs of rivers (Channel A and Channel B). Channel A (Figure 5-17) is a section of the Nant y Wedal in the downstream woodland reach (see Figure 4-4) and Channel B (Figure 5-18) is a more naturalised channel with pool-riffle morphology and riparian vegetation. This restoration project aims to introduce similar habitats to the Nant y Wedal.



Figure 5-17 Channel A (Nant y Wedal)



Figure 5-18 Channel B (naturalised channel)

Respondents were asked to choose which channel they preferred and explain their reasoning. 98% of people who responded to the question answered that they preferred Channel B (Figure 5-19). While only 2% of the of respondents chose Channel A as the channel they preferred.

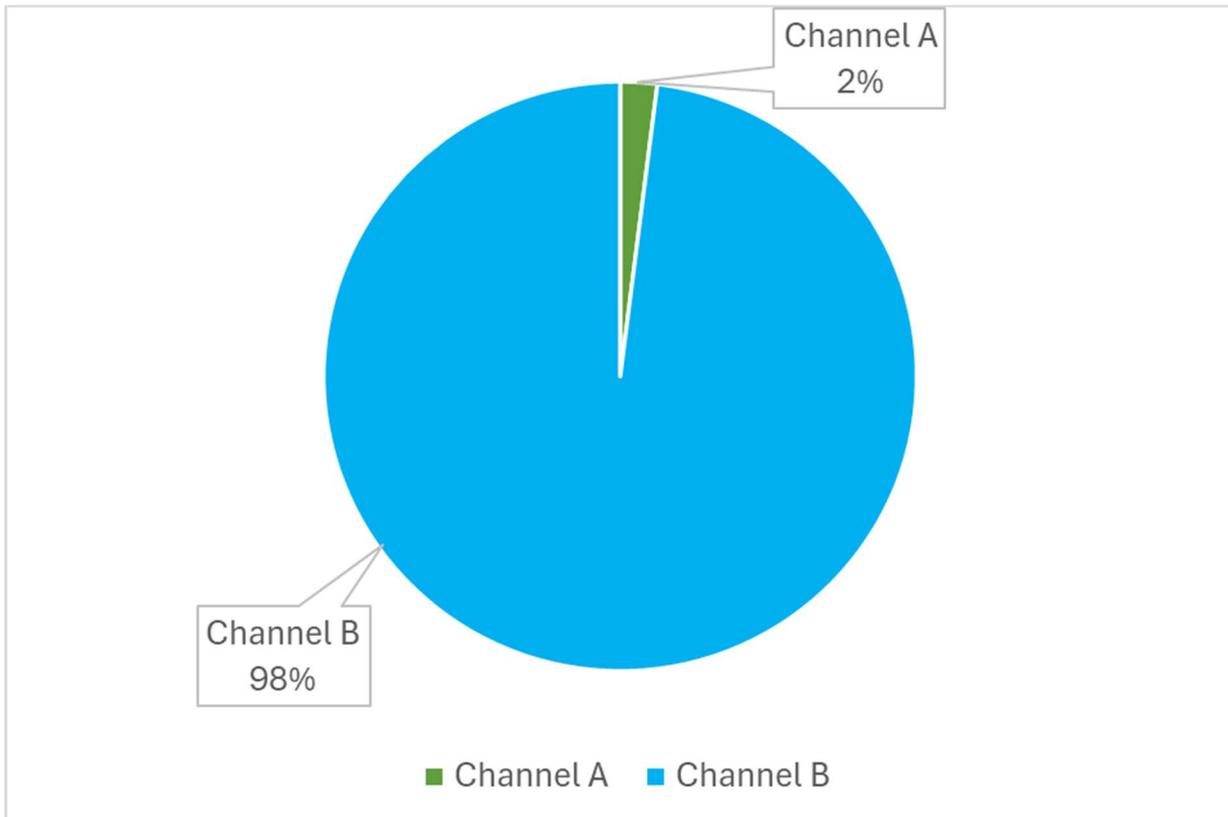


Figure 5-19 Pie chart to show the responses to show 'Out of the two photographs below, which channel do you prefer? Channel A or B'

The respondents were asked to expand on their answer and say why they made their choice. The following reasons were given for choosing Channel B:

- More greenery
- More visually appealing
- More 'alive' and 'thriving'
- More natural
- More shelter for wildlife
- More diverse
- Less sediment loss from the banks
- Clear water

The respondents described Channel A as 'too muddy' and preferred Channel B as the banks are vegetated. This indicates that the public would support opportunities to improve riparian vegetation cover through Heath Park.

Do you think the ideas shown in the sketches would help to improve Nant y Wedal in Heath Park?

Respondents were asked to share their opinion on the restoration ideas presented for Heath Park and the Nant y Wedal (see Section 0). They were asked whether they think the ideas would help to improve the stream and park. Of the respondents who answered, 71% said 'Yes', 22% said 'Unsure, more information needed' and 7% said 'No' (Figure 5-20). This shows that most of the respondents thought that the restoration ideas would improve the park.

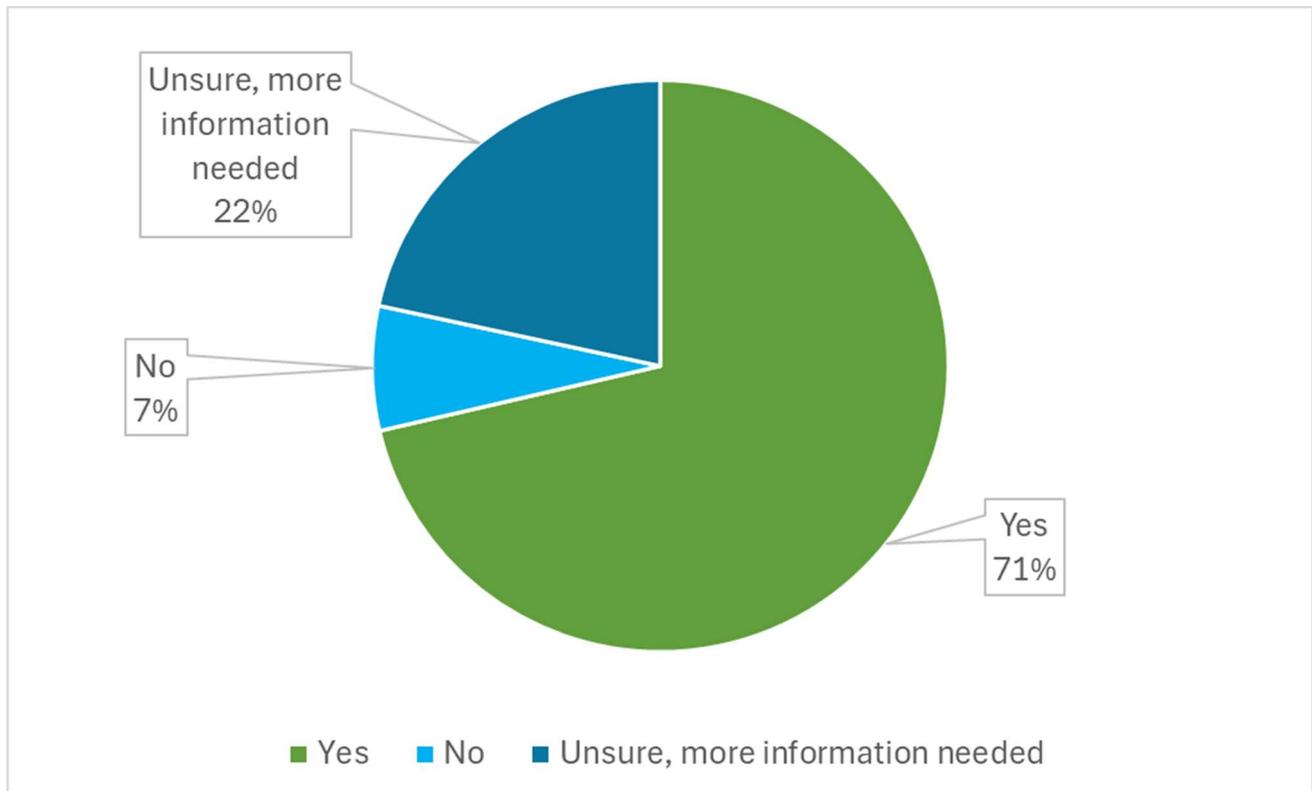


Figure 5-20 Pie chart to show the responses to 'Do you think the ideas shown in the sketches above would help to improve Nant y Wedal in Heath Park?'

Respondents were given the opportunity to expand on their answer. The public shared positive thoughts around improvements to habitat, stream health and ecosystem resilience. Respondents discussed that the ideas would help to increase accessibility and one respondent wrote that they would create 'a peaceful place to sit and stroll'.

Some respondents questioned the benefit of re-meandering if the water quality remains poor. They also raised concerns about loss of existing habitat (particularly the trees planted by volunteers) and increased wetting of the floodplain, with 'marshy boggy areas already'. Respondents were also keen to keep both footbridges over the watercourse to maintain existing access routes, with one respondent sharing that 'both are used on a regular basis'. There were some concerns that formalised footpaths would increase urban ground cover in the park.

Overall, the responses show support for the restoration of the Nant y Wedal, with one respondent sharing that 'these actions can only make positive improvement for the future'. Continued consultation with the public as the design progresses will be useful to reduce the number of people who are 'unsure' of the restoration ideas.

If one footbridge were to be removed to restore natural bends in Nant y Wedal and improve its biodiversity, out of the following statements, what would be your preference?

The public was asked to give their opinion on the removal of a footbridge from the Nant y Wedal to reduce hard engineering within the stream. They were asked to select one of the following three statements:

1. Prefer a footbridge to be included in the re-meandering channel design to maintain existing channel crossings
2. Prefer to lose one footbridge to prevent hard engineering in the re-meandering channel design
3. Unsure, more information needed

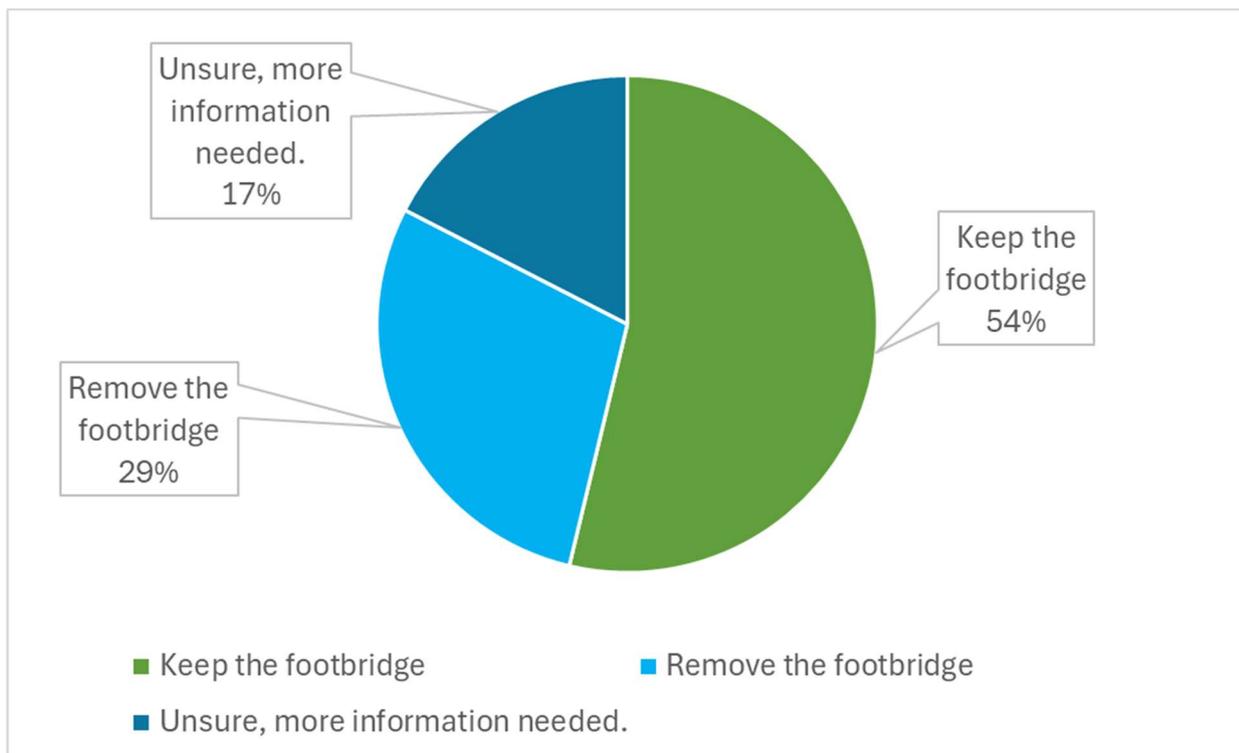


Figure 5-21 Pie chart to show the responses to 'If one footbridge were to be removed to restore natural bends in Nant y Wedal and improve its biodiversity, out of the following statements, what would be your preference?'

The outcome of this question was that most of the public (54%) would like a footbridge to be included in the re-meandering channel design. A smaller 29% answered that they would prefer to lose a footbridge. 17% of respondents, felt they were unsure and needed more information. As such, the majority of the public would like to keep existing access routes across the stream.

Do you have any concerns about the restoration opportunities shown in the figures that you would like us to consider going forward?

The public were asked if they had any concerns about the restoration opportunities shown. Of the respondents who answered the majority at 57% picked that they were happy with the ideas shown. 28% said that they had concerns with the plans and 15% said they were unsure and needed more information. This suggests that further engagement with the public at the detailed design stage would be useful to gain additional support from the local community.

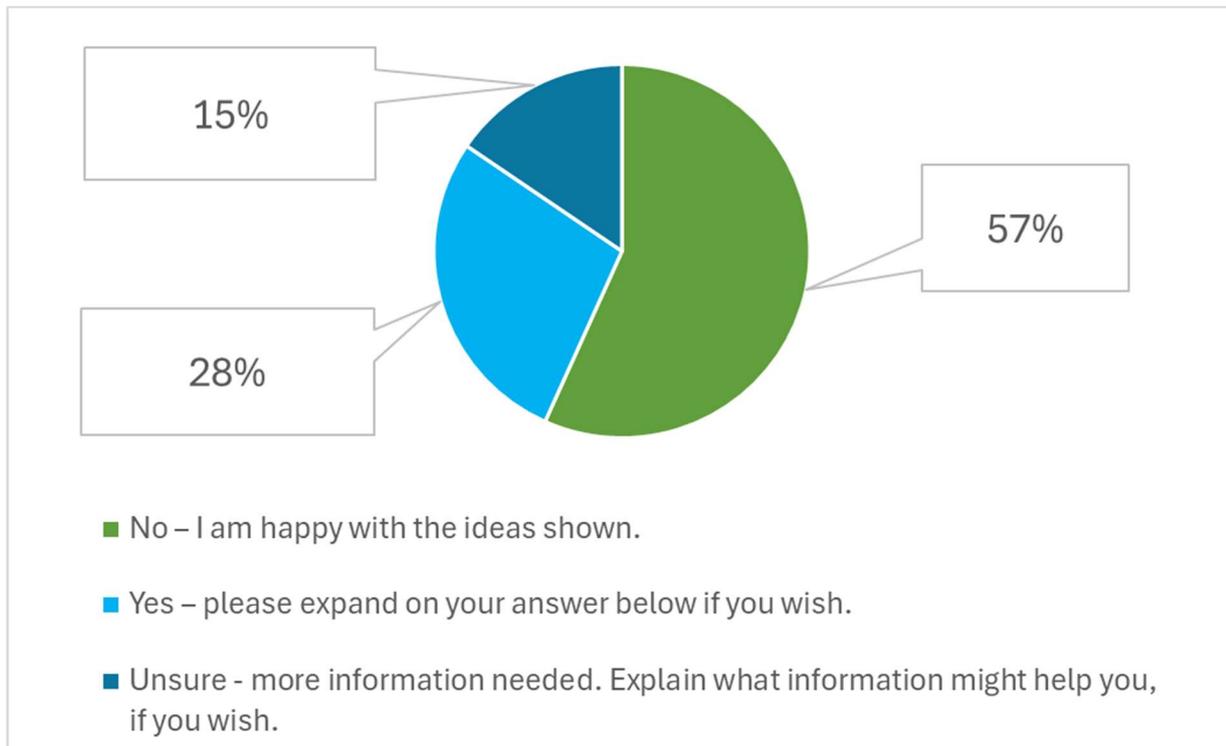


Figure 5-22 Pie chart to show the responses to 'Do you have any concerns about the restoration opportunities shown in the figures that you would like us to consider going forward?'

The public were asked to expand on their answers. The key themes were:

- Concerns with removal of the upstream footbridge, with concerns over increased footfall to the other bridge
- Concerns with tree removal and movement of the cherry trees to create the re-meandered channel
- Concerns that the proposals do not directly address water quality issues
- Concerns over project costs vs benefits
- Concerns over maintenance of the culvert screen at the downstream limit of the site

What improvements would you like to see, if any, to the area around Nant y Wedal?

The public were asked to share any improvements that they would like to see as part of this project. Respondents shared several ideas for improvements in Heath Park, including:

- Benches and picnic areas
- Management of shrubbery
- Information boards about the park and the Nant y Wedal
- More wildlife and natural habitat
- Safety improvements
- More trees and woodland
- More diverse plants
- Improvements to the footpaths including drainage of the path adjacent to the University Hospital of Wales (UHW) which regularly floods

Respondents shared that they would like to see the following improvements made to the Nant y Wedal:

- Improvements to water quality
- Improvements to flow
- Safer bridges across the stream
- Bends in the stream
- Naturalisation of the stream
- More geomorphological diversity for wildlife (pools, riffles)
- Improvements to the banks (gentle banks which vary in profile)
- More vegetation along the stream
- Removal of rubbish
- Localised fencing to reduce poaching by dogs
- A wetland area with a boardwalk

A key theme within the responses was the issue of pollution in the stream, with the public eager to see improvements made to its water quality.

### 5.3.3 Review of the outline design following public feedback

Following analysis of the public consultation results, the restoration options were reviewed. The table below summarises the outcomes of the review.

Table 5-1 Review of the outline design following public feedback

Option	Public feedback	Outcome
In-channel woody material	Overall, the public support this option. A concern raised during the public consultation was that the floodplain is already muddy in the downstream reach and this option will further	To mitigate this concern, there is an opportunity to investigate the creation of a boardwalk through the woodland area at the detailed design stage. The boardwalk would need to be set back from the channel to avoid increased poaching of the banks but this could

Option	Public feedback	Outcome
	encourage wetting of the park and reduce accessibility for people.	help to maintain accessibility through the woodland, whilst also improving lateral connectivity between the stream and its floodplain.
Channel re-meandering	Overall, the public support this option. Some members of the public have concern over a loss of trees (planted along the channel approximately 30 years ago) and movement of the cherry trees to create the re-meandered channel route.	<p>Whilst the re-meander design will result in the loss of some existing tree habitat, the re-meander route has been designed to improve channel-floodplain connectivity and aims to create additional habitat in the channel and on the floodplain. Tree loss along the edges of the channel resulting from this option will be mitigated through 'Natural Woodland Creation'. It is anticipated that this option will create more habitat opportunities for the benefit of wildlife. The cherry trees are young and can therefore be moved. Further engagement with the Friends of Heath Park Woodland group is required to gain further support for the proposed re-meander route.</p> <p>Engagement and education with local groups and possible information boards about woodland management and the woodland habitat.</p>
Footbridge removal or upgrade	The public would like to see the existing bridges which cross the Nant y Wedal channel upgraded to improve safety. They were concerned with plans to remove the upstream footbridge as part of the re-meander design.	Following public feedback, the upstream footbridge will be retained and a new footbridge included in the channel re-meandering design. A second footbridge downstream will be upgraded.

Option	Public feedback	Outcome
Formalise a riverside path with information boards and benches	Overall, the public support this option as it will improve accessibility and engagement with the stream. However, several respondents were concerned over increased urban ground cover in the park.	This feedback has been considered in the outline design. Where possible, the footpaths will remain unsurfaced to limit urban ground cover on the floodplain and in the river corridor.

## 6 Outline design development

### 6.1 Introduction

The following restoration options have been carried forward to outline design following public consultation:

- Channel shape restoration (two-stage channel)
- Channel re-meandering
- Riparian zone planting
- Natural woodland creation
- Removal of a twin culvert structure
- Woodland management
- Addition of in-channel woody material
- Removal of a timber flume

Improvements to Heath Park carried forward to outline design include:

- Upgrade of two footbridges
- Formalisation of a riverside path with information boards and benches
- Upgrade of an existing footpath
- Installation of a boardwalk in the downstream woodland reach
- Installation of a culvert screen

### 6.2 Conceptual drawings

Conceptual drawings of the restoration options carried forward to outline design are provided in Appendix A.

### 6.3 Key considerations and risks

Option	Considerations and risks
Channel shape restoration (two-stage channel)	<p>The existing design has been informed by desk and site-based assessments. Hydraulic modelling is required to determine an appropriate height for the inset floodplain (berms). The inset floodplain must be frequently wetted at higher flows (Q50 water level) to ensure continuity of reed habitat.</p> <p>This option requires works within the river channel and may result in a period of disturbance to substrate and in-channel habitats and species. However, suitable working methods and timings can minimise this risk.</p> <p>This option would result in disturbance to trees along the stream. Targeted species surveys will be required to identify possible ecology constraints. Timing of the works is important.</p>

Option	Considerations and risks
Channel re-meandering	<p>The existing design has been informed by desk and site-based assessments. Hydraulic modelling is required to support lateral connectivity assumptions and to confirm suitable bank heights, feature and channel dimensions at the detailed design stage.</p> <p>There is poor sediment supply to this reach due to extensive culverting. As such, bar and riffle material will need to be imported. The material should be coarse enough to prevent significant mobilisation in peak flow events. Hydraulic modelling and sediment sampling will help to inform a suitable sediment size at the detailed design stage.</p> <p>Hydraulic shear stress modelling will be required to test the designs impact on velocity, erosion and sediment transport.</p> <p>The Nant y Wedal is characterised by low flow and may not have sufficient energy to complete geomorphic work to develop pool features naturally. Hydraulic modelling would help to inform whether the pools will need to be created through excavation or could develop naturally over time.</p> <p>The proposed route of the re-meandered channel will result in disturbance to existing trees along the stream (planted approximately 30 years ago by the Friends of Heath Park Woodland group). Natural woodland creation is proposed to compensate for loss of tree cover. Consultation with the Friends of Heath Park Woodland and Cardiff County Council is recommended to gain further support for this option.</p> <p>This option requires works within the river channel and may result in a period of disturbance to substrate and in-channel habitats and species. However, suitable working methods and timings can minimise this risk.</p> <p>This option will require re-location of the cherry trees along the stream (~7m). Movement of trees would need to be managed e.g. timing of year and additional aftercare undertaken.</p>
Riparian zone planting	<p>All planting should be with native, ideally locally sourced species, and should include species that reflect the flora across the local area.</p> <p>The riparian zone needs to be wetted frequently for reedbeds to establish. Hydraulic modelling is required at the detailed design stage to determine suitability of this habitat.</p>
Natural woodland creation	<p>All planting should be with native, ideally locally sourced species, and should include species that reflect the flora across the local area. But affords opportunity to increase genetic diversity and resilience by increasing species on site.</p>
Removal of the twin culvert structure	<p>This structure acts as a debris trap. If this structure is removed, a debris screen may be required on the culvert inlet downstream. A new initial needs assessment supported by hydraulic modelling and a debris loading estimation would be required to confirm that a debris screen is not required.</p>

Option	Considerations and risks
Woodland management	<p>Targeted species surveys will be required to identify possible ecological constraints to woodland management.</p> <p>Timing is important.</p> <p>Cut wood material could be placed in the channel to encourage flow diversity.</p>
Addition of in-channel woody material	<p>Placement of the woody material is important as it could encourage excessive scour and there is a combined sewer parallel to the stream and crossing the stream at two locations. This will need to be considered at the detailed design phase and consultation with Dwr Cymru Welsh Water (DCWW) will be required. To minimise potential risk to utilities, the woody material will only be installed along the left bank. Hydraulic modelling will be a useful tool at the detailed design stage to assess the implications of in-channel woody material.</p> <p>This option requires works within the river channel and may result in a period of disturbance to substrate and in-channel habitats and species. However, suitable working methods and timings can minimise this risk. Public engagement would be key to delivery.</p> <p>There is potential risk that the woody material could be washed downstream in peak flow events. As such, the material will need to be fixed in place with natural materials.</p> <p>A debris screen may be required at the culvert structure downstream to prevent blockages of the culvert resulting from increased woody material.</p>
Set back or removal of surface water outflow	<p>Further consultation with DCWW is required to determine suitability of this option. DCWW has confirmed that the asset may be live and this would limit potential for removal. Further constraints include the combined sewer at the site location.</p>
Removal of a timber flume	<p>The existing design has been informed by desk and site-based assessments. Hydraulic modelling is required to support lateral connectivity assumptions and to confirm suitable channel dimensions at the detailed design stage.</p> <p>This option requires works within the river channel and may result in a period of disturbance to substrate and in-channel habitats and species. However, suitable working methods and timings can minimise this risk.</p>
Upgrade of two footbridges	<p>The existing design has been informed by desk and site-based assessments. Hydraulic modelling is required to determine appropriate bridge dimensions.</p> <p>The upstream bridge design needs to tie in with the re-meandered channel design.</p>
Formalisation of a riverside path with information boards	<p>This option requires consultation with Cardiff County Council. Paths, benches and information boards require ongoing maintenance and this will need to be agreed by relevant</p>

Option	Considerations and risks
and benches	stakeholders.
Upgrade of an existing footpath	This option requires consultation with Cardiff County Council.
Installation of a boardwalk in the downstream woodland reach	Additional survey of the downstream woodland is required to determine an appropriate route for a boardwalk considering ecological constraints.
Installation of a culvert screen	<p>Will require routine maintenance and cleaning to prevent blockage and flooding of the public footpath to the south. Additional investigations are recommended to assess the structural condition of the structure, existence of entrapment hazards inside the culvert and survey the inlet headwall.</p> <p>Following investigations a further needs assessment is recommended to confirm if a debris, coarse or security screen is required.</p>

# 7 Conclusions and recommendations

## 7.1 Introduction

A study has been undertaken to develop restoration options along the Nant y Wedal at Heath Park. An outline design has been developed which considers the baseline and potential geomorphological functioning of the Nant y Wedal, constraints identified on site and public feedback.

Restoration works at the site will include some, if not all, of the elements below:

1. Channel shape restoration (two-stage channel)
2. Channel re-meandering
3. Riparian zone planting
4. Natural woodland creation
5. Removal of a twin culvert structure
6. Woodland management
7. Addition of in-channel woody material
8. Set back or removal of surface water outflow
9. Removal of a timber flume
10. Upgrade of two footbridges
11. Formalisation of a riverside path with information boards and benches
12. Upgrade of an existing footpath
13. Installation of a boardwalk in the downstream woodland reach
14. Installation of a culvert screen

## 7.2 Recommendations

Table 7-1 provides an indicative guide to help inform what might be needed to progress the restoration options to detailed design. The list of recommended work is not exhaustive and other works may be required before any future scheme is implemented at this site.

Table 7-1 Summary of recommended work to progress the outline restoration design

Recommended work	Requirements
Continued stakeholder engagement	<p>Further discussions with Cardiff Council are recommended to develop the restoration and amenity enhancement options including improvements to footpaths. Ordinary watercourse consent would be needed for the works, which should be sought from Cardiff Council as the Lead Local Flood Authority.</p> <p>Meetings with the Friends of Heath Park group are recommended following concerns with tree loss resulting from the re-meander design. The volunteer group could help to implement the restoration options such as natural wood creation and riparian planting.</p>

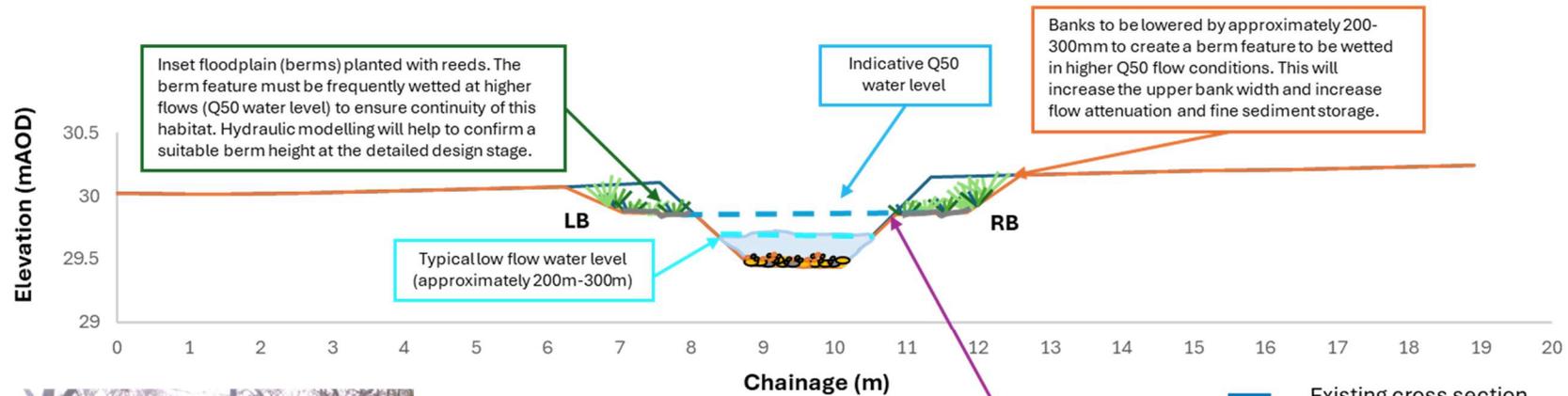
Recommended work	Requirements
	<p>Cardiff Local Nature Partnership and the Cardiff Council Ecologist to ensure this project supports and is incorporated into the wider Cardiff green infrastructure assessment and Nature Recovery Strategy for Cardiff.</p> <p>Further engagement with Welsh Water is required at the detailed design stage to determine whether the proposed options, such as in-channel woody material, pose a risk to existing utilities and therefore require mitigation measures.</p>
Hydraulic model analysis	Detailed hydraulic model analysis is required to assess the flood risk and geomorphological implications of the design including potential impacts to flow and sediment transport dynamics. Hydraulic modelling of the Nant y Wedal should be used in combination with channel survey to determine an appropriate channel width and depth of the re-meandered section and appropriate sizing for the in-channel features.
Sediment sampling	Particle size analysis at several locations across the study reach to establish the natural bed conditions of the Nant y Wedal and D50 sediment size.
Flood Risk Assessment	All interventions will require an assessment into whether they have the potential to influence flood risk. Hydraulic modelling will be required to test the design on flood risk to ensure that there is not increased flood risk to sensitive receptors (properties or infrastructure).
Water Framework Directive Assessment	A Water Framework Directive Assessment of the design will be required to assess potential impacts and benefits of the proposed works on the Roath Brook Water Body.
UXO Risk Assessment	Moderate risk of UXB. The UXO Pre-Desk Study Assessments recommends that a detailed desk study is undertaken.
Costings analysis	To determine the true benefit of the recommended interventions and assess which opportunity would provide the most environmental benefit at a reasonable cost, a full cost benefit analysis is recommended. This should include an assessment of the cost of construction, materials, and labour for any future scheme.
Early Contractor Involvement (ECI)	ECI is recommended at the detailed design stage to ensure the preferred option considers environmentally sensitive approaches to construction methodology, contamination control and waste management.

### 7.3 Conclusions

Additional surveys and detailed design work are required to develop the restoration options for construction. Further engagement with Cardiff Council, Welsh Water and the Friends of Heath Park Woodland group is recommended at the detailed design stage to ensure the scheme is supported by key stakeholders. Utilities such as underground services need to be considered and adequately planned for, prior to undertaking any river restoration works. Minor changes to the design are likely during refinement of detailed designs; however, the basic strategy should remain broadly comparable.

## A Conceptual design drawings

# Channel Shape Restoration

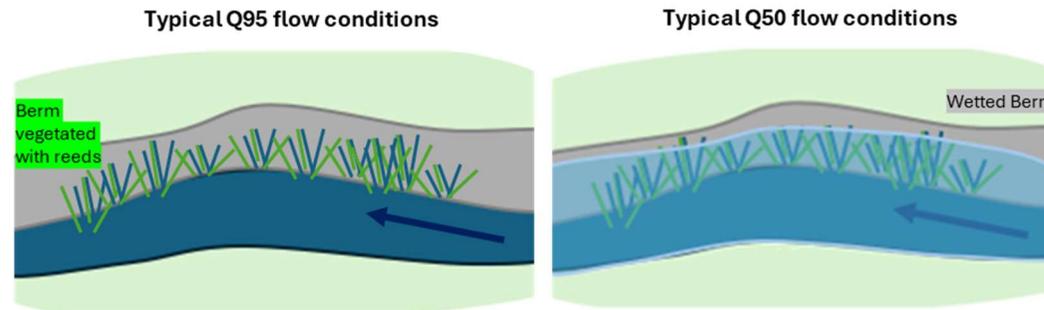


Narrowing of the low flow channel is not proposed as a clear gravel bed was observed on site, suggesting that there is already sufficient energy to transport fine material. The open channel bed width should vary between 1-1.3m (derived from topographic data).

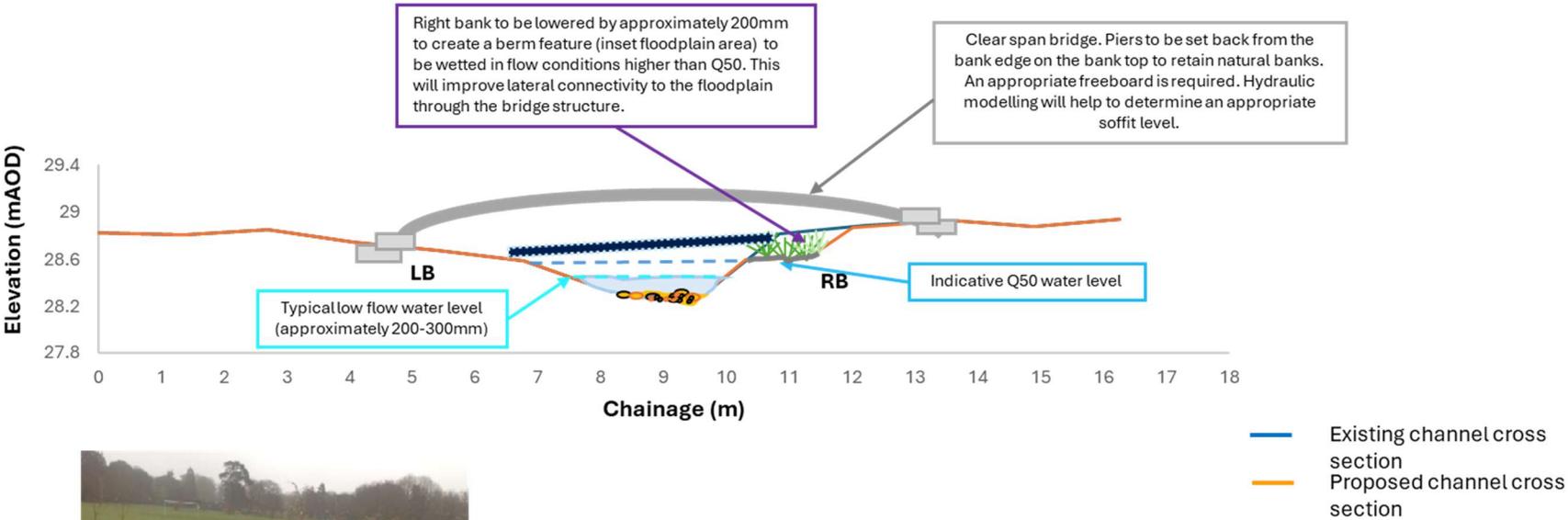
Banks to be lowered by approximately 200-300mm to create a berm feature to be wetted in higher Q50 flow conditions. This will increase the upper bank width and increase flow attenuation and fine sediment storage. Hydraulic modelling will help to confirm a suitable bank height at the detailed design stage.

— Existing cross section  
— Proposed cross section

## Bird-eye view of a berm

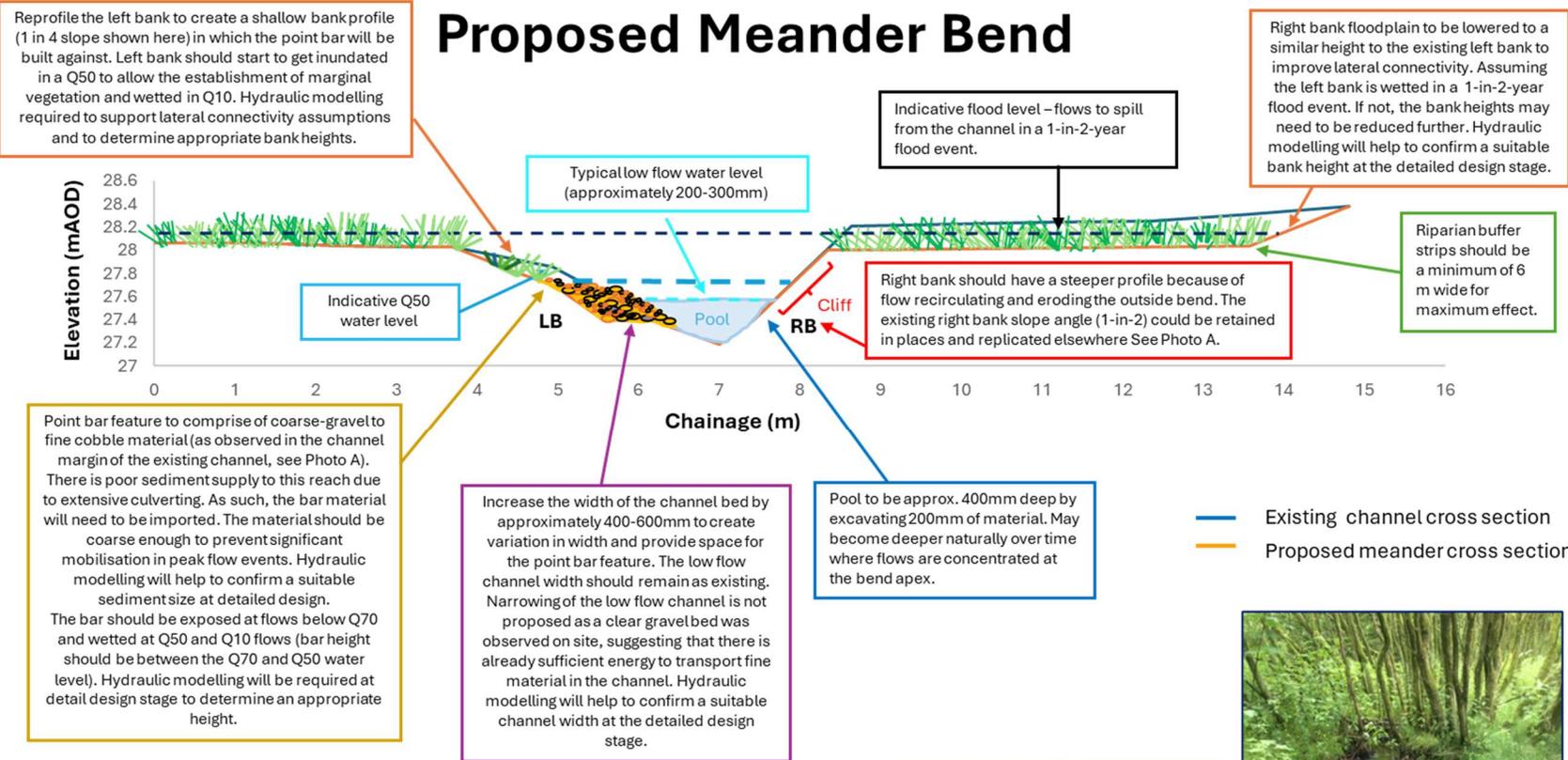


# Footbridge Replacement

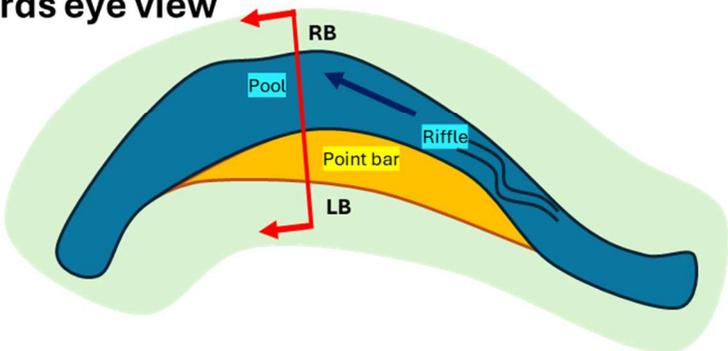


**Photo A**  
Footbridge over the Nant y Wedal channel

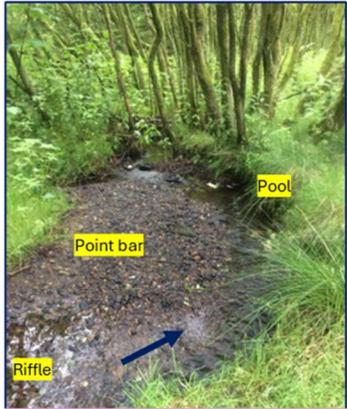
# Proposed Meander Bend



## Birds eye view

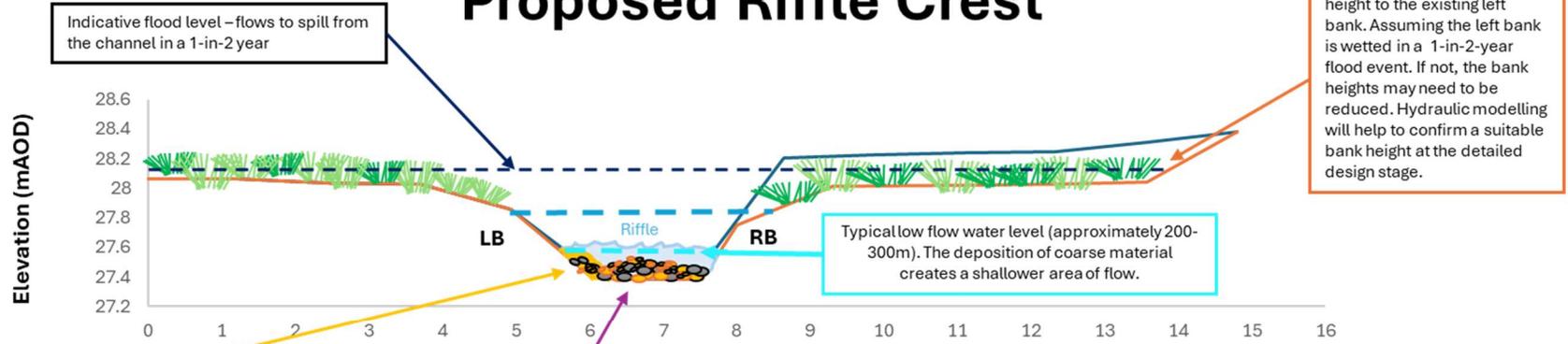


**Photo A**  
Existing Nant y Wedal channel



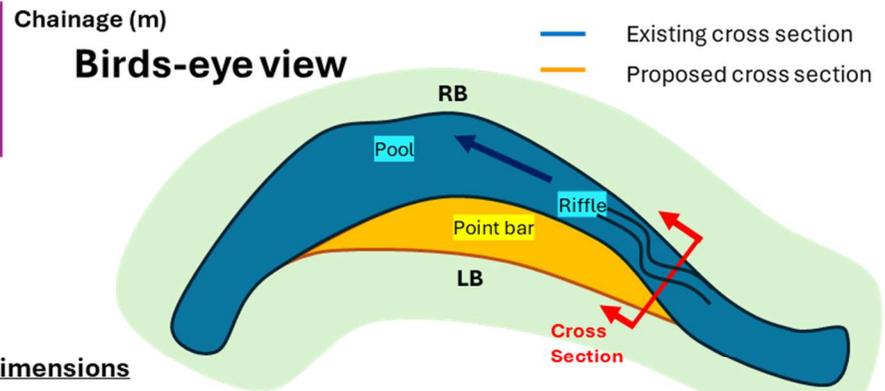
**Photo B**  
Example meander bend in a small stream

# Proposed Riffle Crest

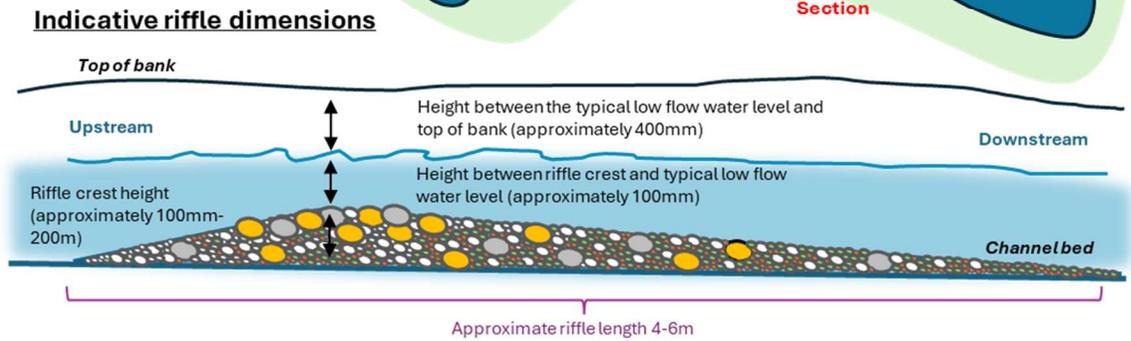


In meandering channels, riffles are often observed along a point bar up until the apex of the meander bend. They are created by deposition of coarse bed material which encourages shallow fast flow with unbroken and slightly broken waves. Riffle to be comprised of coarse gravel-fine cobble material (as observed in the existing channel). Sediment supply is poor to this reach. As such material will need to be imported.

Existing channel bed width is 1-1.3m wide. Increase channel bed width at riffle features by 200-300mm. Narrower than the channel at the bend apex (where the point bar is wider).

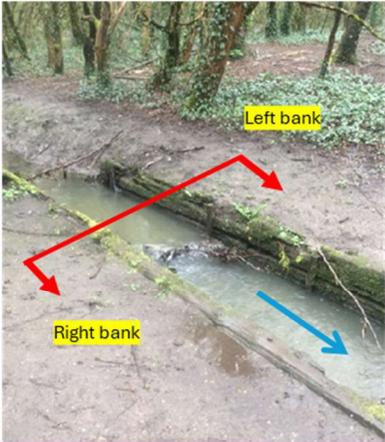
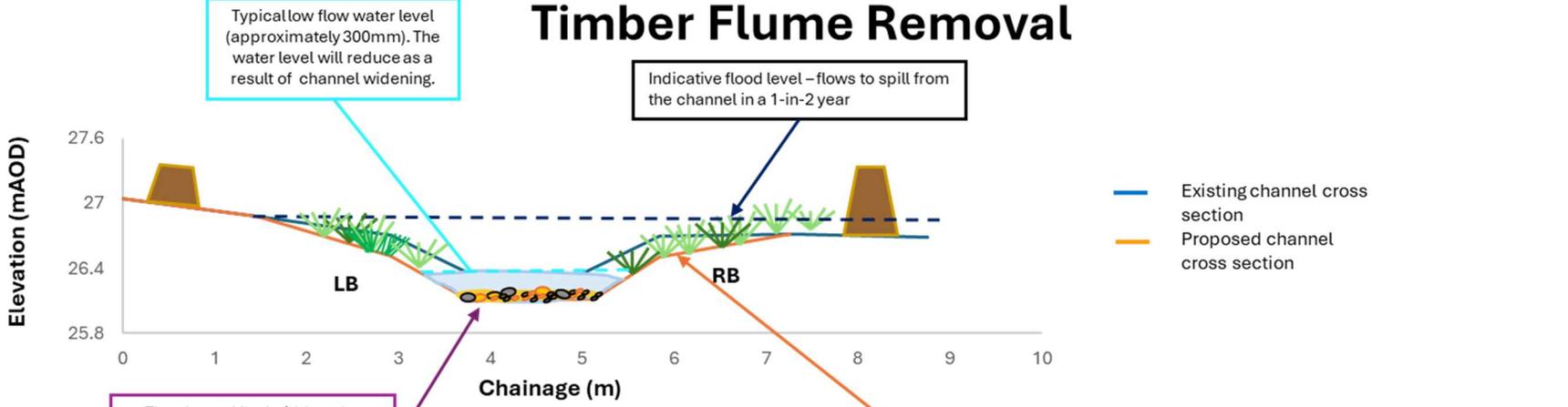


**Photo**  
Riffle in existing Nant y Wedal channel

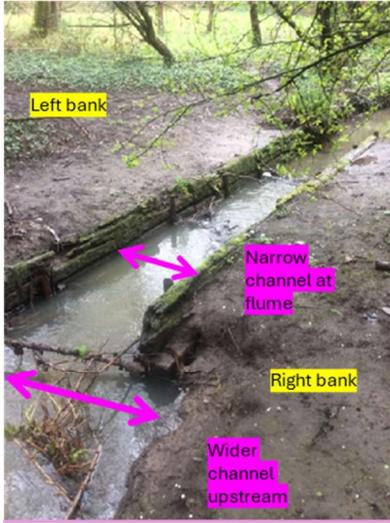


\* Indicative diagram shown with approximate dimensions – hydraulic modelling will help to confirm an appropriate riffle length and height

# Timber Flume Removal



**Photo A**  
Timber flume in existing Nant y Wedal channel (facing upstream)

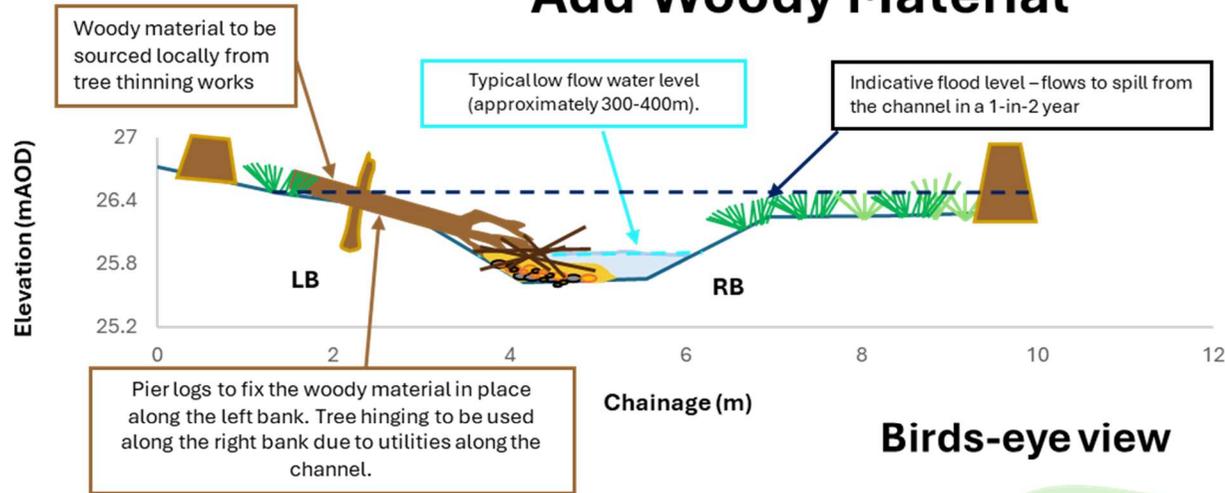


**Photo B**  
Timber flume in existing Nant y Wedal channel (facing downstream)



**Photo C**  
Nant y Wedal channel upstream of flume

# Add Woody Material



Woody material to be placed and fixed across the channel to diversify flows and encourage localised scour and sediment deposition. This may result in the development of pools and in-channel bars, creating morphological diversity. The woody material will also help to encourage flows into the floodplain in peak flow events.

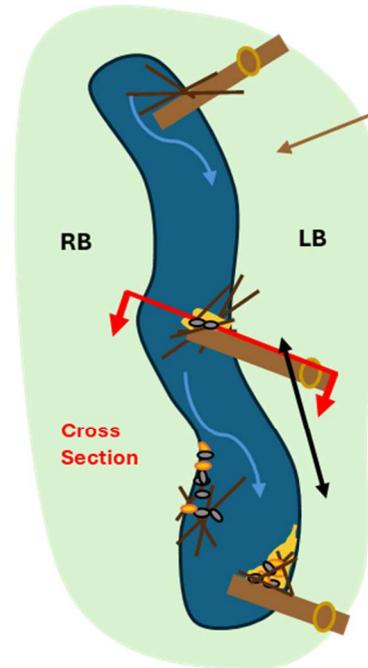
## Birds-eye view



**Photo A**  
Woody material in existing Nant y Wedal channel



**Photo B**  
Woody material in existing Nant y Wedal channel



Hydraulic modelling of this option is recommended at the detailed design stage due to risk of scour close to utilities in the area.

# References

**Offices at**

Bristol  
Coleshill  
Doncaster  
Dublin  
Edinburgh  
Exeter  
Glasgow  
Haywards Heath  
Isle of Man  
Leeds  
Limerick  
Newcastle upon Tyne  
Newport  
Peterborough  
Portsmouth  
Saltaire  
Skipton  
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