

AFON RHONDDA (RHONDDA FAWR AND RHONDDA FACH)

Options for natural flood risk management and opportunities for river enhancement, restoration and aesthetic improvements



For

Natural Resources Wales

FINAL REPORT

June 2014

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Document Revisions

No.	Details	Date
1	Draft Report	May 2014
2	Final Report	June 2014

Disclaimer

These notes are compiled on the basis of the River Restoration Centre® (RRC) expertise and a short walkover site visit. RRC seeks to provide advice and suggestions to facilitate river restoration progress, but is careful not to produce detailed design drawings. In this way the Centre limits its liability. Liability for any restoration designs should be with the consultants tasked with the detailed technical feasibility and design work which will be necessary to take forward any options identified in this document.

RRC is a national centre for information and advice and holds a dataset of river restoration and best practice management works. To inform this inventory please let us know of any progress with this project and also other projects which are carried planned in the future. Please send any information to the RRC (rrc@therrc.co.uk).

Cover images: Rhondda Fach at Maerdy (left); Rhondda Fawr at Gelli (right).

Introduction

Natural Resources Wales (NRW) are in the process of developing a more integrated approach to natural resource management, as outlined in the proposed Wales Environment Bill (due in 2015/16).

The Rhondda is broadly divided into two valleys. The Afon Rhondda (*River Rhondda*) has two major tributaries; the Rhondda Fawr (*Large Rhondda*) and the Rhondda Fach (*Little Rhondda*). Both rivers are heavily modified and engineered, and run predominantly through urban areas where large areas of land have been identified as being at risk of flooding.

From a fisheries perspective, while the Rhondda Fawr is fully accessible by salmon, it is uncertain if the Rhondda Fach is accessible as it has been stocked with Salmon (2011 data). The Fawr waterbody is at ~~Bad~~?WFD ecological status (2011 data). Reasons for failure include poor morphology and water chemistry. The Fach waterbody is at ~~Moderate~~?WFD ecological status (2011). An internal Environment Agency investigation in 2011 identified barriers and possible easement measures.

The RRC has been asked to support this process by helping to identify options for natural flood risk management and opportunities for river enhancement, restoration and aesthetic improvement.

Aims of the report

This scoping report aims to outline:

- Options for more natural flood risk management (including restoration and re-meandering);
- Opportunities for habitat improvement, restoration and enhancement;
- Initiatives to champion the environment in the context of sustainable development, to create better places for people and wildlife.

Various options may be delivered by a range of authorities, agencies and local interest groups, and many could be adopted and integrated into local planning aspirations and policies. Some will require significant capital investment. Others could be possible with community engagement and action. Opportunities identified within the Rhondda Cynon Taf Local Development Plan up to 2021 [[link](#)] for improvement of the River Rhondda and its tributaries and redevelopment may support some of the aspirations in this report to be realised. These are referred to within the relevant reach-scale map.

Reach-scale opportunity maps

A desk-based assessment by NRW and RRC, using satellite maps, helped to identify potential areas where there may be an opportunity to overcome ~~?~~pressures?(e.g. culverts, river disconnected from their floodplain). Twelve reaches were identified and these were ground truthed over a two-day site visit (Figure 1). Eight are on the Rhondda Fawr (refer to maps 1-8 in the next section of the report), three are on the Rhondda Fach (maps 9-11) and one is at the confluence of the two rivers. For each opportunity identified, an assessment has been made about potential ecosystem service benefits; an indicative cost; and the ease of delivery; using the following symbols.

Ecosystem service benefits

ECO = Economic

FSH	= Fisheries
FRM	= Flood Risk Management/ Natural Flood Management
HBF	= Habitat/ Biodiversity/ Fisheries
SAE	= Social/ Amenity/ Education

Indicative cost category

£	= £0-10,000
££	= £10,000-50,000
£££	= £50,000+

Deliverability category

- D1 = Options which could be by coordinated and implemented by local groups/ volunteers.
- D2 = Projects that have one or more significant constraints that would require design and consultation efforts to implement.
- D3 = Complex projects which would require significant design and development inputs involving multiple landowners, consents, permissions and long-term management requirements.

Many of the D2 and D3 schemes could be developed in stages depending on funds available and the need, timing and extent of works. Not only would many of these enhance the wildlife corridor function of the Rhondda valley; but they would also reflect the wider regeneration of this area.

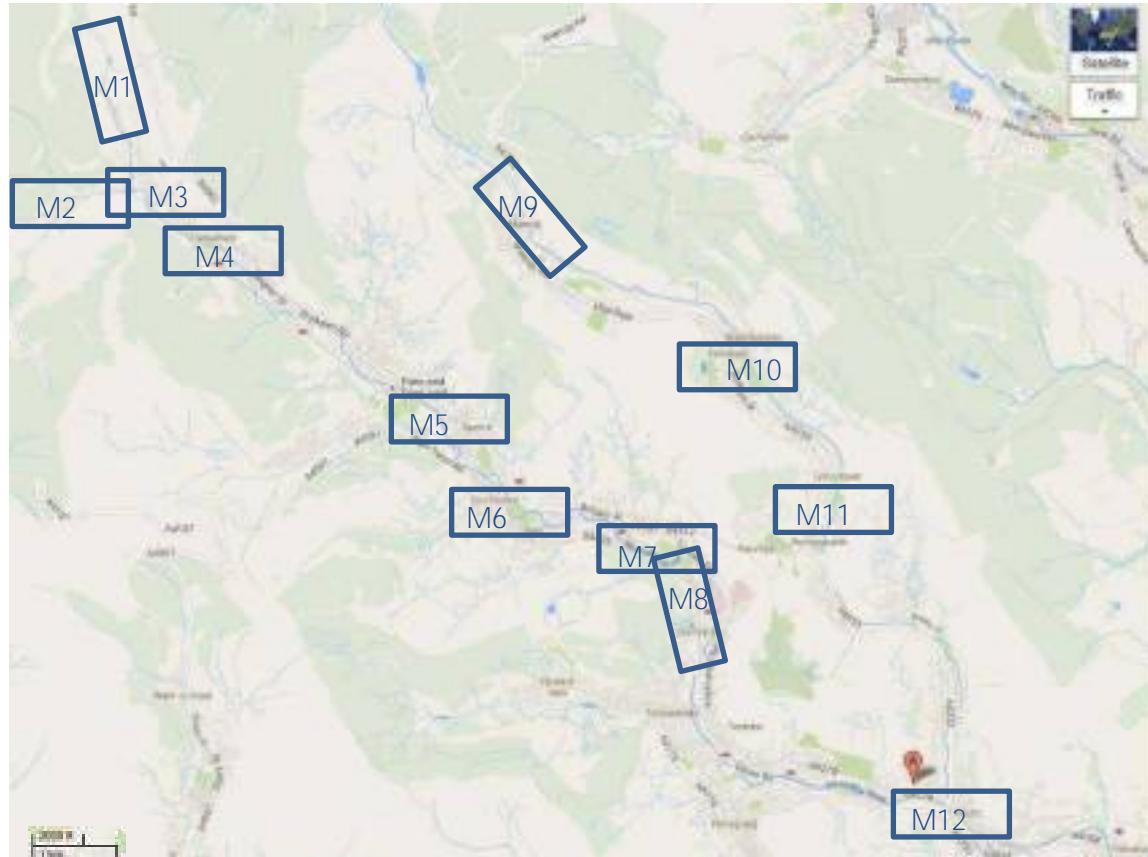


Figure 1 Rhondda Valley overview map (M1-12 indicates which reach-scale map to refer to). ©Google Maps 2014

Constraints

- Very steep, confined valley sides
- Large slag heaps dominate the landscape
- River is disconnected from its floodplain
- River is confined between bridges and gabions (flood alleviation works)
- Rapid hill slope runoff with little natural vegetation to buffer/ intercept precipitation
- Land subsidence risk

Links to existing plans/ policies

Rhondda Cynon Taf LDP Policy NSA 5 ? A strategic site for development (residential and open space), subject to a large-scale reclamation scheme. Plans include the restoration of channels and green corridors for the Rhondda Fawr and its tributaries.

Opportunities

All generic - bearing in mind plans to redevelop the site:

- Regrade slag heaps and move material to natural depressions at the foot of steep slopes.
- Restrict the flow by blocking the bottom of straight channel drains and culverts to encourage water to back up and attenuate on the land, slowing the flow? At the foot of one slope, wetland was found. Extend this area (see top photo, right column).
- Remove redundant hard standings that generate runoff rills and gullies. Use permeable gravels.

Ecosystem service benefits

- FRM
- ECO (may increase property values in Blaenrhondda if redevelopment with new green infrastructure).

To investigate

- Flow pathways, runoff rates & land at potential risk of subsidence, e.g. using a rainfall-runoff model.
- Rise/ fall in river levels in comparison to the height of existing flood defence gabions, using photos.

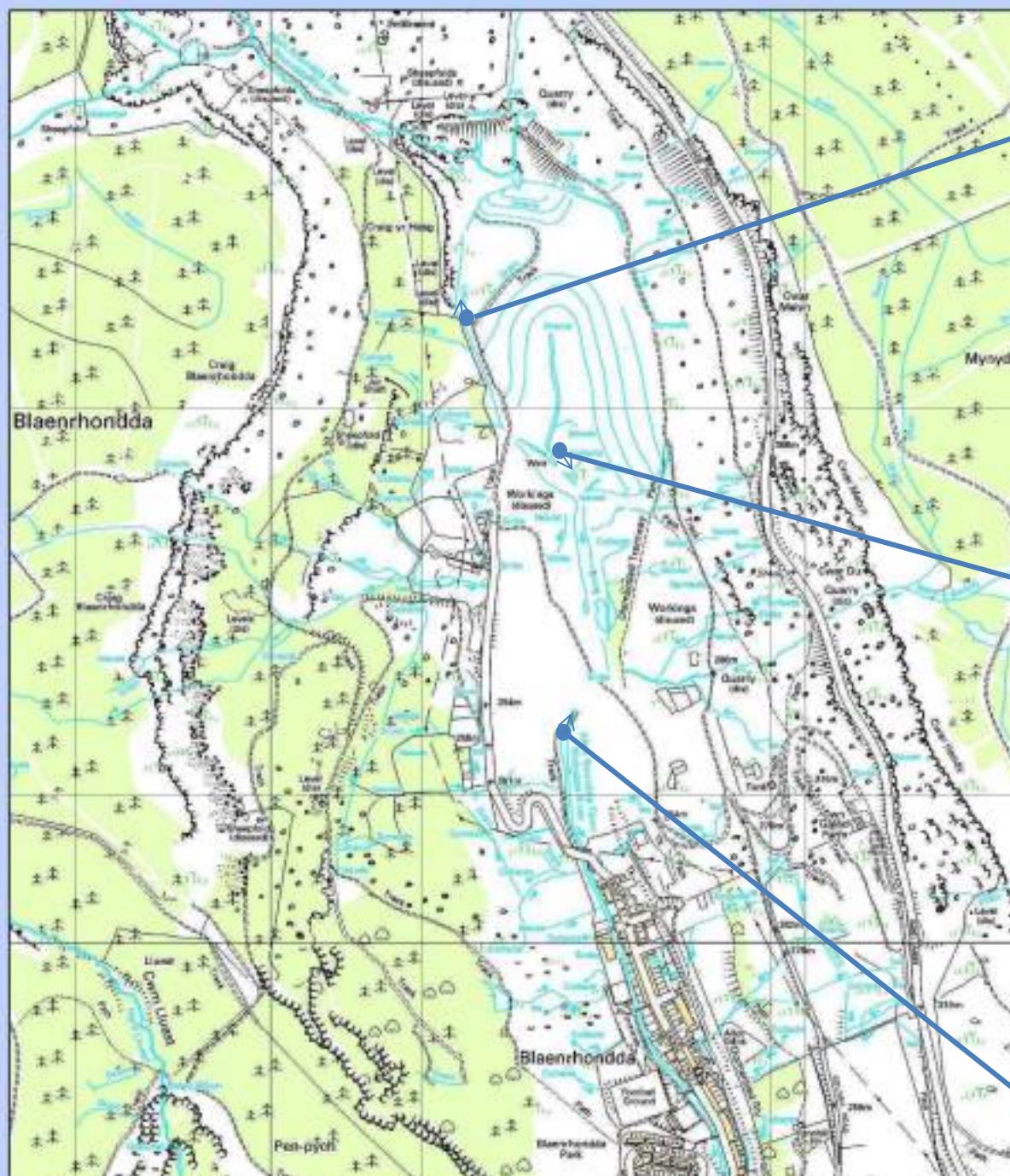
Indicative cost category

£££ (likely to require a development scheme to deliver)

Deliverability category

D3

Map 1: Former Fernhill Colliery Site, Blaenrhondda



Coordinate System: British National Grid

Projection: Transverse Mercator

Datum: OSGB 1936

False Easting: 400,000,000.000

False Northing: -100,000,000.000

Central Meridian: -2.0000

Scale Factor: 0.9996

Latitude Of Origin: 49.0000

Units: Meter

Scale 1:10,000

0 125 250 500 Meters



An area of Wetland?(left of photo) could be extended by blocking the bottom of culvert drains, to diversify habitat.



Steep, straight drains and gullies into the sides of the hill slopes, cause rapid rates of overland flow to the river.



Modified banks (flood defence works in the 1970s).

Constraints

- Steep in part, confined valley sides
- Nant y Gwair has been straightened as it flows north of the settlement of Blaencwm and is confined within blockstone (following flood alleviation works in the 1970s)

Links to existing plans/ policies

No existing development plans for this site within the Rhondda Cynon Taf Local Development Plan.

Opportunities

- Extend depressions in the land, block drains or create scrapes in the valley of the Nant Seisig (above Blaencwm) to increase flood storage.
- Alongside the left bank of the Nant Y Gwair, a biodiversity management scheme to improve an area of riparian land adjacent to the riverside path would improve ecological connectivity.
- An information board could be erected to educate people about the importance of the existing variety of river and wetland habitats (ponds, SUDs, wet woodland) in this reach.
- Enhance underutilised green space (close to Dilys Street) where wetland scrapes or a community pond could be created to add biodiversity value.

Ecosystem service benefits

- FRM
- SAE (provision of local community open space)
- HBF

To investigate

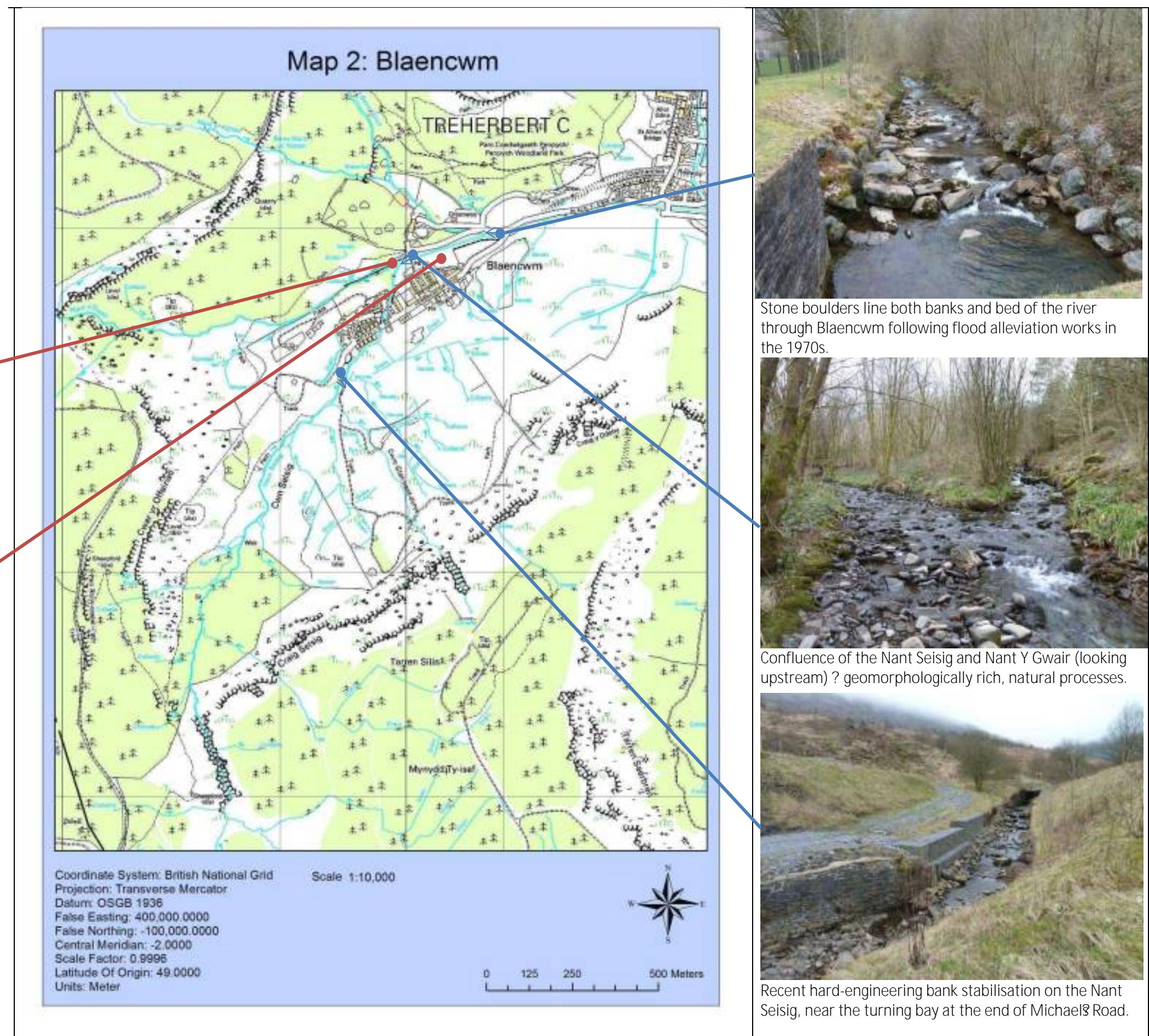
- If there is a management plan for the green space.
- The topography of the green space land to identify if a wetland scrape/ community pond is feasible.
- Community interest in creating a scrape/pond.

Indicative cost category

£ (apart from ££ for Nant Seisig opportunity)

Deliverability category

D1 (apart from D2 for Nant Seisig opportunity)



Constraints

- Flood prone residential area (terraced housing).
- River is disconnected from its floodplain
- Derelict land (marked Works on map) close to the river is marked as a 1 in a 100 year flood storage area but asbestos/ tipped material is held on site.
- Convergence of tributaries/ drains discharging into the Rhondda Fawr (upstream of, and alongside the Works site) puts pressure on the conveyance of the river around Eileen Place.

Links to existing plans/ policies

No existing development plans for this site within the Rhondda Cynon Taf Local Development Plan.

Opportunities

- Given the proximity of the river to the disused site, there is scope for biodiversity and flood risk gains by redeveloping this area. There is a small embankment between the river and the site which should be lowered to create a more natural gradient from the tributary down to the Works site. Sustainable urban drainage should be considered.
- The bridge between the site and Eileen Place could be removed to prevent floodwaters backing up.

Ecosystem service benefits

- FRM
- HBF
- ECO (redevelopment)
- SAE (ideal location to work with local businesses and local people to promote the sustainable use of water by creating community scrapes/ sustainable urban drainage ponds to slow surface water flow to the river by attenuating more on site; at the same time increasing flood storage area)

To investigate

The extent of tipped material and asbestos on the old Works site. Secure the site.

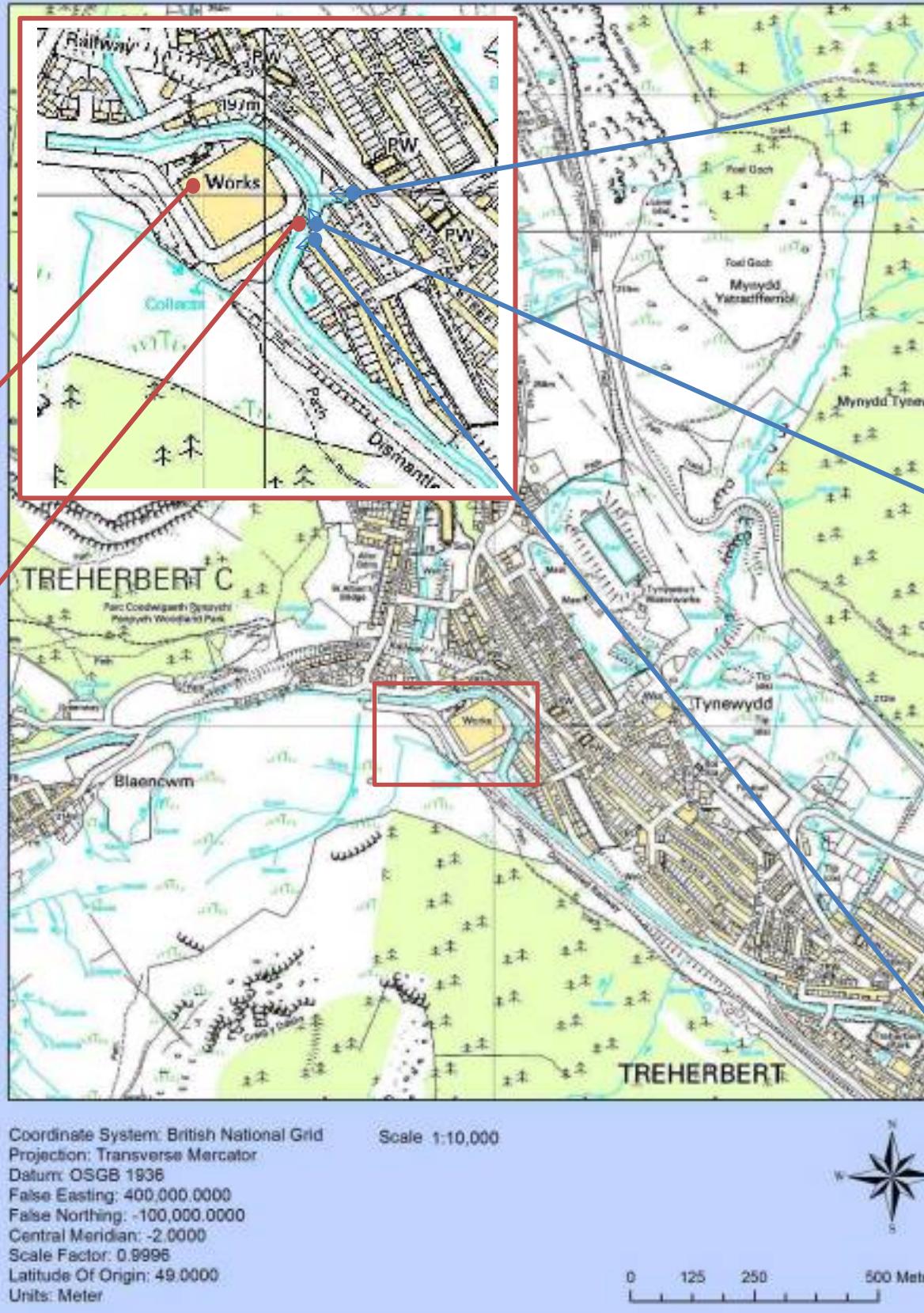
Indicative cost category

EE

Deliverability category

D3

Map 3: Undeveloped site, Twnewydd



The Nant Ystradffernois feeds into the Rhondda east of the undeveloped site.



Heaped piles of scrap materials on the undeveloped site.



Flood walls on the left bank, downstream of the footbridge from the undeveloped site to Eileen Place.

Constraints

- River is disconnected from its floodplain and confined between road and rail infrastructure.
- Numerous outfalls discharge water in this section. Sewage fungus at a covered manhole on the river (west of Oak Street) was observed and reported.

Links to existing plans/ policies

No existing development plans for this site within the Rhondda Cynon Taf Local Development Plan.

Opportunities

There is an underutilised area of rough grassland next to the Industrial Estate buildings off Cwmsaerbren Street. Shallower embankments indicate that the river is less disconnected from its floodplain than in other reaches of the upper Afon Fawr. The industrial estate should consider the potential benefits of creating a series of sustainable urban drainage ponds to better manage runoff from their site. The land adjacent to their site will need to be partly excavated and terraced to achieve this. This would improve the biodiversity and amenity value of the site which is known to be a popular route for walkers.

Ecosystem service benefits

- FRM
- HBF
- SAE (information boards could be erected to show for example the detrimental impact that litter has on river ecology).
- ECO (provision of green space within the industrial site, adding value to the building units)

To investigate

Approach the industrial estate conglomerate to find out if they are aware of sustainable urban drainage options and illustrate the potential economic savings that could be made by implementing a SUDs scheme.

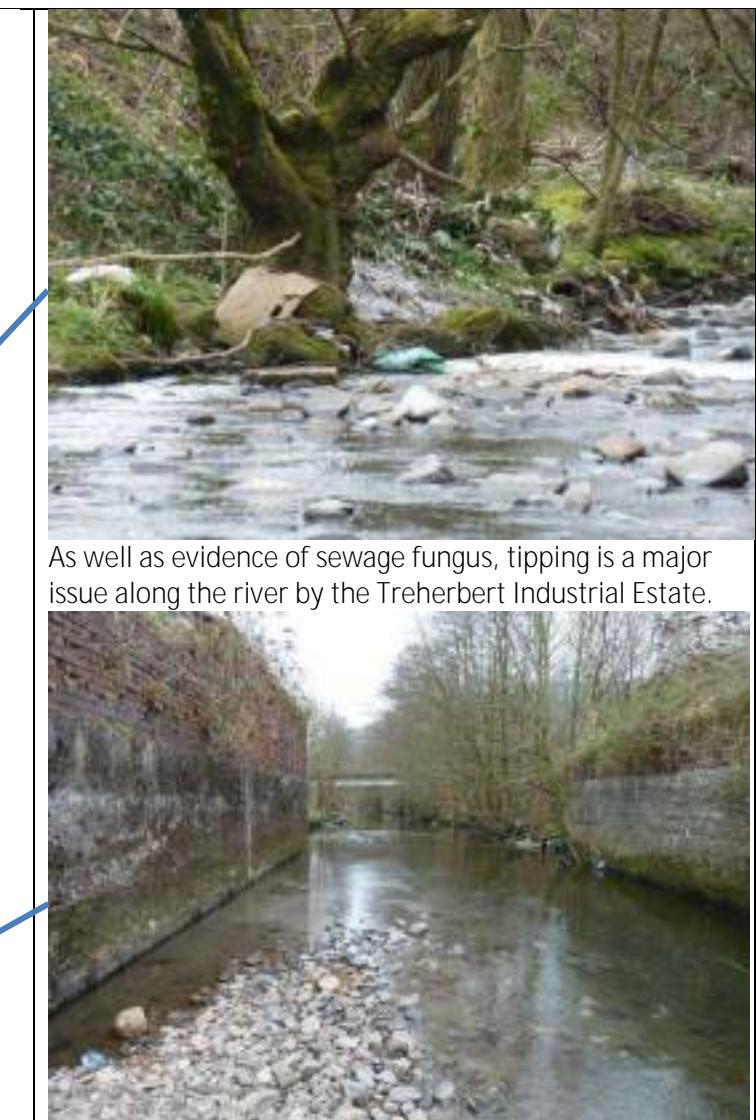
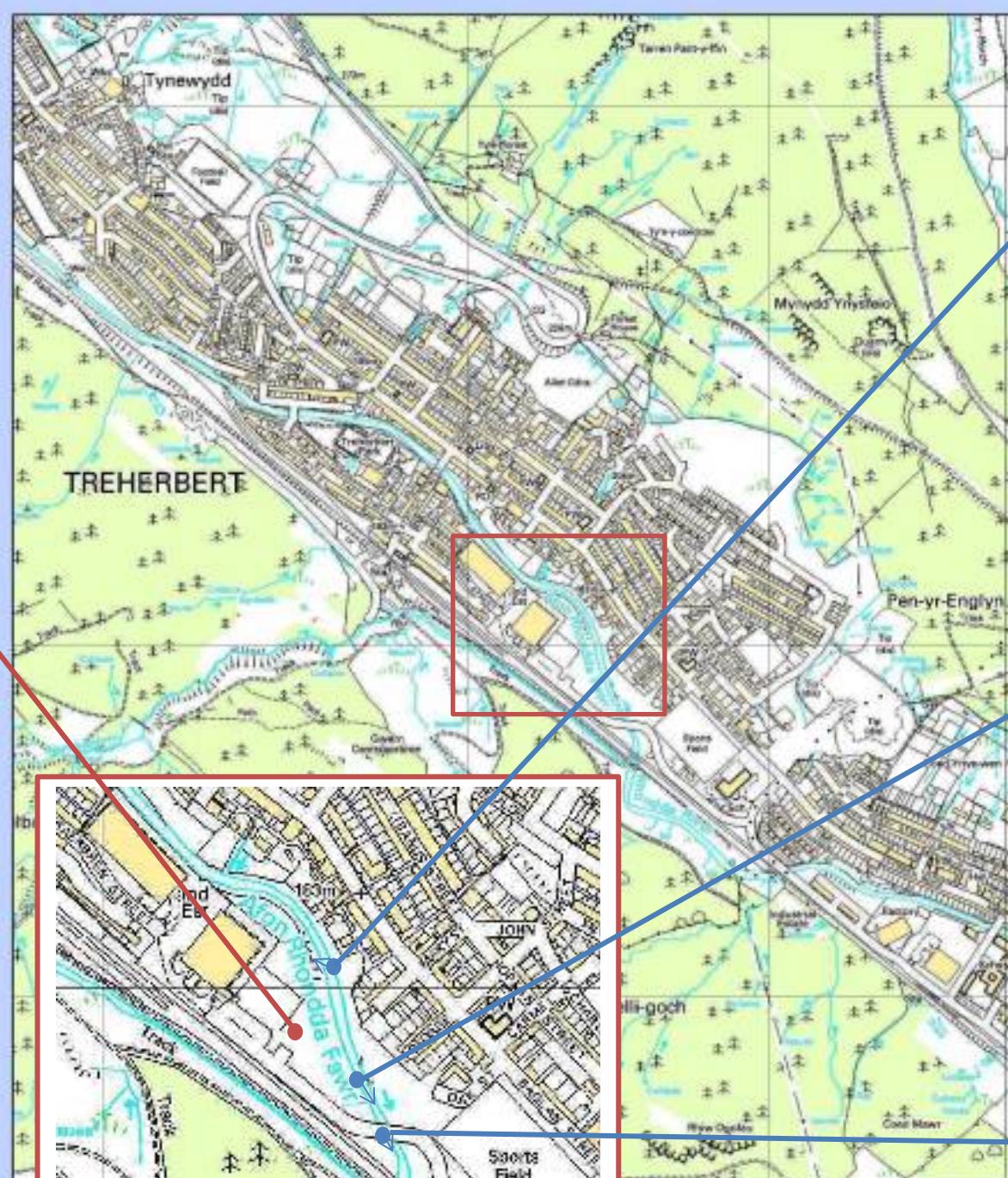
Indicative cost category

££

Deliverability category

D2

Map 4: Treherbert Industrial Estate



As well as evidence of sewage fungus, tipping is a major issue along the river by the Treherbert Industrial Estate.



Redundant bridge piers line the channel upstream of the Treherbert Sports Field.

Sediment bars, which improve river habitat variability, show that natural geomorphic processes are occurring in this section between the Sports Field and the railway line.

Constraints

- River is disconnected from its floodplain.
- River is confined through the town of Treorchy.

Links to existing plans/ policies

Rhondda Cynon Taf Local Development Plan up to 2021 Policy Cae Mawr Industrial Estate ? A non-strategic site where any redevelopment scheme would need to address flood risk.

Opportunities

- Installing a series of 3-4 low lying woody deflectors upstream of the road bridge would encourage small scale morphological diversity. Small willow trees have rooted and narrow strips of gravel have deposited around these, within the edges of the channel upstream of the road bridge. The Council and NRW should collaboratively trial sensitive channel maintenance in this short section to observe whether valuable in-channel habitats and a healthy riparian zone will establish naturally. Flood risk managers should be encouraged to visit this site and an information board could be erected to demonstrate the value of natural river features including wood. Unless it affects flood risk, it should be retained in situ.
- Litter is a major issue. This could be managed by setting up an Afon Rhondda Friends of Group who could do clean up events. This would help to empower local volunteers and may encourage residents and locals to better appreciate the river.

Ecosystem service benefits

- FRM (addressing flood risk through development).
- ECO (redevelopment as industrial units)
- HBF (as a result of sensitive channel maintenance)
- SAE (information boards, river clean-up events)

To investigate

Potential plans for the Cae Mawr Industrial Estate.

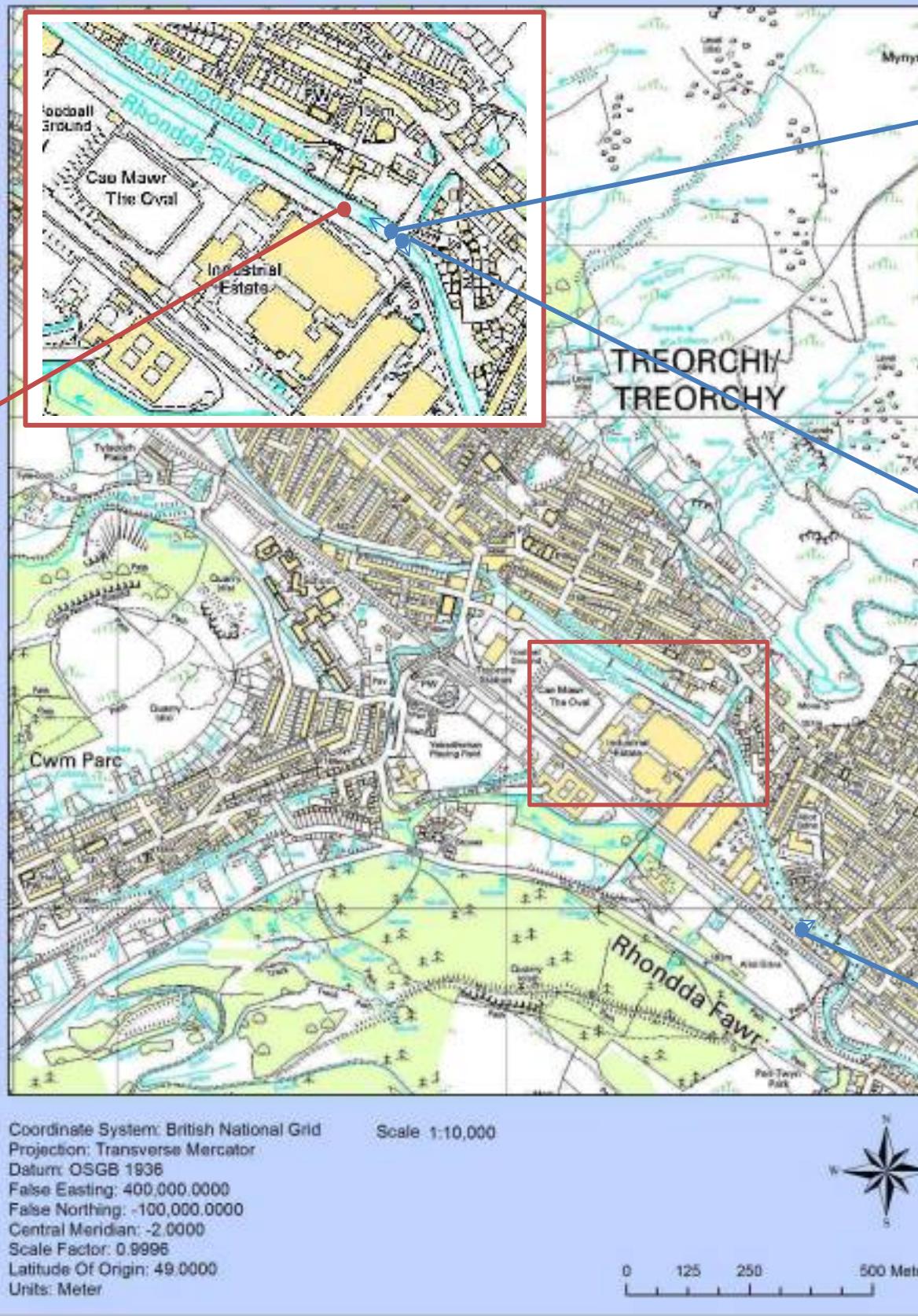
Indicative cost category

££

Deliverability category

D2

Map 5: Cae Mawr Industrial Estate site, Treorchy



Straightened channel (upstream of bridge) where gravel deposits provide a base for tree growth at the margins.



Riparian areas between the river and flood walls provide habitat and act as a buffer zone, preventing undercutting.



Litter should be removed. Residents overlooking the river should be encouraged to get involved in clean up events.

Constraints

- River is disconnected from its floodplain.
- Anthropogenic control/ modification of the river. The river was widened to construct the railway bridge and as the flow has favoured the left arc channel (photo 1, right column), sediment deposits in large shoals on the right bank as the channel loses energy and drops its load. Annual deshoaling has lowered the bed level and a dip downstream of the bridge caused undercutting of the exposed central bridge pier until concrete was used to prevent this.

Links to existing plans/ policies

No existing development plans for this site within the Rhondda Cynon Taf Local Development Plan.

Opportunities

- Review the purpose of deshoaling (in red rectangle). Assess potential risks of further bed lowering, e.g. destabilisation of the toe on the outside of the meander where the wall is starting to be undercut. In future this may require expensive capital works to stabilise the slope (up to the Pen-Twyn Road) if the bed level continues to lower due to deshoaling.
- Reduce the height of the left bank and erect a bund set back on the floodplain to increase channel conveyance through this section. A defunct utilities pipe on the left bank could be removed.

Ecosystem service benefits

- ECO (reduced maintenance costs)
- FRM

To investigate

- What guidelines are currently adhered to regarding the removal of sediment? (Quantity and coverage?)
- Left bank ownership
- Local students could investigate the critical bed level whereby if shoal levels are lower, deshoaling may not be necessary.

Indicative cost category

££

Deliverability category

D2

Map 6: Ton Pentre



Deshoaling has led to a drop in the bed level. Large stone slabs cover the river bed and banks under the bridge to stop it headcutting upstream. Willow/alder trees would have been at bank level but now they are high and dry?



Gravel piled on the bank could be mobilised in a flood.



Deshoaling has likely led to a drop in the bed level (by up to 1m). Fast outer bend flows are undercutting the bank.

Constraints

- River is disconnected from its floodplain.
- Flood alleviation scheme has led to steel sheet piled banks along both sides of the river for circa 200m.
- Annual deshoaling is carried out to maintain flood conveyance.

Links to existing plans/ policies

No existing development plans for this site within the Rhondda Cynon Taf Local Development Plan.

Opportunities

- Review the cost- benefits of annual deshoaling.
- A small area of amenity space on the left floodplain could be used to create storage for floodwaters, to reduce flood peaks downstream. The left bank could be excavated to a more natural gradient (30-45°) on the inside of the bend to reconnect the river with its floodplain (dashed red arrows). Additional storage could be made available on land adjacent to the river (a training pitch). The spoil gained could be used to create an embankment in front of the railway (green oval in inset map). The existing path on the north edge of the green space may need to be moved, either onto the embankment or nearer the river.
- Volunteer events to better maintain and enhance the green space and walkways to foster a greater local public interest in conserving biodiversity.

Ecosystem service benefits

- FRM
- ECO (reduced maintenance costs).
- HBF
- SAE (as an example of natural flood management in the local community).

To investigate

If there is an existing management plan for this area.

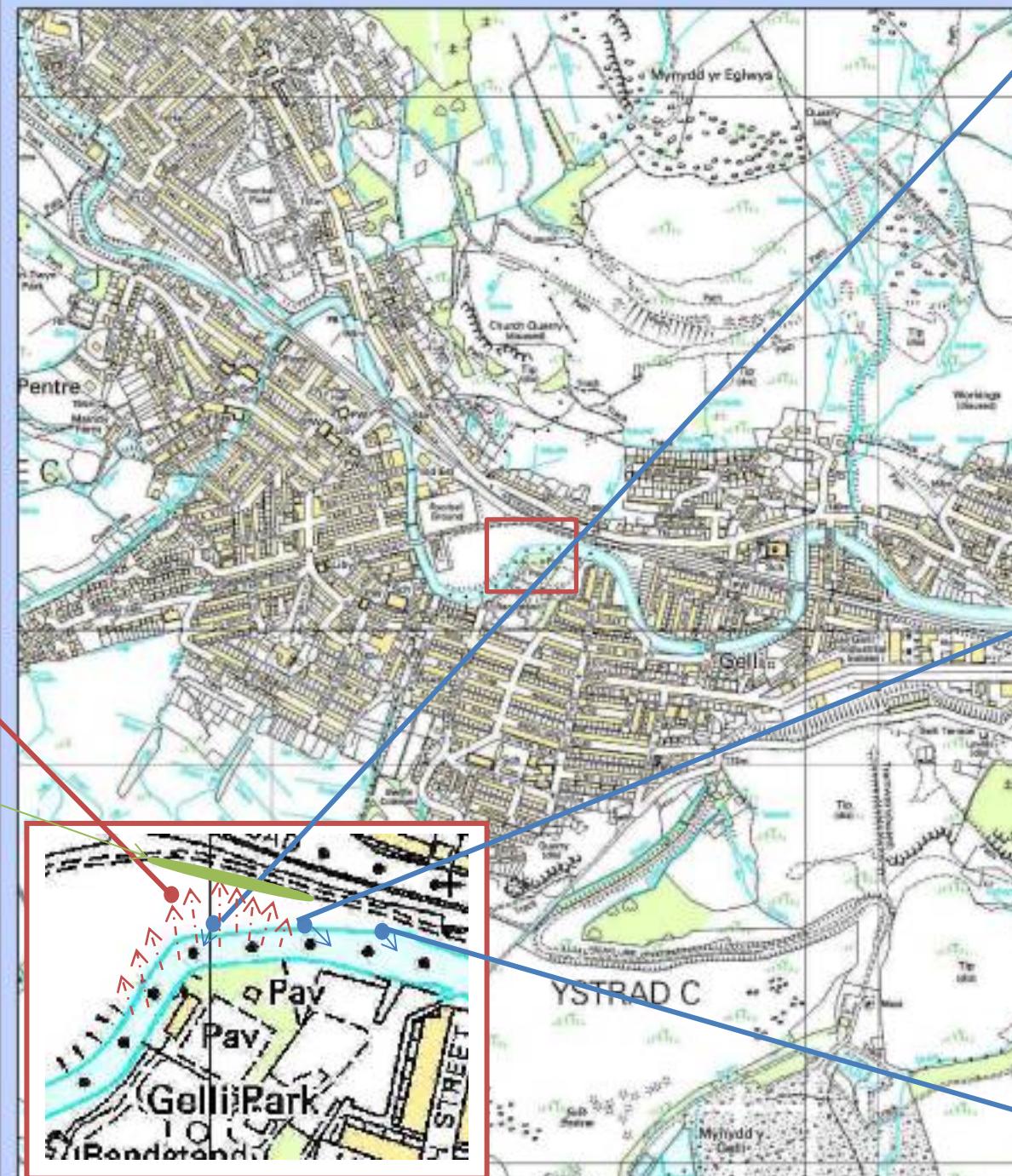
Indicative cost category

Volunteer events (E)/ floodplain reconnection (FFF)

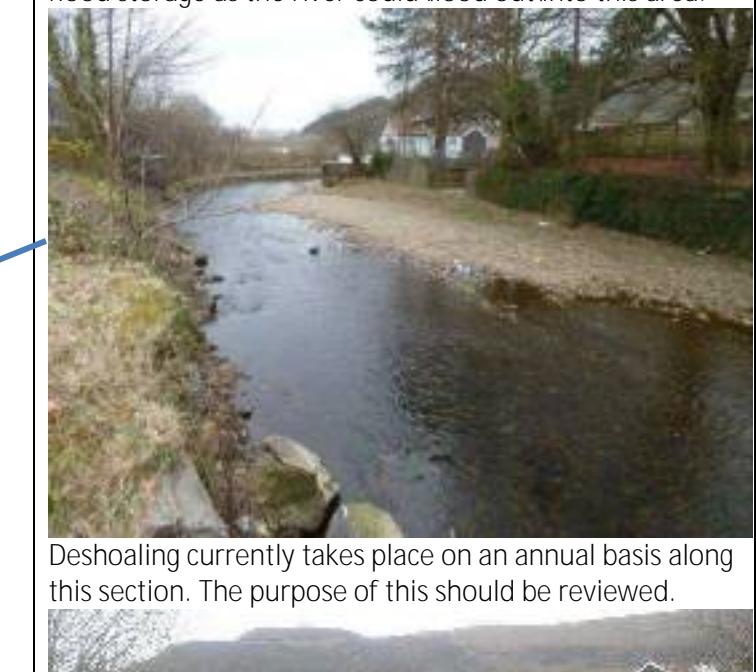
Deliverability category

D1/D3

Map 7: Green space opposite Gelli Park (left bank)



Lowering and reprofiling the left bank could increase flood storage as the river could flood out?into this area.



Deshoaling currently takes place on an annual basis along this section. The purpose of this should be reviewed.



Flood walls erected as part of a flood alleviation scheme line the right bank, from an outfall downstream of the deshoaled section to the Tysaf Road bridge.

Constraints

- The SINC is circa 15m below the Nant-y-Gwyddon Road.
- Difficult to access this area of land (railway on the left bank).

Links to existing plans/ policies

No existing development plans for this site within the Rhondda Cynon Taf Local Development Plan. SINC status helps raise awareness of its importance for wildlife and makes it a focus for nature conservation.

Opportunities

- Add features in channel to encourage water to flow out on to the floodplain (e.g. wood deflectors to allow natural processes to raise the bed level in a few areas without having to add gravel). Existing depressions in the floodplain could be widened to create a range of different sized wetland scrapes.
- Promote the whole of the SINC as a reference site for degraded sections of the Afon Rhondda. The level of the river banks are more natural and the river is connected with its floodplain.
- Work with Keep Wales Tidy as currently the SINC is used as a fly-tipping site. Work with businesses nearby to tackle the car park litter problem.
- Consider increasing public accessibility to the SINC. Given that Craig Pont Rhondda and Craig Nant y Gwyddon are popular walking areas in the hills above the Natural Resources Wales car park off the Nant-y-Gwyddon Road, this area could attract both visitors and locals. Boardwalks may help to increase access to the site without comprising biodiversity.

Ecosystem service benefits

- HBF
- SAE (as an example of the Natural River Rhondda).

To investigate

- Current management plan for the SINC.

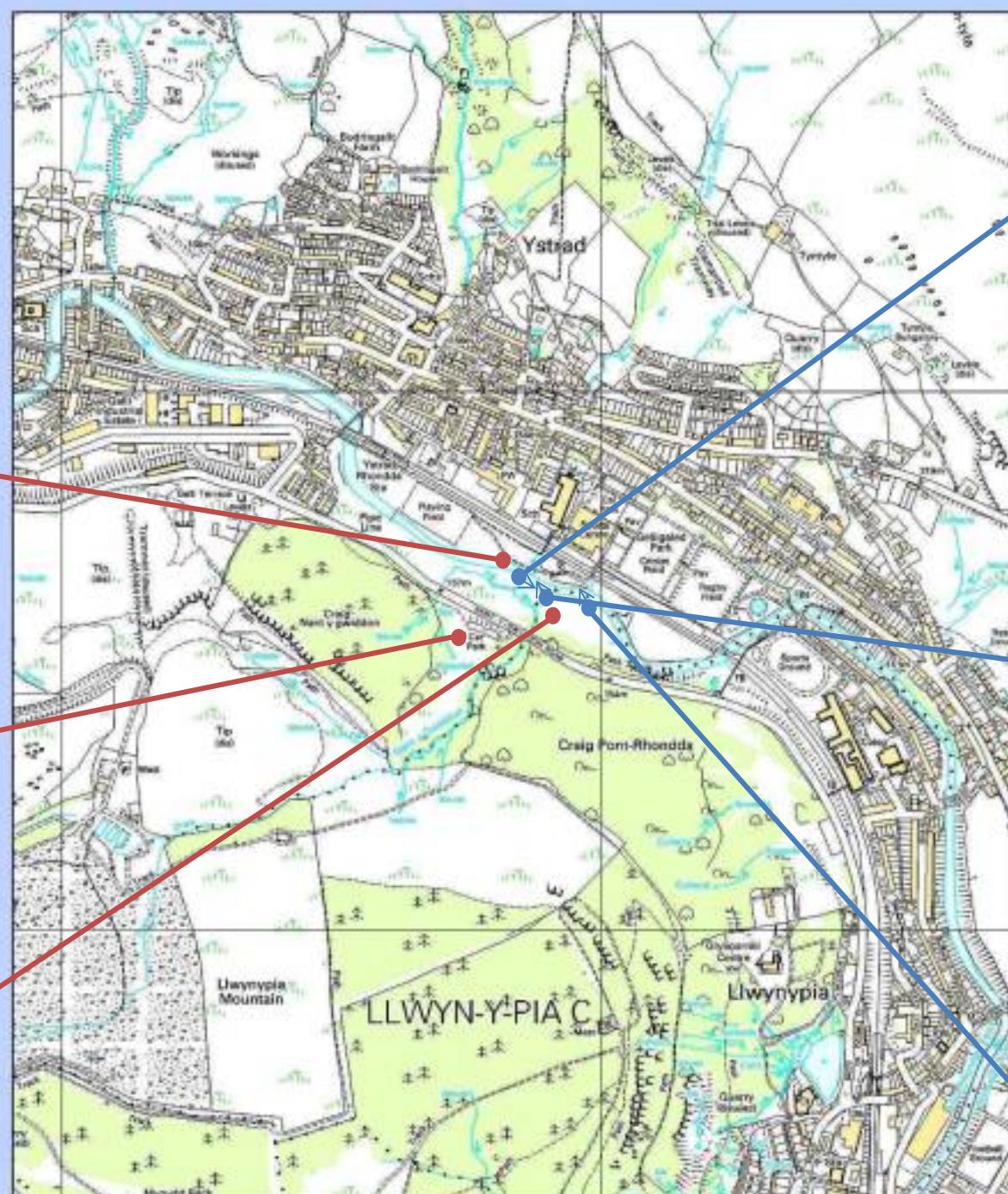
Indicative cost category

££

Deliverability category

D2

Map 8: Site of Important Nature Conservation (SINC)



Coordinate System: British National Grid

Projection: Transverse Mercator

Datum: OSGB 1936

False Easting: 400,000,000.000

False Northing: -100,000,000.000

Central Meridian: -2.0000

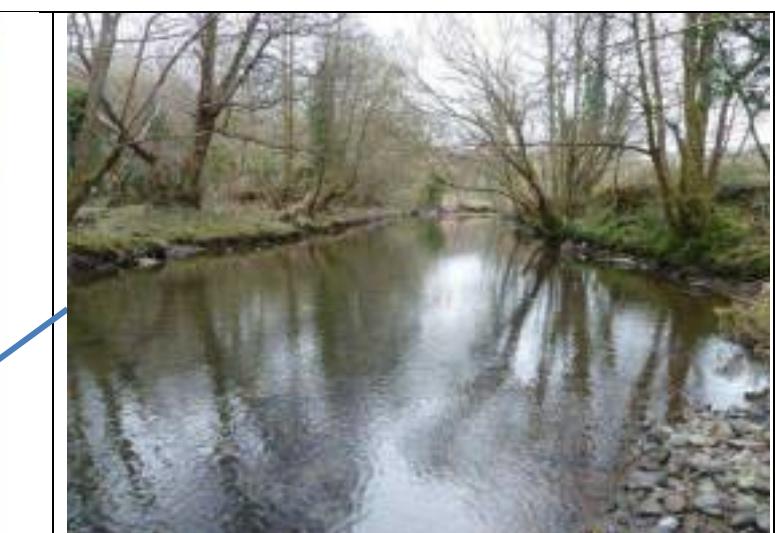
Scale Factor: 0.9996

Latitude Of Origin: 49.0000

Units: Meter

Scale 1:10,000

0 125 250 500 Meters



The channel is much wider than in the constrained upstream and downstream reaches. As the land is not built up, the levels are more natural and the river is connected with its floodplain with a good riparian edge.



Litter is a key concern throughout the length of the SINC.



A side channel provides morphological diversity and refuge for aquatic fauna.

Constraints

- River is disconnected from its floodplain.
- The river is constrained by bridge crossings, the disused railway line and tipped material along this section.

Links to existing plans/ policies

Rhondda Cynon Taf Local Development Plan up to 2021 Policy NSA 4 ? A strategic site for the construction of 1 hectare of employment land, visitor centre and an area of informal recreation contained in a historic landscape.

Opportunities

- As part of any redevelopment plan, there would be an opportunity to excavate the land to recreate a low level floodplain to increase capacity for flood storage. Currently there is a wide, flat area of land adjacent to the river but as the right bank is circa 3m higher than the river bed, water is unlikely to overtop it. The spoil gained from excavating a low level floodplain could be used to raise the land which will be built on. This would reduce flood risk to new buildings etc. (refer to inset box).
- Downstream of Maerdy Park, willow trees and coarse sediment could be used to stabilise the bank. Currently unconsolidated fine gravels, unprotected behind large boulders placed at the foot of the bank, appear to be picked up by the river in flood flows. In sections of the river, either bank could be regraded to a more natural gradient (30°) to widen the capacity of the river corridor, lowering the risk of further bank erosion.

Ecosystem service benefits

- FRM
- HBF
- ECO

To investigate

The interest from developers in pursuing opportunity 1.

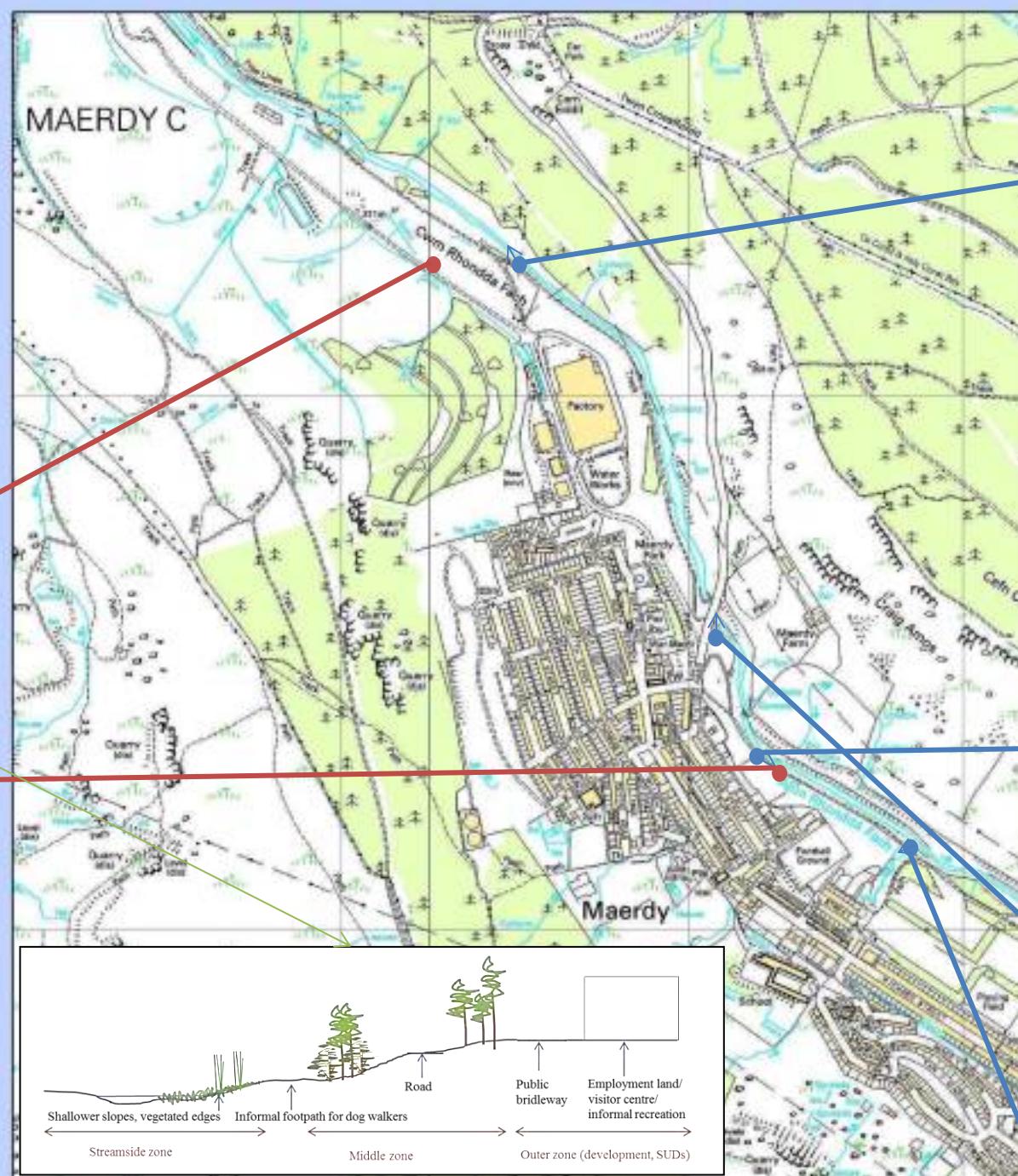
Indicative cost category

£££

Deliverability category

D3

Map 9: Former Maerdy Colliery



The typical cross-section at the top of the Rhondda Fach. There is an opportunity to recreate flood storage given policy NSA 4 in the local plan which identifies this to be a potential development area.



On the right bank (right of photo), unconsolidated fine material behind boulders is being eroded in high flows.



Two existing sustainable drainage areas.

Constraints

- The Ferndale and Highfields Industrial Estate is high above the river.

Links to existing plans/ policies

Rhondda Cynon Taf Local Development Plan up to 2021
? Ferndale and Highfields Industrial Estate, Maerdy. 8.38 Ha of cleared, brownfield land, identified as an area for employment allocations.

Opportunities

Any development of the Ferndale and Highfields Industrial Estate on land high above the river should look to incorporate green infrastructure and sustainable drainage to reduce the rate of runoff down the steep slopes to the river (particularly if buildings and surfaces increase the area of impermeable surfaces). Sustainable urban drainage ponds would be cost effective and lead to an increase in habitat and biodiversity value for the industrial estate (note: unfortunately no photographs were taken of the Industrial Estate on the site visit).

Ecosystem service benefits

- HBF
- ECO (green space may increase the economic value of the proposed employment allocation units).
- FRM (sustainable urban drainage, slower release of water via hill slope runoff to the Rhondda Fach).

To investigate

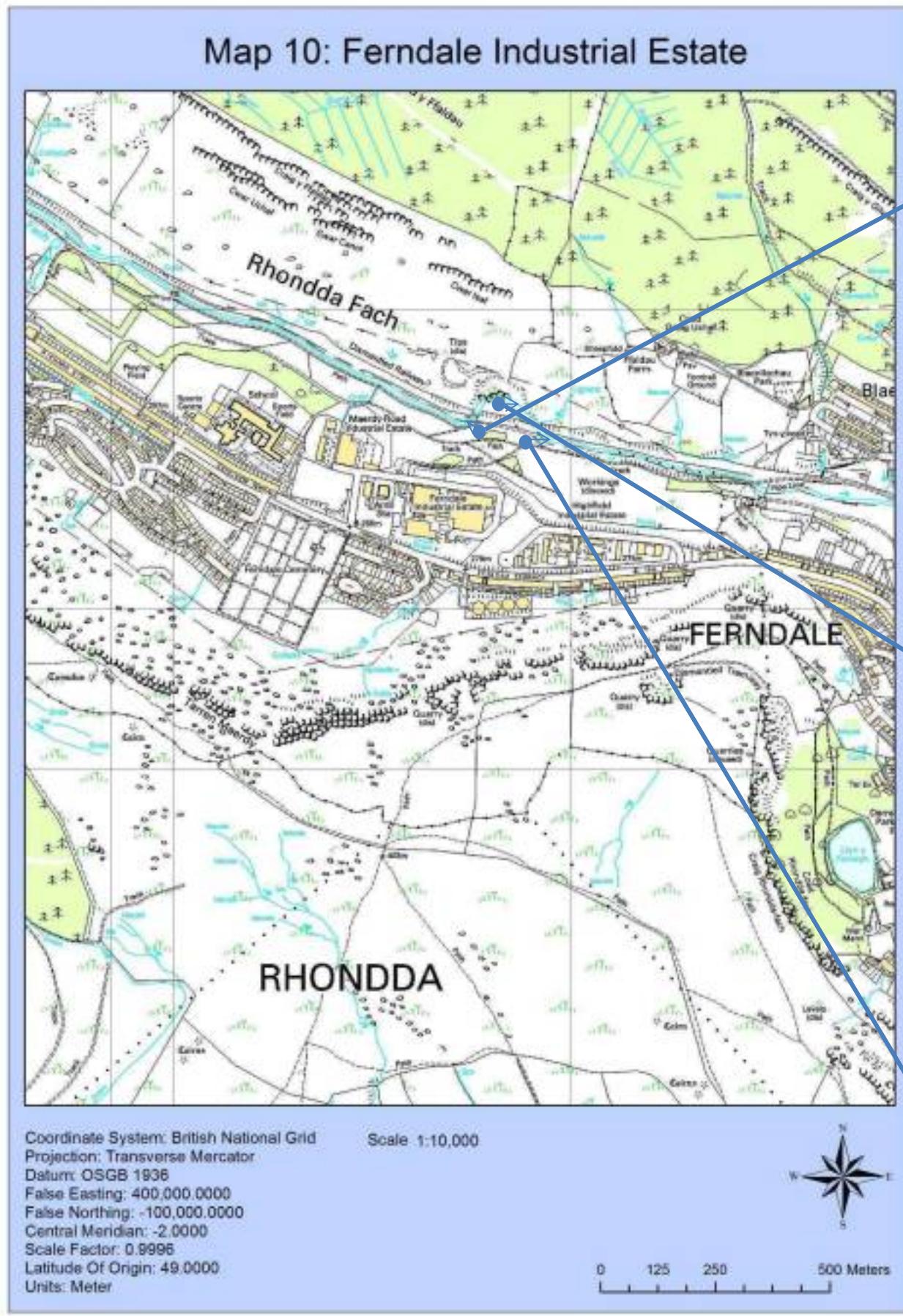
What plans, if any, have been discussed for the Ferndale and Highfields Industrial Estate.

Indicative cost category

EE

Deliverability category

D2



There is a high diversity of in-channel flows and habitats upstream of the meander.



The river has cut down to bedrock. Rock outcrops dominate the steep, outer meander bend.



Downstream of the meander, there are a number of small side channels. In-stream wood helps to retain sediment.

Constraints

- River is disconnected from its floodplain.
- River enters a culvert 10m+ below an area of green space in Stanleytown making it unfeasible to daylight? (i.e. remove the culvert).

Links to existing plans/ policies

No existing development plans for this site within the Rhondda Cynon Taf Local Development Plan.

Opportunities

An urban green space in Stanleytown could be improved to offer greater biodiversity and education value. The Rhondda Fach National Cycle Network Trail goes through this area making it well connected to other settlements including Ferndale and Maerdy on the Rhondda Fach. Small wetland scrapes could provide off-river habitat for plant and animal species. They help to attenuate water, slow the runoff of overland flow as well as provide a different type of habitat (currently this green space is primarily rough grassland and woodland).

As the green space is easily accessible, it could become a resource for local school children to learn about habitats and for example mini-beasts? (commonly a key early years curriculum topic) in a safe environment.

Ecosystem service benefits

- HBF
- FRM
- SAE (information boards, connect nature with the heritage of the area using the National Cycle trail as the spine).

To investigate

Is there a management plan for the green space? If not, to find out whether there may be any interest from local people in setting up a group to help maintain it.

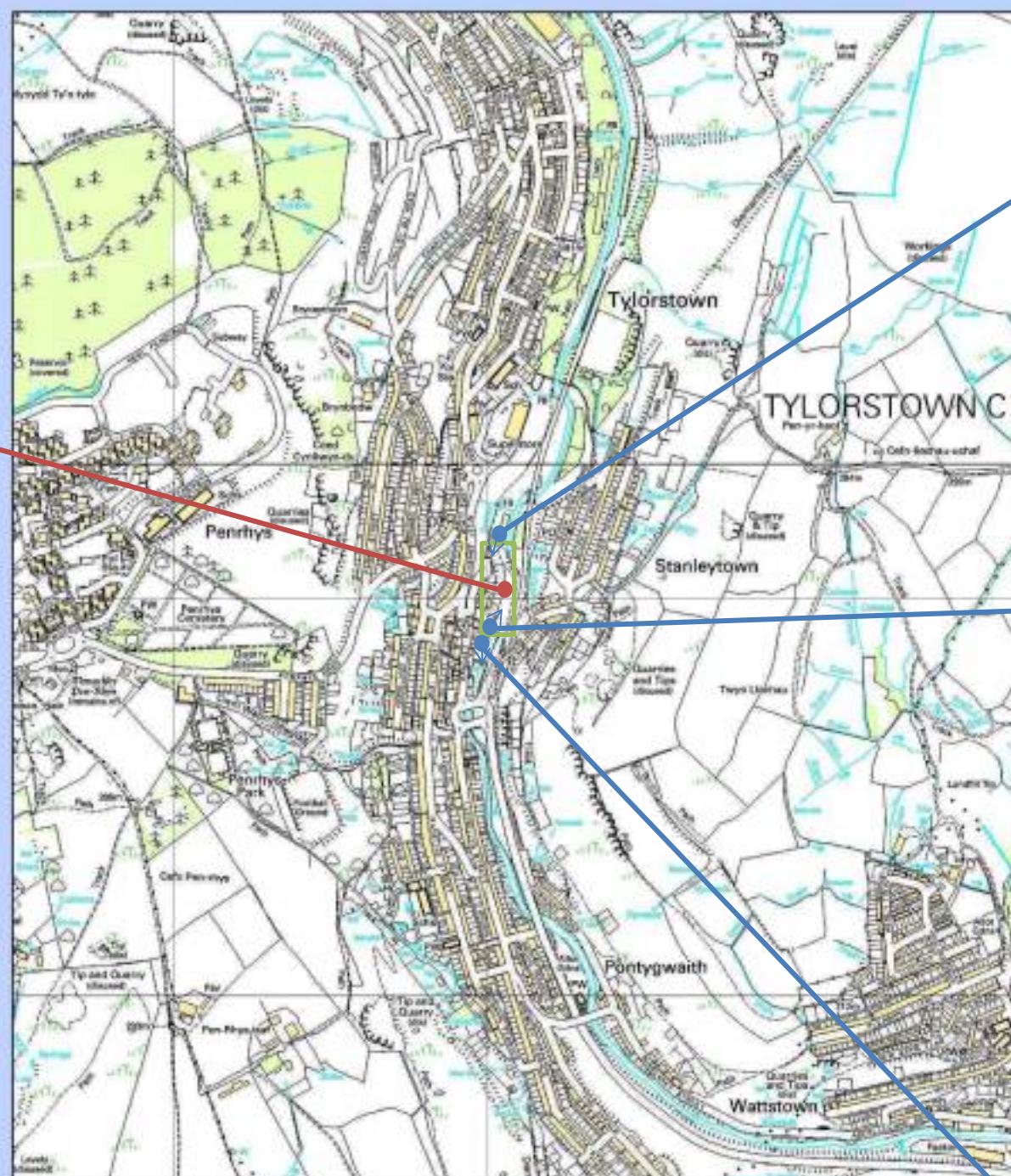
Indicative cost category

E

Deliverability category

D1

Map 11: Stanleytown



Coordinate System: British National Grid

Projection: Transverse Mercator

Datum: OSGB 1936

False Easting: 400,000,000.000

False Northing: -100,000,000.000

Central Meridian: -2.0000

Scale Factor: 0.9996

Latitude Of Origin: 49.0000

Units: Meter

Scale 1:10,000

0 125 250 500 Meters



The Afon Fach is culverted for circa 150m (green box).



Underutilised rough grassland and green space above the culverted watercourse which could be diversified by the creation of seasonally WetScrapes.



Downstream of the culvert, the river flows through a straightened channel and a series of bridges.

Constraints

- River is disconnected from its floodplain.
- A series of low bridges downstream of this site.
- Confluence at Porth, a large urban area in the Rhondda Valley.

Links to existing plans/ policies

No existing development plans for this site within the Rhondda Cynon Taf Local Development Plan.

Opportunities

Reduce the frequency of gravel shoal maintenance at the confluence of the Rhondda Fawr and Fach. The impact of shoal removal appears to be less problematic than at Ton Pentre (map 6); however similar issues could occur here (e.g. undercutting bridge support) in future if no action is taken. Stockpiling sediment on the right bank of the channel at Porth appears to have little benefit. Removal of sediment can unnecessarily affect aquatic and terrestrial fauna that cohabit riverside habitats.

Ecosystem service benefits

- ECO (reduced maintenance costs)
- FRM

To investigate

- What guidelines are currently adhered to regarding the removal of sediment? (Quantity and coverage?)
- As at Ton Pentre (map 6), students could undertake cross-section surveys to indicate the critical level at which deshoaling may not be necessary.

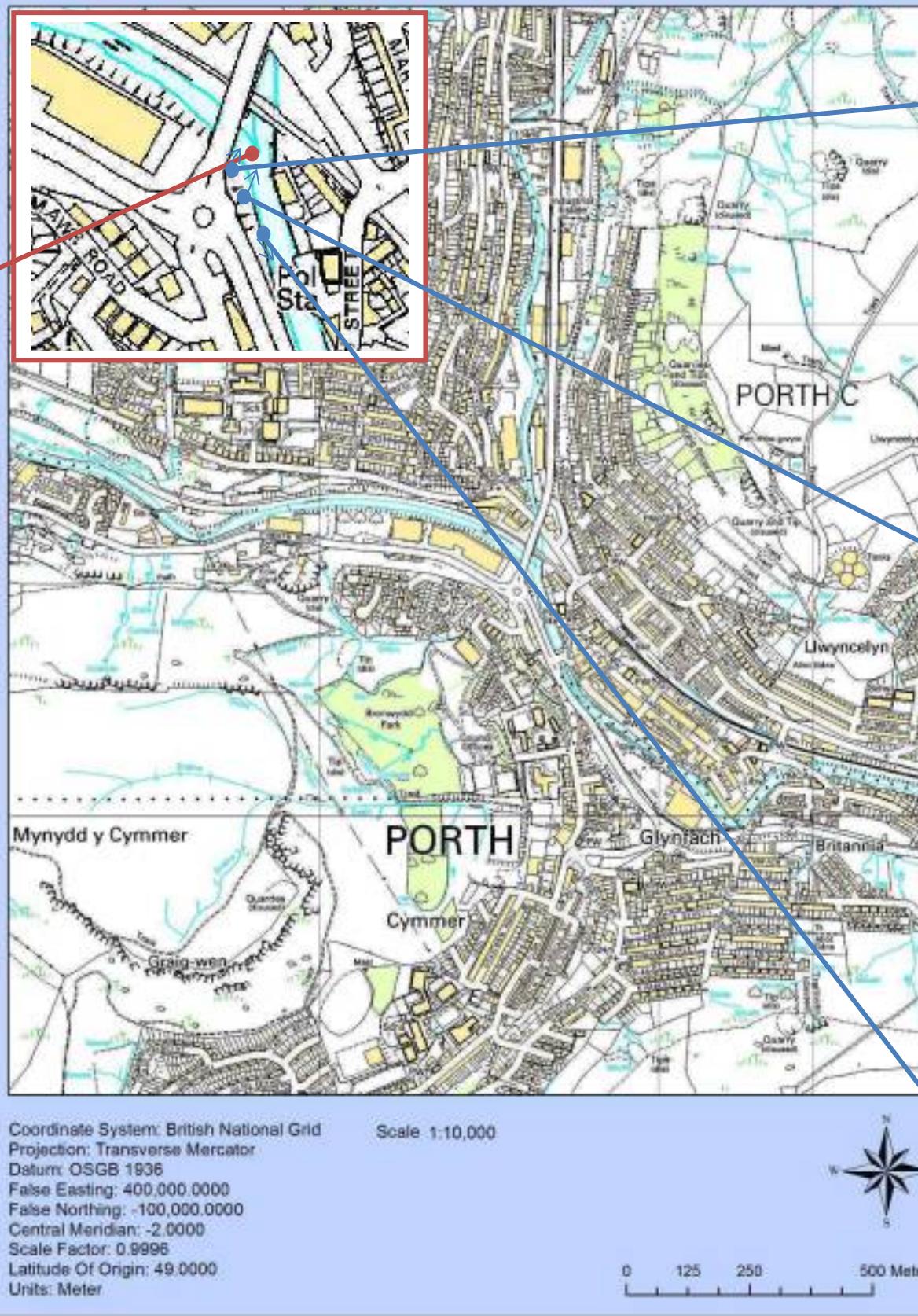
Indicative cost category

££

Deliverability category

D2

Map 12: Porth (confluence of Rhondda Fawr & Fach)



The Rhondda Fawr upstream of the confluence with the Rhondda Fach.



Sediment deposition on the inside of the confluence. This has been dredged and piled up on the right bank in much the same way as as Ton Pentre (map 6).



Downstream of the confluence, the river has been straightened. Utility pipes run along both banks.

Catchment scale initiatives

Afon Rhondda Friends of Group/ Conservation Partnership

A group set up to champion the river environment in the context of sustainable development, and raise awareness about the importance of conserving, restoring and enhancing the Rhondda River for current and future generations could have a significantly positive impact in this area.

A partnership with representatives from statutory agencies, local authorities, conservation bodies, landowners and local communities would help to formalise a common vision for the Afon Rhondda. The partnership could help to raise funds for actions such as habitat improvement and coordinate clean up events and river monitoring. There are a number of existing local river partnerships such as Thames21 in Greater London and the Bollin Valley Partnership in North West England which a group in the Rhondda could learn from and joining forces with successful volunteering campaign groups such as Keep Wales Tidy would help to kick-start the process.

Afon Rhondda Heritage Trail

The National Cycle Network Trail along the length of the Rhondda Fach could provide the foundation for an educational trail along the river corridor. The river is a cornerstone of the area's rich heritage and the trial could make use of existing public footpaths, bridleways and access points. At key locations along the river, information boards could be erected to describe anthropogenic influences on the river and showcase characteristics of the Natural Rhondda (for example the meander loop close to Ferndale and in the river SINC). It could become an important education resource for local schools and students.

Other sites visited with no river enhancement opportunities:

Tonypandy

Culverted section at ST 01035 94752 ? the drop is significant and urban development has encroached on the land where the river would have been.



Ynshir/ Wattstown

Multiple drains around ST 02326 94458. Steep hill slopes so little opportunity to slow the flow in this part of the catchment.



Trehafod

Few opportunities exist given historic flood alleviation works on the left bank, protecting properties.



Summary of options

This table summarises the key opportunities, indicative costs and identifies relevant examples to draw inspiration from.

Map	Opportunities	Ecosystem service benefits	Indicative cost	Deliverability	Examples and case studies
1	<ul style="list-style-type: none"> Identified in the Local Development Plan as a strategic site for development, with plans to restore the Rhondda Fawr, its tributaries and green corridors. This should include reggrading slag heaps, blocking drains to encourage water to attenuate on the land, slowing the flow and removing hard standings that generate runoff rills/ gullies. 	FRM ECO	£££	D3	No known examples of similar re-development and river restoration in an upland valley setting like this; although refer to best practice natural flood risk management case studies such as: Holnicote Estate project (National Trust et al.) Slowing the flow at Pickering (Forestry Commission et al.), and see Related projects? heading at the bottom of this webpage.
2	<ul style="list-style-type: none"> Extend depressions or create scrapes in the Nant Seisig valley to increase flood storage. Improve riparian land adjacent to Nant Y Gwair, to improve ecological connectivity. Erect an information board to educate people about existing riverine habitats. Enhance underutilised green space close to Dilys Street by creating a community pond. 	FRM SAE HBF	£/££	D1/2	Mayesbrook Park restored in 2011? A demonstration site for adapting public green space to take account of climate change, with community aspirations at the heart of the scheme (RiverWiki case study) , (Natural England green infrastructure report) , (Rivers Trust case study)
3	<ul style="list-style-type: none"> Redevelop the disused old Works site adjacent to the river to increase biodiversity and flood storage area. 	FRM HBF	£££	D3	Susdrain.org (UK case studies, rural and urban examples)

	<ul style="list-style-type: none"> Remove the bridge between the site and Eileen Place to stop floodwaters backing up. 	ECO SAE			
4	<ul style="list-style-type: none"> The industrial estate should consider the benefits of creating sustainable urban drainage ponds to better manage runoff from their site. Will need to terrace the land between the river and site to achieve this. Improve the biodiversity and amenity value of rough grassland adjacent to the Industrial site, known to be a popular public pathway. 	FRM HBF SAE ECO	££	D2	Susdrain.org (UK case studies, rural and urban examples)
5	<ul style="list-style-type: none"> Install woody deflectors upstream of the road bridge to encourage morphological diversity. Trial sensitive channel maintenance to observe whether habitats and a healthy riparian zone will establish. If successful, encourage flood risk managers to visit this site and erect an information board to describe the value of natural river features. Litter clean up?events by an Afon Rhondda Friends of Group or volunteers to empower local people and improve the river corridor. 	FRM ECO HBF ECO	££	D2	River Park Linear Park Enhancement project, London 2011- (RRC case study ? volunteer-led, small scale restoration (e.g. woody deflectors, berms) along the length of the river, still ongoing in 2014)
6	<ul style="list-style-type: none"> Review the cost-benefits of deshoaling and assess the potential risks of further bed lowering. Reduce the height of the left bank and erect 	ECO FRM	££	D2	River Kent, Cumbria (EA sediment & Habitats report, see p34-35 for case study, and wider report recommendations)

	a bund set back on the floodplain to increase channel conveyance through this section. Remove a defunct utilities pipe.				
7	<ul style="list-style-type: none"> Review the cost-benefits of deshoaling. Reconnect the floodplain by excavating the left bank and regrading it. Spoil could be used to create an embankment at the north edge of the green space to reduce flood risk to the railway line. Volunteer events to maintain and enhance the green space to foster a greater local public interest in conserving biodiversity. 	FRM ECO HBF SAE	£/£££	D1/3	River Kent, Cumbria (EA sediment & Habitats report, see p34-35 for case study, and wider report recommendations)
8	<ul style="list-style-type: none"> Add in-channel features to encourage water to flow out on to the floodplain to raise the bed level, working with natural processes. Widen existing depressions to form scrapes. Promote the SINC as a reference site for degraded sections of the Afon Rhondda. Work with Keep Wales Tidy to address fly-tipping and littering. Increase public access to the SINC to attract visitors and locals. Boardwalks may help to do this without comprising biodiversity. 	HBF SAE	££	D2	<p>River Bure, Norfolk (RRC Manual of River Restoration Techniques case study ? Felling and placing trees for habitat and flow diversity, in a natural setting)</p> <p>EU LIFE New Forest project (Black Water) (RiverWiki case study ? in particular, click to show additional details and see the documents under Additional links and references?)</p>
9	<ul style="list-style-type: none"> Identified in the Local Development Plan as a strategic site for the construction of 1 hectare of employment land, visitor centre 	FRM HBF	£££	D3	Sinderlands Brook, Greater Manchester 2004- (RRC Olympic Challenge award winner (2013)), (RRC Newsletter article)

	<p>and informal recreation, recreating a low level floodplain would increase capacity for flood storage. Spoil could be used to raise land which will be built on to reduce flood risk to new buildings.</p> <ul style="list-style-type: none"> • Downstream of Maerdy Park, willow and coarse sediment could help to stabilise eroding parts of the bank. Regrading the bank to a more natural angle to increase capacity would also lower risk of erosion. 	ECO			
10	<ul style="list-style-type: none"> • Re-development of the Industrial Estate should look to incorporate green infrastructure and sustainable drainage to reduce the rate of runoff down steep slopes to the river and increase biodiversity value. 	FRM HBF ECO	££	D2	Susdrain.org (UK case studies, rural and urban examples)
11	<ul style="list-style-type: none"> • Improve an area of green space to improve biodiversity. The site could also be used as an educational resource for local schools • Create scrapes to attenuate water, slow surface water runoff and diversify habitat. 	HBF FRM SAE	£	D1	Salmons Brook Urban Diffuse Pollution project 2012- (Catchment Restoration Fund, briefing note ? community centred schemes to create SUDs)
12	<ul style="list-style-type: none"> • Review the cost-benefits of deshoaling at the confluence of the Rhondda Fawr and Fach. 	FRM ECO	££	D2	River Kent, Cumbria (EA sediment & Habitats report , see p34-35 for case study , and wider report recommendations)