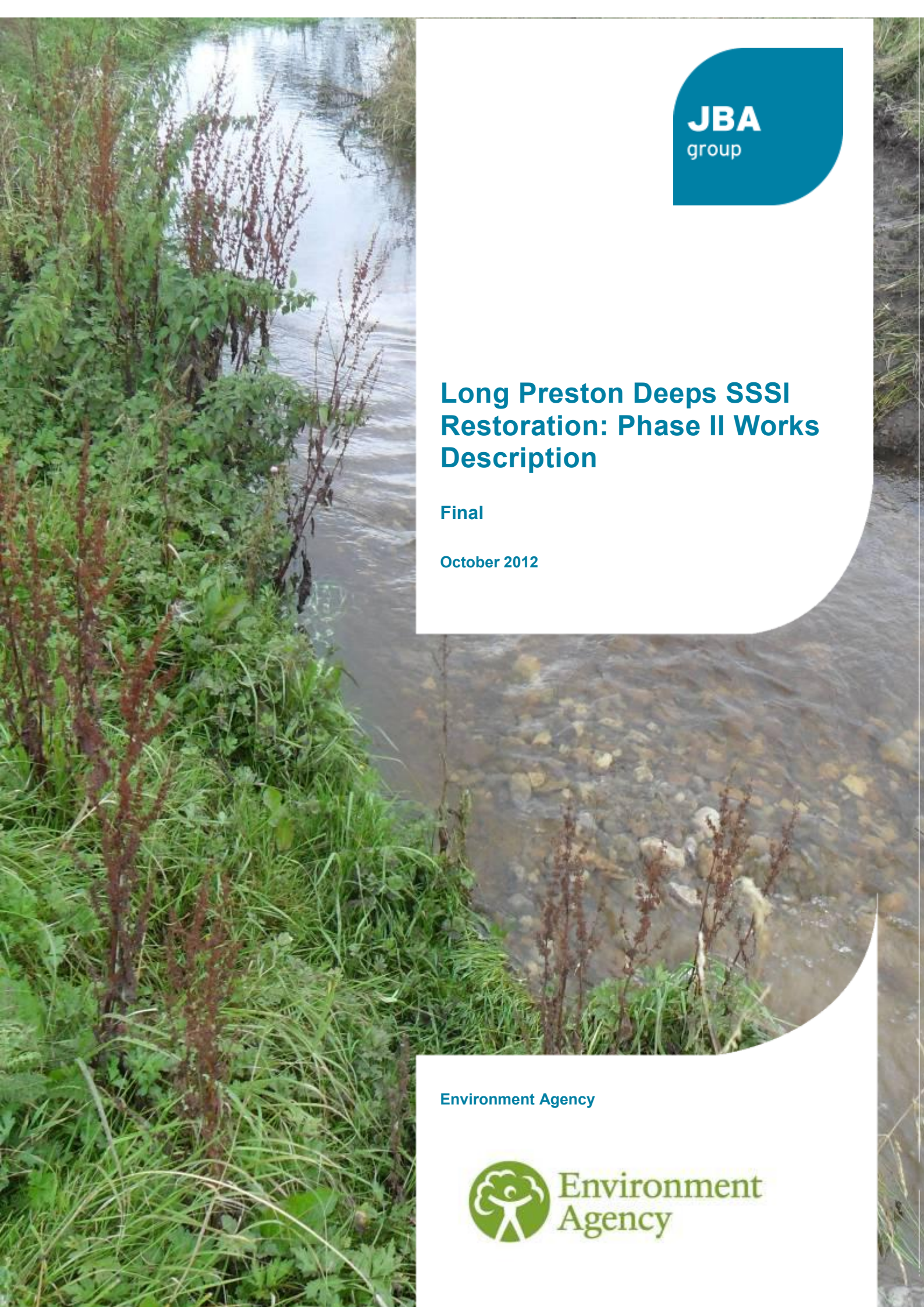

Long Preston Deeps SSSI Restoration: Phase II Works Description

Final

October 2012

Environment Agency

JBA Project Manager

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Revision History

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Contract

This report describes work commissioned by Askams, on behalf of the Environment Agency, by an email dated 6th August 2012. Askam's representative for the contract was Sam Boyd. George Heritage and of JBA Consulting carried out this work. Alison Whalley was the project manager for the Environment Agency

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Purpose

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Contents

1 Phase II Restoration Works at Long Preston 1

1.1 Background 1
1.2 Plan of Works 1
1.3 Detail on the Works Upstream of Phase I 2
1.4 Detail on the Works Downstream of Phase I 9
1.5 Summary changes 12
1.6 Long Preston Deeps Restoration Works: Site Working Practice 16

List of Figures

Figure 1. Proposed works under Phase II of the restoration plan for Long Preston Deeps. 2
Figure 2. Upper left bank reprofiling on the River Ribble. 3
Figure 3. Lower left bank reprofiling on the River Ribble. 3
Figure 4. Chute channel creation on the River Ribble. 4
Figure 5. Flowing channel conditions created following culvert interception. 5
Figure 6. Artificial backwater creation following palaeo-channel reconnection on the River Ribble. 5
Figure 7. Natural backwater creation following palaeo-channel reconnection on the River Ribble. 6
Figure 8. Left bank flood bank realignment showing reconnected floodplain. 6
Figure 9. Retained revetment along the River Ribble. 7
Figure 10. Ponded silted tributary channel before confluence culvert removal. 8
Figure 11. Two riffle areas on the Trout Beck tributary. 8
Figure 12. Detail of the flood bank realignment, chute channel and floodplain scrapes. 10
Figure 13. Flood bank realignment on the River Ribble. 10
Figure 14. Construction of floodplain chute on the River Ribble. 11
Figure 15. Construction of floodplain scrape on the River Ribble. 11
Figure 16. Effect of fencing on vegetation community on the River Ribble. 12
Figure 17. Effect of flood bank realignment and high level chute creation on the River Ribble. 13
Figure 18. Effect of floodplain lowering on the River Ribble. 14
Figure 19. Effect of gravel bar chute creation on the River Ribble. 15
Figure 20. Effect of creating functional riffles on the Trout Beck. 16

1 Phase II Restoration Works at Long Preston

1.1 Background

Over many years the course of the River Ribble has been altered for flood defence, land drainage, water supply and navigation. Modifications, like this, have had a detrimental effect on how the river flows, the quality of its water and the habitats and wildlife it supports.

The Environment Agency and Natural England have developed a plan (link to http://www.naturalengland.org.uk/regions/yorkshire_and_the_humber/ourwork/riverribblerestoration.aspx) for 7km of the Ribble between Settle and Long Preston, which has been classified as 'heavily modified'. The remedial actions in this plan aim to enhance the rivers natural processes, which will also improve its habitat for valuable wildlife and help the landscape to adapt to the demands of our changing climate.

1.2 Plan of Works

The restoration measures (Figure 1) planned upstream and downstream of the Phase I works at Long Preston Deeps consist of the following:

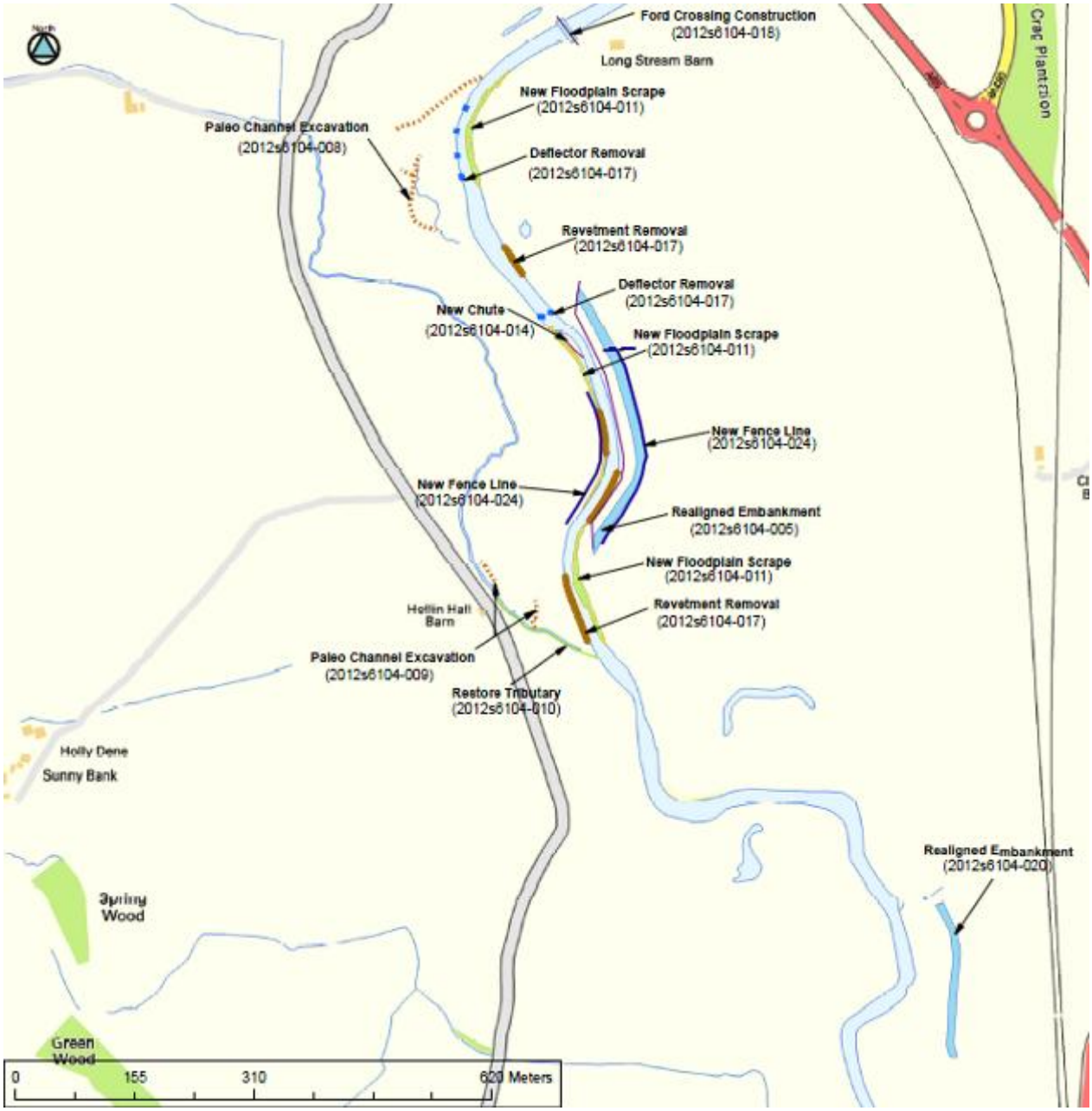
1.2.1 Upstream of Phase I

- Inner bend reprofiling: Three floodplain scrapes were proposed, however, only the two on the left bank were executed following landowner consent.
- Chute channel creation: The right bank gravel bar was altered to create an inner bank flood channel.
- Palaeo-channel reconnection and tributary deculverting: Several palaeo-channels were excavated and reconnected to the main channel over the right bank floodplain.
- Flood bank realignment: The adjacent flood bank on the left bank was realigned 25m back across the floodplain.
- Deflector removal: Four delta shaped rock deflectors and a pair of wooden centre deflectors were removed from the river.
- Revetment removal: Several lengths of revetment were proposed for removal. Fisheries concerns meant that much of this remained in place.
- Pool-riffle reinstatement: Around 300 m of the Trout Beck was dredged and the entrance culvert to the main river removed and replaced with a bridge crossing. 12 riffle areas were reinstated. Channel blockage at the dry stone wall upstream was removed and pipe access installed to allow fish passage upstream.
- Fencing and planting: Limited fencing was conducted on the right bank and the new flood bank realignment on the left bank was fenced for later planting.

1.2.2 Downstream of Phase I

- Flood bank realignment: Around 400 m of adjacent flood bank was realigned 30-50 m away from the channel edge.
- Chute channel creation: A wide high level chute was cut across the floodplain surface.
- Inner bend reprofiling: Two lowered sections of floodplain were constructed.
- Fencing and planting: The new flood bank realignment on the left bank was fenced for later planting. Fencing continued through the next field around 30 m from the river isolating this area for later planting.

Figure 1. Proposed works under Phase II of the restoration plan for Long Preston Deeps.



1.3 Detail on the Works Upstream of Phase I

1.3.1 Condition of the river and floodplain locally

This section of river is currently unstable with significant localised bank erosion along both banks delivering fine sediment to the river. Walling is present along several lengths and this is failing in many places causing localised erosion, redundant groyne structures are having a similar effect. In places gravels have built up significantly and are deflecting flows towards the outer bank causing erosion. The floodplain is cut off from the main river in many places by flood banks and by general river bed incision. The flood banks have also cut off old backwater

areas. The bed of the river is gravelly and the sediments are presently frequently mobilised under high flows. Bank side vegetation is very poor and rarely extends into the river.

1.3.2 Inner bend reprofiling

Three floodplain scrapes were proposed, however, only the two on the left bank were executed following landowner consent. The reprofiling removed silt from over the underlying gravels (Figure 2 & 3) lowering the level of the feature and to ensure more frequent flood inundation.

It is anticipated that this locally increased channel capacity will reduce in-channel flood levels and flood shear stress leading to a slowing down of erosion along the outer bend.

Flows 0.5 m above the normal range inundate the both new gravel surfaces.

Figure 2. Upper left bank reprofiling on the River Ribble.

Figure 3. Lower left bank reprofiling on the River Ribble.

1.3.3 Chute channel creation

The right bank gravel bar was altered to create an inner bank flood channel (Figure 4). This channel will become active at the upper range of normal flows in the river and will reduce the flow concentration presently directed at the outer bank opposite.

It is anticipated that flood flows will keep the new chute open and may cause it to develop further, however, frequent and often substantial movement of river gravel has been observed on the river and there is a risk the chute channel may become infilled.

Figure 4. Chute channel creation on the River Ribble.

1.3.4 Palaeo-channel reconnection and tributary deculverting

Several palaeo-channels were excavated and reconnected to the main channel over the right bank floodplain. This excavation intercepted a field drain to create an open flowing channel downstream (Figure 5) and a set of ponded backwater reaches upstream and off of the main channel (Figures 6 & 7). The wetting of natural riparian zones will result in rapid ecological gains. Artificial backwaters will take a few seasons to before vegetative colonisation results in ecological gains.

Figure 5. Flowing channel conditions created following culvert interception.

Figure 6. Artificial backwater creation following palaeo-channel reconnection on the River Ribble.

Figure 7. Natural backwater creation following palaeo-channel reconnection on the River Ribble.

1.3.5 Flood bank realignment

The adjacent flood bank on the left bank was realigned 25m back across the floodplain. Although this is a narrow strip it has already been inundated on several occasions and will act as a fine sediment deposition zone and flow energy reduction zone leading to reduced in-channel gravel movement and sediment unit stabilisation.

Standing water zones appear to be forming on the reconnected floodplain (Figure 8).

Planting will occur across the reconnected floodplain area.

Figure 8. Left bank flood bank realignment showing reconnected floodplain.

1.3.6 Deflector removal

Four delta shaped rock deflectors and a pair of wooden centre deflectors were removed from the river. This will reduce erosion pressures on the banks adjacent to their original position.

1.3.7 Revetment removal

Several lengths of revetment were proposed for removal. Fisheries concerns meant that much of this remained in place.

Figure 9. Retained revetment along the River Ribble.

1.3.8 Pool-riffle reinstatement

Around 300 m of the previously ponded Trout Beck (Figure 10) was dredged and the entrance culvert to the main river removed and replaced with a bridge crossing. 12 riffle areas were reinstated (Figure 11). Channel blockage at the dry stone wall upstream was removed and pipe access installed to allow fish passage upstream.

The present imposed morphology is functioning to create loose open gravels across the riffle surfaces and there is some potential for gravel mobilisation during high tributary flows moving material into the intervening pools. The lack of coarse sediment input from upstream due principally to the dredged nature of the channel will meant that these features will not be resupplied with material and may alter their profile or coarsen up over time. Without a wider restoration programme for the beck this is inevitable.

The installed level of the riffles is also controlling floodplain groundwater levels lifting these to create a wetland with standing water. Adjustment of the riffle levels will impact on this connectivity degrading this environment.

Figure 10. Ponded silted tributary channel before confluence culvert removal.

Figure 11. Two riffle areas on the Trout Beck tributary.

1.3.9 Fencing and planting

Limited fencing was conducted on the right bank and the new flood bank realignment on the left bank was fenced for later planting.

1.3.10 Fisheries benefits

- The flood bank realignment will reconnect the river with its floodplain on the left bank opening up a 20 m strip where excess flood energy will be dissipated. This will reduce flow energy in the main channel and significantly slow outer bank erosion rates

helping to stabilise the gravels in the adjacent channel making them more suitable for fish spawning.

- Silt deposition will occur across the opened up floodplain. In terms of fisheries this is unlikely to impact locally as the bed is already gravelly with few fines, however, it will reduce the overall river sediment load meaning that silted areas downstream will benefit from a reduced supply and should start to gravel up.
- The lowered inner bank floodplain areas will operate under higher flows. As such they will spread the flow flood energy reducing bed and bank erosion pressures. Inner bank chute channels will create backwater adjacent to the main river suitable for juvenile fish.
- The new farm crossing will prevent disruption to the new spawning sites developing as a result of the restoration activities in Phase I of the project.
- Reconnection of backwater areas will create low energy permanently wetted channels away from the main river suitable for spawning, juvenile development and acting as refuge areas in flood.
- The re-establishment of a functioning fine gravel tributary bed will provide optimal trout spawning sites presently rare along this reach.
- Tree and shrub planting with a variety of willows, alder, hawthorne will quickly generate marginal cover for fish with vegetation and roots extending into the water. Over the longer term the vegetation will also further slow the rate of bank erosion again reducing the amount of fine sediment going into the river. Woody debris trapped on the channel margins will act as new habitats for insects providing an increased source of prey for many fish species.

1.4 Detail on the Works Downstream of Phase I

1.4.1 Description of the present condition of the river

This section of river is currently unstable with severe outer bank erosion along both banks delivering fine sediment to the river. The channel is over-deep and poorly connected with the floodplain and this is made worse by adjacent engineered flood banks. The bed of the river is gravelly and the sediments are presently frequently mobilised under high flows. Bank side vegetation is very poor and rarely extends into the river.

1.4.2 Flood bank realignment

Around 400 m of adjacent flood bank was realigned 30-50 m away from the channel edge reconnecting this area of floodplain with the river and reducing flood energy levels against the right outer bank (Figures 12). Additional chute channel and scraping further enhanced the connectivity and these are detailed below.

Figure 12. Detail of the flood bank realignment, chute channel and floodplain scrapes.

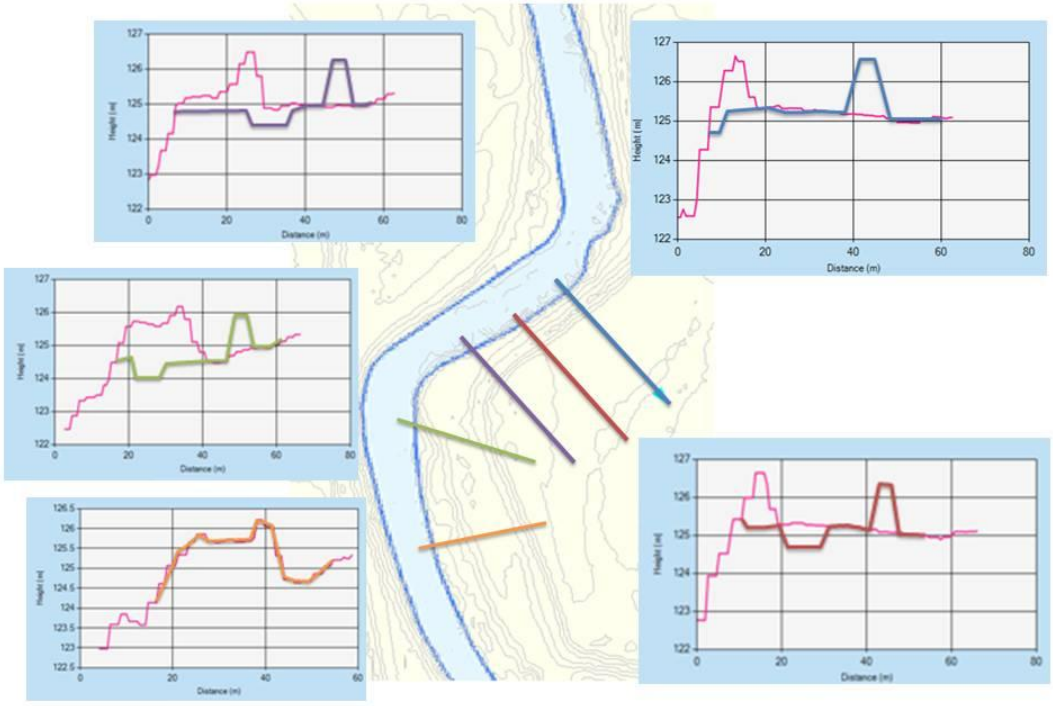


Figure 13. Flood bank realignment on the River Ribble.

1.4.3 Chute channel creation

A wide high level chute was cut across the floodplain surface (Figure 14). This feature was designed to accommodate only high winter flows and to be shallow sloping to allow easy traverse.

Figure 14. Construction of floodplain chute on the River Ribble.

1.4.4 Inner bend reprofiling

Two lowered sections of floodplain were constructed (Figure 15) to accommodate higher flows and to provide better river access as a secondary benefit. New floodplain levels are designed to be inundated frequently during winter reducing the flow volume and erosive energy in the main channel.

Figure 15. Construction of floodplain scrape on the River Ribble.

1.4.5 Fencing and planting

The new flood bank realignment on the left bank was fenced for later planting. Fencing continued through the next field around 30 m from the river isolating this area for later planting. Figure 16 illustrates the rapid change to the floristic community that can occur following fencing during the Phase I works.

Figure 16. Effect of fencing on vegetation community on the River Ribble.

1.4.6 Fisheries benefits

- The realignment will reconnect the river with its floodplain on the left bank opening up a 30-50 m strip where excess flood energy will be dissipated. This will reduce flow energy in the main channel and significantly slow outer bank erosion rates helping to maintain more stable pools in the bends of the channel.
- The reduced energy will also help to stabilise the river bed gravels making them more suitable for fish spawning.
- Silt deposition will occur across the opened up floodplain. In terms of fisheries this is unlikely to impact locally as the bed is already gravelly with few fines, however, it will reduce the overall river sediment load meaning that silted areas downstream will benefit from a reduced supply and should start to gravel up.
- The chute channels will function under higher flows and will be at different levels. As such they will also divert flood energy away from eroding banks and create backwater areas where they re-enter the main river suitable for juvenile fish.
- Tree and shrub planting with a variety of willows, alder, hawthorne will quickly generate marginal cover for fish with vegetation and roots extending into the water. Over the longer term the vegetation will also further slow the rate of bank erosion again reducing the amount of fine sediment going into the river. Woody debris trapped on the channel margins will act as new habitats for insects providing an increased source of prey for many fish species.

1.5 Summary changes

The works delivered during phase II of the Long Preston Deeps Restoration Plan generally seek to lower flow energy in the main channel to reduce gravel mobility by diverting flow away from key erosive sites and providing more area for flood flows. This has been achieved through flood bank realignment, chute channel creation and floodplain lowering (Figures 17 to 19). Additional benefits from these actions include improved floodplain connectivity and floodplain palaeo-feature rejuvenation.

Other local works have restored flow to an open watercourse and have created process conditions suitable for the maintenance of installed riffle units (Figure 20).

Figure 17. Effect of flood bank realignment and high level chute creation on the River Ribble.

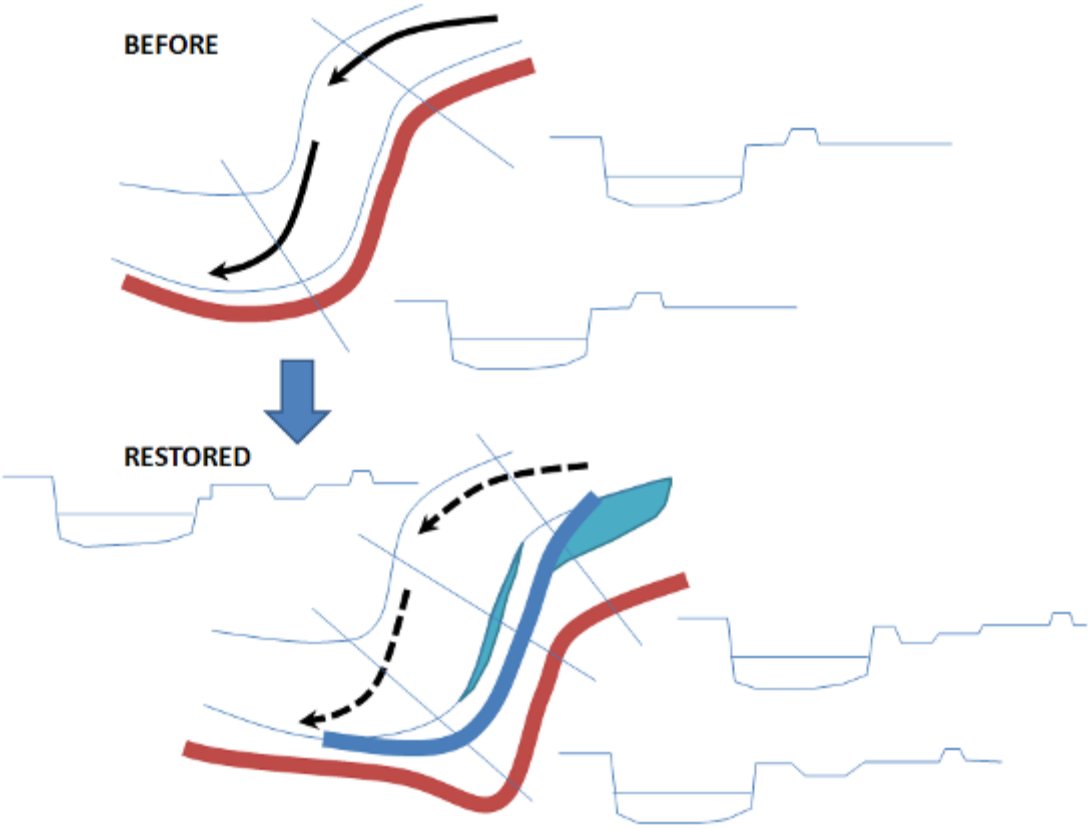


Figure 18. Effect of floodplain lowering on the River Ribble.

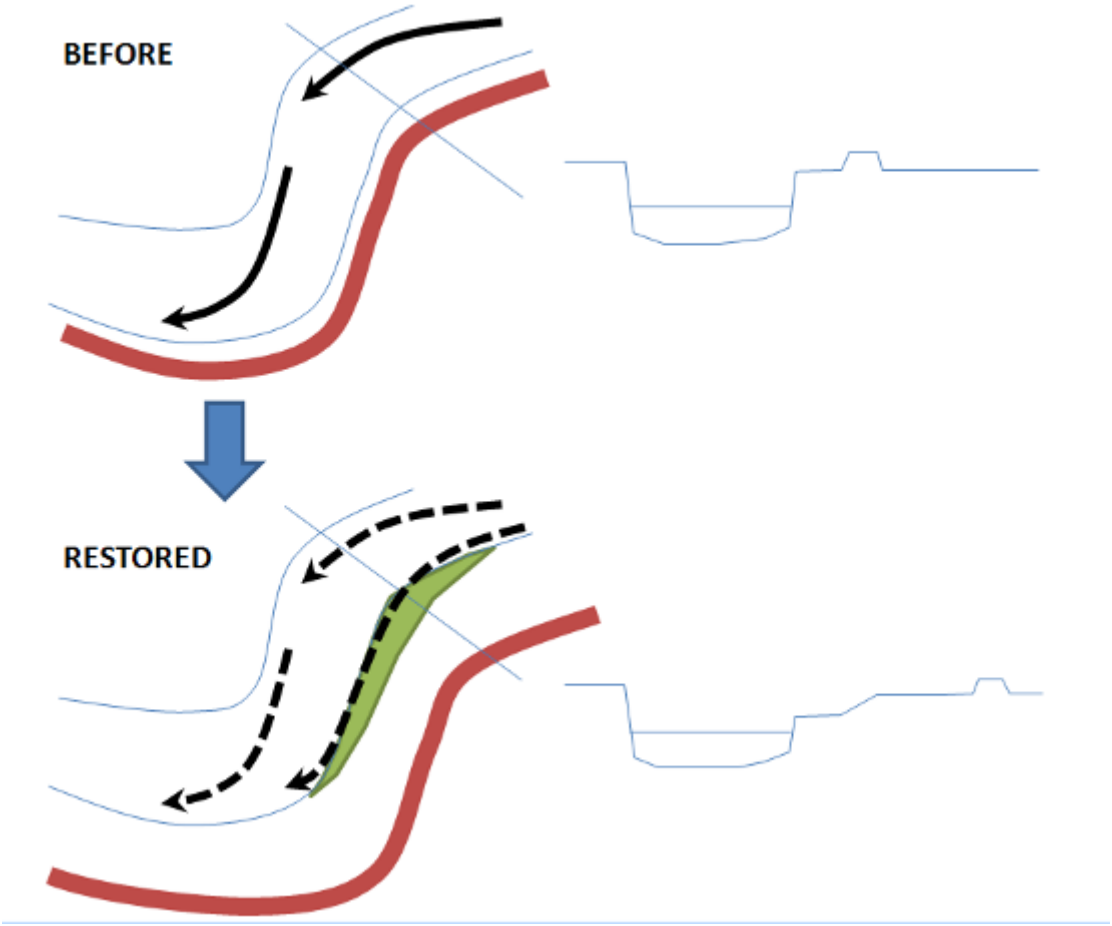


Figure 19. Effect of gravel bar chute creation on the River Ribble.

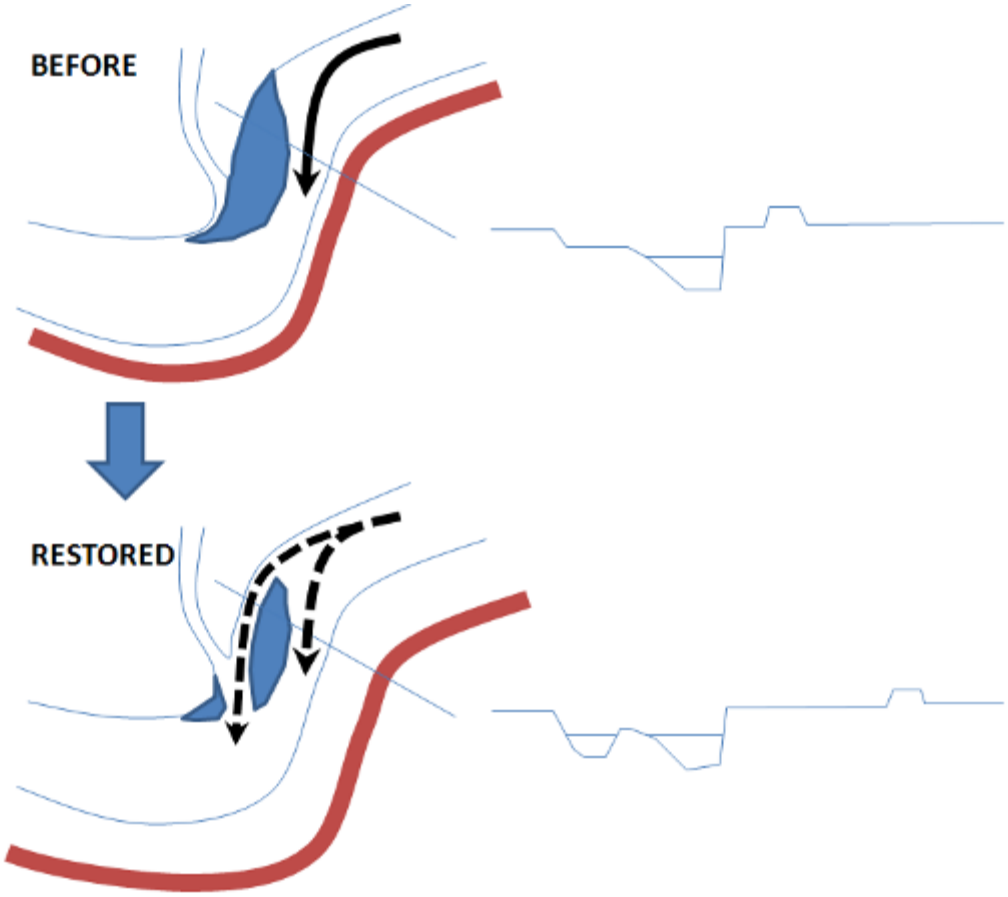
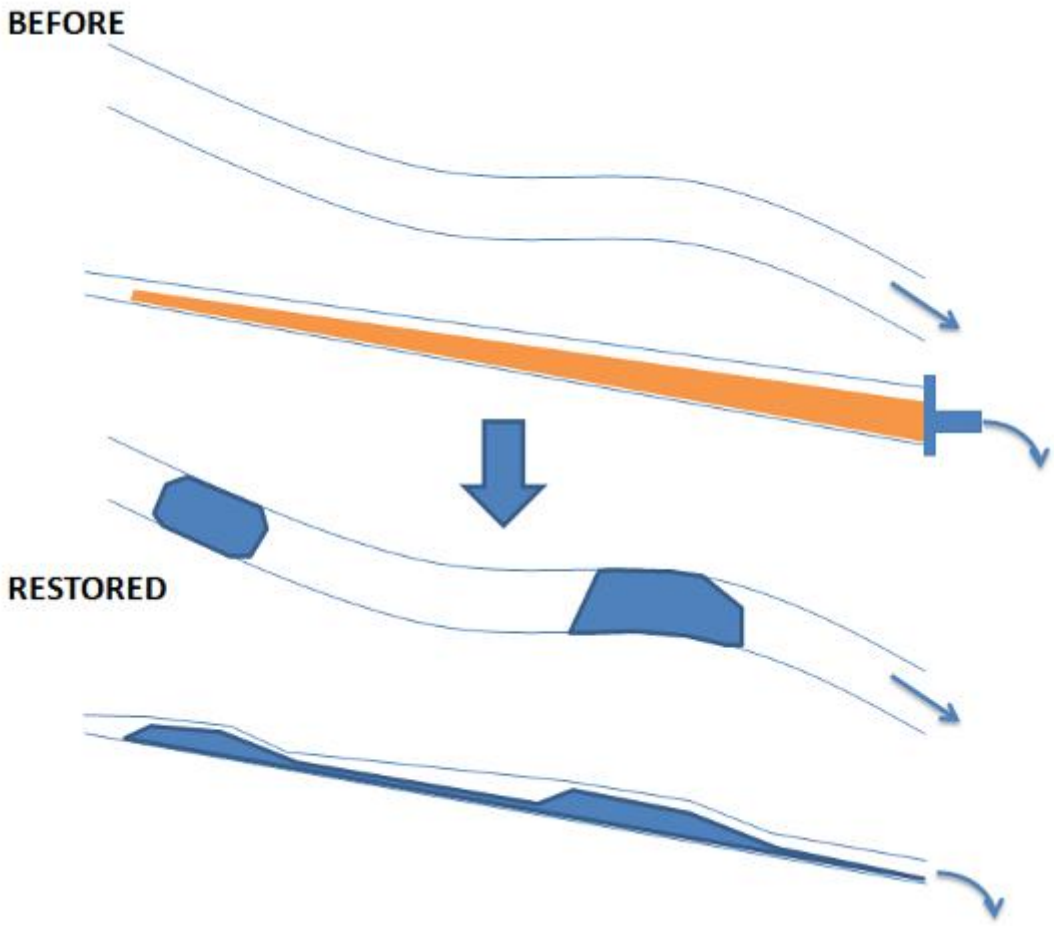


Figure 20. Effect of creating functional riffles on the Trout Beck.



1.6 Long Preston Deeps Restoration Works: Site Working Practice

1.6.1 Silt production associated with plant crossing

Plant will be making a single traverse of the river onto and off of site at a riffle site. The bed composition at this site is dominated by coarse gravels with an infill of finer gravel, sands and some silt. Minor disruption of the bed is anticipated releasing limited fine sediment into suspension. Tracking up the bank side will cause local erosion of fine deposits, this level of loss is seen all along the banks of both sides of the river. This will quickly be dissipated across the flow and will be for a very short period of time. Overall the volume of released sediment will be well within normal transport limits for this river during elevated flows and no methods to reduce releases are recommended.

1.6.2 Silt production associated with palaeo-channel reconnection

Floodplain sedimentological evidence suggests that the palaeo-channel excavation will expose previous river gravels in the bed. This material will have a high level of fines which will be released when the channels are rejoined. As such excavation should be of the central portion first followed by downstream reconnection and finally upstream reconnection. Sediments should be employed at the palaeo-channel exits to catch released sediment.

1.6.3 Silt production associated with revetment removal

Short lengths of masonry blockwork should be removed from the main channel. This will be completed from the bank wherever possible but some plant access to the channel may be required. The bed material around the revetment is dominated by coarse gravels with an infill of finer gravel, sands and

some silt. Minor disruption of the bed is anticipated releasing limited fine sediment into suspension. The volume of released sediment will be well within normal transport limits for this river during elevated flows and no methods to reduce releases are recommended. Impact on downstream gravel units will be undetectable.

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