LICHFIELD & HATHERTON CANALS RESTORATION TRUST

L&H

Lichfield Canal

Restoration Feasibility Study

Final Report - July 2009

ATKINS

Acknowledgements

The Lichfield and Hatherton Canals Restoration Trust Limited would like to acknowledge the assistance of the following in preparing this report:

British Waterways West Midlands has contributed considerable staff time as an in kind donation to the feasibility study. BW has inspected works constructed to date, advised as to the design criteria required and provided assistance with budget estimates for specialist elements of the scheme.

Lichfield District Council has provided Ordnance Survey Mapping and other assistance, including identifying local nature sites and consultation over environmental issues, to the feasibility study.

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The Inland Waterways Association (IWA) have provided a grant of £5,000 to part fund the feasibility study, and this support is gratefully acknowledged.

IWA's Consultant Engineers have reviewed the engineering proposals and their suggestions have been taken into account and incorporated where appropriate.

The Environment Agency have indicated their support in principle for the restoration of the Lichfield Canal

The invaluable work of the Trust itself, and all its members and officers is also acknowledged. In particular, John Horton and Mike Smith have undertaken much early work developing solutions which this study validates and on which, in part, it is based. John produced the first analysis of a potential alignment for the restored canal, and Mike has developed options to demonstrate that a restored canal would be able to use the Lichfield Southern Bypass corridor.

Lichfield Canal Restoration

Feasibility Study Report

May 2009

Notice

This report was produced by Atkins Limited for Lichfield and Hatherton Canals Restoration Trust Limited for the specific purpose of demonstrating the feasibility of restoring the Lichfield Canal (formerly known as the Wyrley and Essington Canal [Ogley Locks Section]) to navigation.

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Contents

Section Page

List of Tables

List of Figures

Appendices

Executive Summary

Atkins was engaged by the Lichfield and Hatherton Canals Restoration Trust Limited (the Trust) to undertake a study and report on the feasibility of restoring the Lichfield Canal.

The canal linked Huddlesford Junction, east of Lichfield in Staffordshire, with Ogley Junction east of Brownhills also in Staffordshire. The canal was abandoned in 1954 and the alignment was sold off by the then navigation authority, the British Transport Commission. Most of the canal's 30 locks were infilled and survive, along with much of the former "track" (the alignment) of the canal. A few of the bridges and other structures are also still extant.

The Lichfield & Hatherton Canals Restoration Trust Limited (hereafter referred to as "The Trust") was incorporated in 1989. The Trust aims "to promote the restoration of the Lichfield Canal and the Hatherton Canal to reopen links between Staffordshire and the West Midlands, for the benefit of the environment, amenity and prosperity of the people of the region and to enhance the nation's inland waterway system".

The Trust has already undertaken or funded major works at a number of locations, including the installation of an aqueduct to carry the canal over the new M6 (Toll) Road during the road's construction, something which would have been virtually impossible once the road opened.

Restoration of the canal would provide an important link between the East Midlands canals and canals in the Black Country and towards South West England. It is estimated that there would be around 5,000 boat movements per year along the restored canal.

Atkins has completed a detailed study of the feasibility of the engineering works required and the key findings are:

- Restoring the canal using the alignment shown on the Proposal Maps is technically feasible, and can be achieved at an estimated cost of £47.7 million;
- There are several "pinch points" (most notably alongside the proposed Lichfield Southern Bypass just west of London Road, and at the site of former Lock 19 where the proposed alignment turns between the Southern Bypass alignment and its original course alongside the Walsall – Brownhills – Lichfield freight railway), but these can be resolved simply without recourse to unduly complex or convoluted engineering solutions;
- The vast majority of the engineering works required can be delivered using existing, proven technology – innovation is restricted to the development of a method of ensuring that short pounds (sections of canal between locks) do not run short of water whilst minimising the amount of water required to operate the canal;
- There is very little adverse impact on existing development; no domestic property will have to be demolished to enable the canal to be restored. Four properties will require modifications to access and / or gardens (one of which is owned by the Trust) and precautions may be required (subject to detailed design) to protect one further property during the construction phase.

Design parameters have been established and agreed with British Waterways, and recommendations are made regarding construction methods and potential engineering solutions for the structures required.

Where possible, the proposed alignment re-uses existing canal infrastructure to reduce costs and maintain and enhance the heritage value of the "legacy" structures. Detailed proposals are given for each road, railway and watercourse crossing which will be required to complete the restoration.

A proposal for phasing the restoration has been developed and is detailed in Table 2.1.

Consideration has been given to water supply, both on completion of the whole scheme, and in the interim period whilst the various proposed restoration phases are constructed. The water supply ("feed")

requirements of the scheme have been assessed. Whilst potential sources of sufficient feed water have been identified for the scheme, further work will be required to prove the viability of these sources. There are, fortunately, many potential alternative sources of water on the existing canal system at or above the level of Ogely Junction. Further study is recommended which should be taken forward by the Trust and British Waterways to assess the suitability of all the potential water sources (with input from other stakeholders such as the Environment Agency) and to develop a plan which will ensure that provision can be made to feed sufficient water to both the Lichfield Canal and to the proposed Hatherton Canal restoration scheme, which takes some of its water from the same canal pound as the Lichfield Canal.

A detailed account of the proposed route and engineering requirements is give for each phase of the scheme. This can be found in sections 2.4 to 2.8 of this Feasibility Report.

The methodology for developing estimates of construction costs is described, and detailed breakdowns of the cost estimates are included as Appendix A to this Feasibility Report.

Heritage and ecological impacts of the proposed restoration are set out, with details of consultation undertaken and proposals for mitigating adverse impacts. There are few significant adverse impacts, and providing mitigation measures should be relatively straightforward, often using narrow strips of land which will be islanded by the proposed canal and will have to be acquired to facilitate the restoration. The scheme will be beneficial in heritage terms, bringing back into use many historic structures which currently stand without a use, or are buried, and, unlike many canal restoration schemes, very few historic structures will have to be demolished in order to construct the canal to modern standards.

Flood risk has been considered and is limited to a short section at the east end of the scheme where the proposed canal is situated just above and adjacent to the floodplain of Darnford Brook. There will be four main watercourse crossings – two are already in place (one may require repair and possibly capacity enhancement), and the other two will be designed to accommodate the necessary flood flows. A detailed Stage 2 Flood Risk Assessment is recommended.

The planning context, in terms of national, regional and local planning policy, is explored and a way forward proposed which includes a recommendation that the scheme should be put forward for inclusion in the emerging Local Development Framework. The Trust is understood to be making progress in this respect and the availability of the Proposal Maps prepared as part of the study should assist in this regard. A discussion of the development potential of the canal and the surrounding area is provided to inform this process.

An assessment of the socio-economic benefits arising from the restoration of the canal has been made. This includes detailed projections of the likely number of boats/boaters and other recreational users who will make use of the restored canal, and estimates that the annual economic benefit to the area around the canal (and the other canals connecting to the west end of the Lichfield Canal which will see large increases in visitors resulting from then Lichfield Canal Restorations) is around £1.8 million per year. This excludes job creation and secondary supply benefits during the construction phase, and maintenance and operation costs and benefits are assumed to cancel each other out.

Adopting an unadjusted Net Present Value analysis, costs break even against benefits in year 40, so the scheme will have generated benefits equal to the costs of construction forty years after commencement, or thirty years after projected opening of the canal as a through route.

Potential sources of funding are reviewed and it is recommended that these are monitored as the existing funding regimes are in a state of flux at present, so future opportunities should be recognised and seized.

A number of recommendations for further study are made:

- Water Supply Study
- Stage 2 Flood Risk Assessment
- Screening opinion for Environmental Impact Assessment
- Options Study for Provision of Alternative Moorings for Lichfield Cruising Club

Recommendations are also made as to the process for implementing each phase of the scheme. It is recommended that, whilst ensuring that there is sufficient funding available to take advantage of synergies with the construction of the Lichfield Southern Bypass, the Trust should undertake the advanced studies and then commence the restoration in earnest by commissioning outline design of phase 1, and putting together a funding package based on the outline design report and cost plan.

It is concluded that the scheme is feasible and desirable and should be taken forward into the Local Development Framework.

1. Introduction

1.1 The Canal

The Lichfield Canal, originally known as the Wyrley and Essington Canal (Ogley Locks Section), was opened in 1797, connecting the Wyrley and Essington at Ogley near Brownhills to the Coventry Canal at Huddlesford near Lichfield.

Figure 1.1, below, shows the location of the canal in the context of the present day inland waterway network.

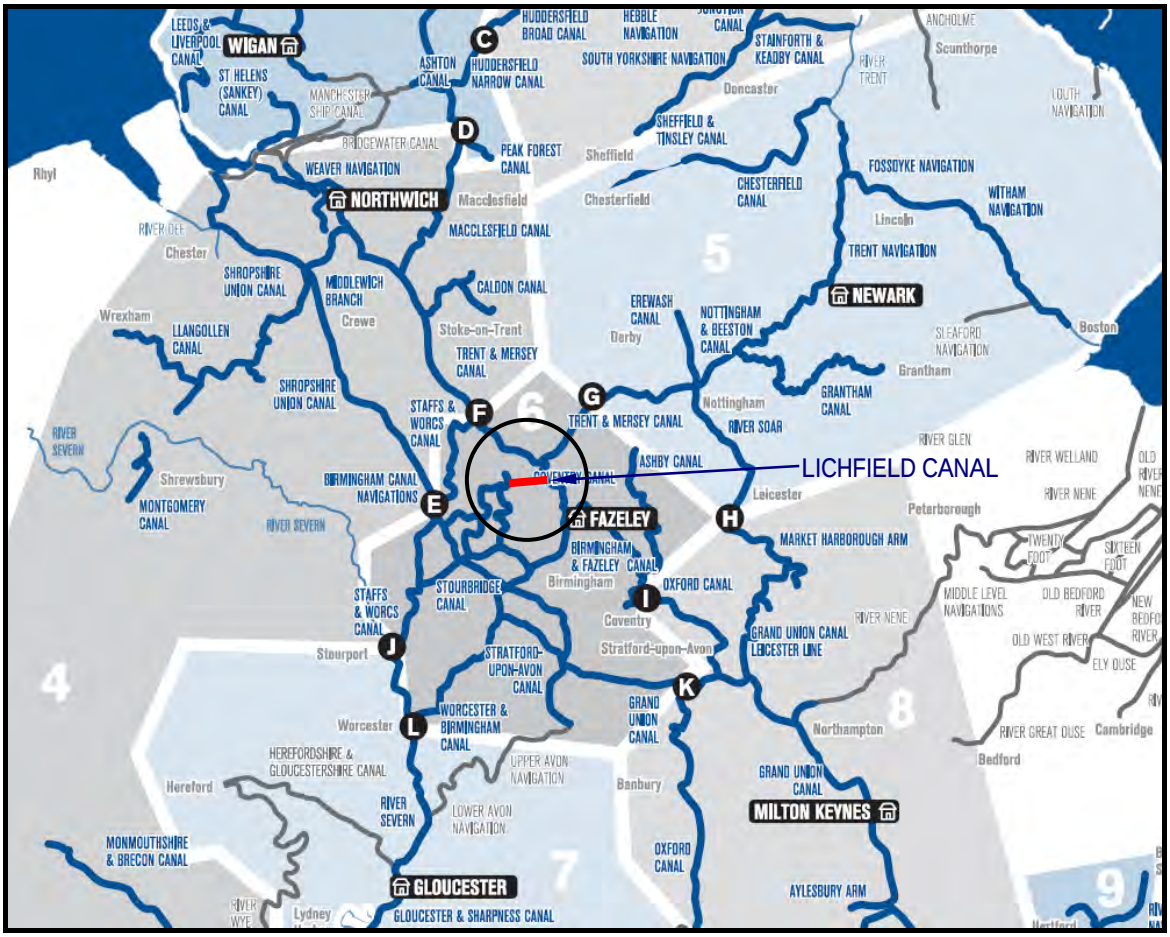

Figure 1.1 – Location Plan[1]

The entire canal is located in Staffordshire, in the present day Lichfield District Council area.

The Lichfield Canal formed a key link in the northern part of the Birmingham Canal Navigations Company's system, providing a direct route for traffic between Nottingham and the east and the Black Country and South West. Boats otherwise would have to use the busy Coventry Canal and Birmingham and Fazeley Canals.

If restored, the Lichfield Canal would make this direct route available once more and reinvigorate the Wyrley and Essington Canal, which is currently very lightly used, and also forms part of the route linking east and west via the Black Country. These links are shown on the map below.

[1] Based on an extract from the British Waterways "Waterway Map and Addresses", available from http://www.britishwaterways.co.uk/media/documents/BW_Waterway_map_and_addresses.pdf

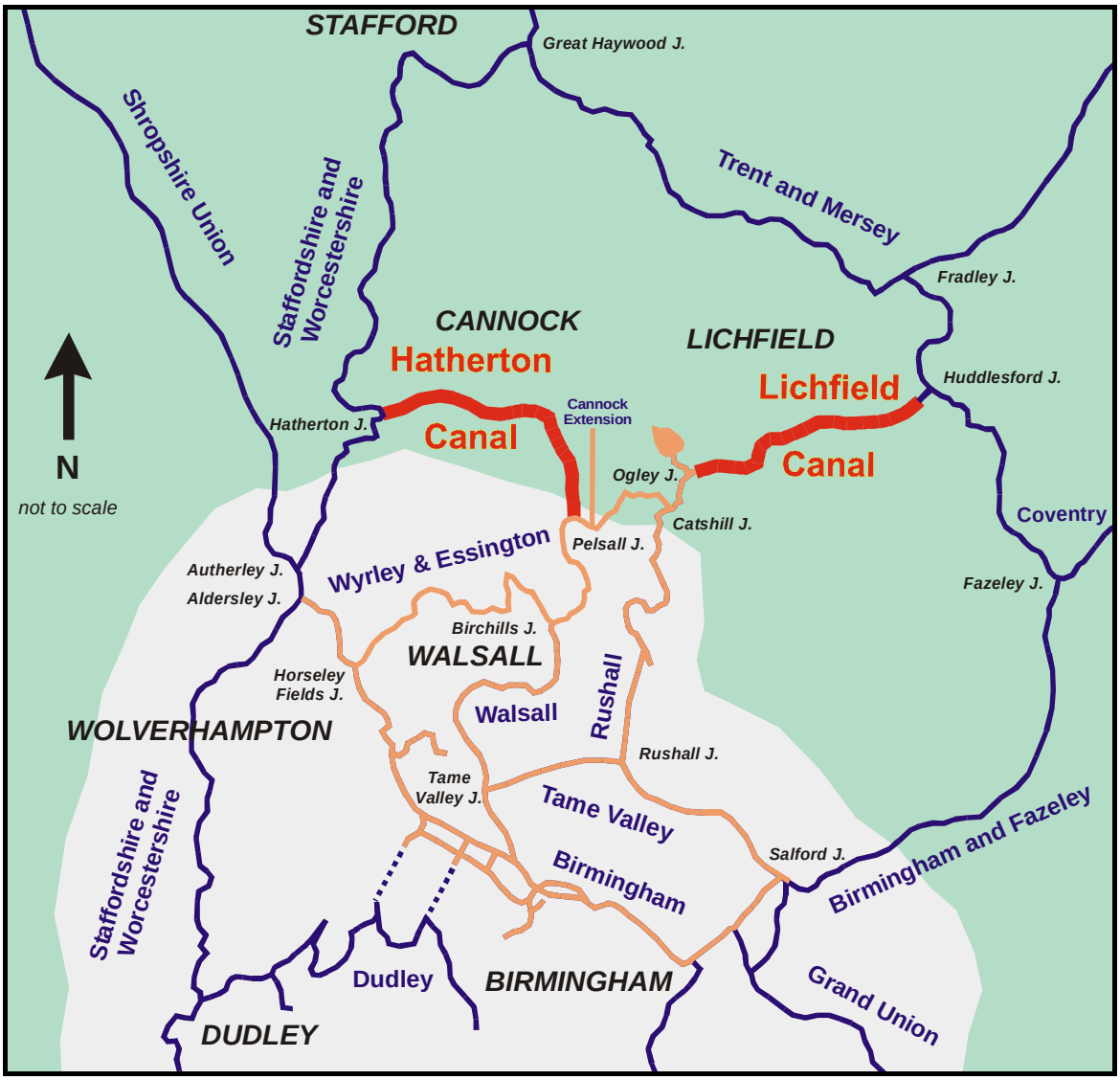

Figure 1.2 – Black Country Canals Network[2]

Following national declines in the amount of traffic carried by the canal network from the end of the nineteenth century, the entire Ogley Locks Section was abandoned in 1954 by the then British Transport Commission.

Abandonment extinguished the navigation rights and the navigation as an entity, and made provision for disposing of the land and dealing with any liabilities arising such as land drainage. In effect, the navigation ceased to exist as a legal entity.

The 1968 Transport Act defined the Coventry Canal as Cruiseway and the rest of the Wyrley and Essington Canal as Remainder Waterways. Remainder Waterways were to be managed in the interest of public safety rather than for navigation. Any lengths of the Ogley Locks Section that were in BW's ownership at that time would also have been declared a remainder waterway by definition (Remainder Waterways were those not classified as anything else), although this would have lapsed on disposal.

After abandonment, much of the land was sold off, and sections of the canal were infilled. Bridges, particularly over the major roads, have been removed since the abandonment of the canal. Locks

[2] This map supplied and used by courtesy of LHCRTL

have also been infilled over time, and two short sections of the original alignment cannot now be used, one because of development and the other due to changes in levels of the major roads south east of Lichfield. Most of the lock chambers and several of the bridges remain in-situ, and much of the line of the canal is still evident. Comparatively little land has been redeveloped or re-used, and much of the canal is visible today as a shallow depression in wasteland bordering fields.

A short section from Huddlesford Junction to Cappers Bridge remains in water and in use as a mooring site for Lichfield Cruising Club.

1.2 The Lichfield and Hatherton Canals Restoration Trust Limited

The Lichfield & Hatherton Canals Restoration Trust Limited (hereafter referred to as "The Trust") was incorporated in 1989. The Trust aims "to promote the restoration of the Lichfield Canal and the Hatherton Canal to reopen links between Staffordshire and the West Midlands, for the benefit of the environment, amenity and prosperity of the people of the region and to enhance the nation's inland waterway system"[3].

The Trust has already taken significant strides towards this objective, most notably in raising sufficient funds to ensure that structures which would be required for the restoration of both canals were provided at the time of the construction of the M6 Toll motorway. In addition the Trust has purchased some of the land required for the restoration projects and have regular volunteer work teams on both canals which have been excavating infilled sections of the canals and restoring locks and other structures over the last fifteen years.

1.3 The Restoration Project

The Trust has, as noted above, taken many steps towards the restoration of the Lichfield Canal, mostly in response to proposed development which could sever the line of the canal. Part of the aim of the feasibility study is to formalise both the steps already taken and those which will be required into a defined project.

The Trust has developed an alignment, in outline in most areas, and in detail in areas subject to development pressure, which it has worked to protect over recent years.

Physical works have been undertaken already in a number of locations and these are listed below:

- A replacement bridge has been constructed on Cappers Lane at the "dead" end of the Lichfield Cruising Club moorings;
- Piling has been undertaken along a section of the canal adjacent to the golf course between Cappers Lane and Darnford Lane;
- A lift bridge has been installed across the line of the canal at Darnford;
- Considerable restoration work has been undertaken at Borrowcop, south of Lichfield, including the excavation and restoration of two infilled lock chambers, construction of bywash weirs and channels, and construction of new waterway walls and a new footbridge;
- A new navigable culvert has been provided under Birmingham Road south of Lichfield in association with work by Staffordshire County Council to create a roundabout connecting Birmingham Road and a section of the Southern Bypass;
- Lock 18 near Fosseway Lane Bridge has been excavated and the masonry repaired;

[3] The statement of the aims of the Trust is taken from the Trust's website: http://www.lhcrt.org.uk/index.htm

- The construction of the Birmingham Northern Relief Road (now known as the M6 Toll) posed a considerable challenge to the Trust as the proposed motorway was to cross the line of the Lichfield Canal close to Muckley Corner. A campaign was launched, initially with the objective of ensuring that provision was made within the new motorway works for a structure to enable the restored canal to cross the motorway. When it became clear that this structure would not be funded by the road promoters or government, the Trust launched a campaign to raise funding to pay for the structure. This was successful, the aqueduct was constructed as part of the motorway works, and thus one of the biggest hurdles to restoration has been overcome already.

British Waterways have visited the main work sites and their Third Party Works Engineer has inspected the quality of the work undertaken to date. The piling adjacent to the golf course will require repair due to the length of time it has been left without support or backfilling, and a minor grouting repair is required to a short section of wall at Borrowcop. In all other respects, British Waterways were satisfied with the standard of construction of works undertaken to date.

1.4 The Feasibility Study

Initial studies into the practicality of overcoming these obstacles to restoration have resulted in outline solutions being found in all cases and thus engineering concepts have already been proposed.

A cost-benefit study was completed in 1993/4 which proved to be favourable for restoration. An environmental report assessing the environmental impact of the re-opening of the canal was completed in 2000.

Atkins were appointed by the Trust in late 2008 to provide a full and detailed single feasibility report which will bring together the work undertaken previously, validate it, and add further detail in terms of water supply, engineering, environment, and economic benefits. The report is a stand-alone document which will be used to support the Trust's input to the Local Development Framework, and will be used to explain the project to potential funders.

1.5 Information supplied by the Trust

The following information was supplied by the Trust.

Ref	Title	Source
A	A38 and A51 Roads, Canal Tunnel Crossings.	Trafalgar House, March 1993.
B	The Lichfield Canal, Considering costs, benefits and possible timescale of the restoration, including potential sources of funding.	John Horton for LHCRT, December 1993.
C	Lichfield Canal Business Plan 1993-2023, (draft partial adaptation of the above report).	Bob Williams for LHCRT, [2000]
D	Exemption from Waste Management Licensing at Darnford Land and Fosseway Lane, Lichfield.	Environment Agency letter, June 1996.
E	Agreement for canal restoration at Fosseway Lane, Lichfield,	Lichfield District Council, December 1996.
F	Lichfield Canal Survey — Economic benefits of restoring the Lichfield Canal.	Mike Smith for LHCRT, 1997.
G	The Potential Impacts, Environmental Benefits and Disbenefits of the Restoration of the Lichfield Canal.	Ed Sharkey Associates, February 2000.

H	Freehold Title to “Railtrack” land near Fosseway Lane Lichfield. NOTE: 1926 record of Sandfields Water Works ”pumping 15 million gallons pa into the canal from their own drop wells”.	HM Land Registry SF430106, August 2000. Acting trustees of Sandfields Pumping Station
I	Possible Landscape Proposals for the Darnford Lane Section of the Lichfield Canal.	Ed Sharkey Associates, September 2000.
J	Agreement for construction of Cappers Bridge, Lichfield.	Staffordshire County Council, October 2003
K	Construction drawings of Lichfield Canal aqueduct over M6 (Toll) motorway near Muckley Corner.	Completed September 2003.
L	Hydraulic Assessment for Proposed Restoration of the Lichfield Canal.	Severn Trent Water, July 2004.
M	Freehold title to land adjoining MS Toll motorway by the aqueduct near Muckley Corner.	HM Land Registry SF465953, September 2004.
N	Lease relating to former Land at Tamworth Road to Lichfield & Hatherton Canals Restoration Trust Ltd.	Lichfield City Council, June 2006.
O	The Lichfield & Hatherton Canal Historic Environment Survey.	Green Arc Partnership, October 2006.
P	Hatherton Canal Restoration, Feasibility Report including Portfolio of Drawings.	Arup, September 2006. *[Electronic version also available].*
Q	Biodiversity Strategy 2003-2013.	Lichfield District Council, 2004.
R	Licence to abstract water at Darnford Lane, Lichfield.	Environment Agency, Dec. 2000, renewed March 2007.
S	“A Tale of Two Canals” (public information booklet)	L & H Trust, updated 2008
T	Draft Greens and Open Spaces Strategy, and Open Spaces Assessment.	Lichfield District Council, January 2008.
U	The Lichfield & Hatherton Canals, a strategy for completing restoration.	L & H Trust, January 2003, revised July 2008.
V	Various documents, plans and pictures relating to Lichfield Southern Bypass.	LHCRT, LDC, SCC, 2004 - 2008
W	Panoramic map across Hatherton Canal and Lichfield Canal with features identified.	LHCRT display, current.
X	Fosseway Lane / Lichfield Southern Bypass proposal	LHCRT – Mike Smith
Y	Birmingham Road to London Road / Lichfield Southern Bypass Proposal	LHCRT – Mike Smith
Z	Supplement to levels in Severn Trent Report (Item L)	LHCRT – Mike Smith
AA	Detailed plan and long section for restoration (two sheets – locks 1-18 and locks 19-30)	LHCRT – John Horton
AB	Artistic Impression of Ogley Junction Development Potential	British Waterways

AC	Specimen Works Programmes for Landscape Works	LHCRT – Mike Battison
AD	Proposal Drawing and Specification for Re-watering the Pound between Locks 25 and 26	LHCRT – John Horton
AE	PowerPoint Presentation of Potential for Marina Development at Boley Park	LHCRT – Lucy Walsh

Table 1.1 – Information Supplied by the Trust

1.6 Other Information Used

Ordnance Survey MasterMap 1:2,500 mapping was obtained under sub-contractor license from Lichfield District Council.

Ordnance Survey 1:25,000 mapping and NextMap 5m Digital Terrain Model data was purchased for an area generally about 250m either side of the proposed alignment.

For historical information reference has been made to the Birmingham Canal Navigation Society's publication, "The Other Sixty Miles"[4] and to various historical maps (in addition to those supplied by the Trust and its members).

[4] "The Other Sixty Miles – A survey of the abandoned canals of Birmingham and the Black Country", Richard Chester-Browne, published by the Birmingham Canal Navigations Society (second publication, 1991)

2. Canal Route and Engineering

2.1 General Engineering

2.1.1 Design Parameters

The alignment was drawn using design criteria which were derived from those agreed for the previous study into restoration of the Hatherton Canal[5] between Arup and British Waterways. The following criteria have been specifically approved by British Waterways for the Lichfield Canal[6]:

- General width of canal not less than 9 metres (except in special circumstances over short sections and through structures);
- Generally a 3 metre wide towpath (including any verges – towpath surface to be generally 2 metres wide);
- The headroom above normal water level will be 2.5 metres where practicable, with an absolute minimum of 2.0 metres[7] - it may be felt necessary to install warning signs or gauge boards / chains either side of bridges with lowered headroom to reduce the risk of injury to people on boat roofs;
- Draft (the depth of water from normal water level to canal bed level) to be 1.5 metres over a main navigation channel width of at least 5 metres, and adjacent to any vertical waterway walls.

Other parameters used for the design are:

- Minimum curve radius 60 metres (BW agreed for the Hatherton Canal this could be 40m with channel widening, but the Lichfield Canal is for the most part more rural without the physical constraints which dictated such sharp curve radii, and the points where the 60 metre radius could not be met are identified in the detailed description of the proposed route below)
- The minimum construction depth of road bridges has conservatively been taken to be 1.0m from soffit to carriageway level, although it should be possible to reduce this in many cases in the detailed design process;
- The maximum slope used for embankment and cutting batters is generally 1 in 2, and where steeper slopes have been used this is identified in the detailed description of the proposed route below.

2.1.2 Feasibility Design Methodology

PDS ground modelling software was used to produce contours from the Digital Terrain Model, and the approximate alignment, contours and mapping information were overlaid and plotted. The initial vertical and horizontal alignment was based on drawings prepared by John Horton of the Trust. Some initial refinements were made where the contouring exercise highlighted areas for improvement and the drawings were hand annotated to identify the various options.

Meetings were held with Mike Smith and John Horton to discuss these options and verify that there were no pertinent issues known to the Trust which had not been taken into account. Further notes were made on the composite drawing and were then used for the next stage.

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[5] "Hatherton Canal Restoration – Final Feasibility Report", Arup (for British Waterways acting as agents for the Lichfield and Hatherton Canals Restoration Trust), September 2006

[6] By email from BW West Midlands Engineering Manager to the Study Project Manager dated 3 February 2009

[7] The constraints on the neighbouring canals are understood to be 1.98m on the Coventry Canal and 1.80m on the Wyrley and Essington.

Areas where there are vertical pinch points were identified using the contoured drawing and the proposed vertical alignment, and limited surveys were carried out at the six locations listed below to verify the headroom available and assist with the layout of road and watercourse crossings:

- Darnford Lane (road and brook);
- Cricket Lane;
- Coppice Lane;
- Watling Street;
- Walsall Road (by the Boat Inn);
- Barracks Lane.

The surveyed levels were then used to assist in establishing suitable lock locations and proposed canal pound levels.

The computer model of the proposed horizontal and vertical alignment was then analysed to give an understanding of the approximate volumes of material to cut and fill. This first earthworks balance exercise identified a considerable excess of excavated material so the vertical alignment was reviewed.

Amendments to the lockage arrangements have been made where possible to introduce additional embanked sections that will reduce the amount of material to be disposed of to off-site tips and therefore reduce construction costs.

The model also enables the footprint required to restore the canal to be identified so that the necessary land can be protected in the Local Development Framework, and the Trust can work towards acquiring the necessary title.

2.1.3 Locks

The locations of existing locks have been plotted using historical mapping. Where the locks are on the line of the proposed restoration they have been re-used as far as possible. Efforts to determine former pound[8] levels from remaining features have been made both by the Trust and by Atkins, but the exact levels of all of the former pounds cannot yet be determined and therefore some pound levels may have to be adjusted as detailed design of the project progresses.

The locks which are to be re-used are generally expected to be in fairly good condition, having been rebuilt by the BCN Company to a consistent and high standard in the mid Victorian period, and preserved after closure by infilling of the chambers. The experience of the Trust in excavating Locks 18, 24, 25 and 26, (all of which have been in a very good condition) would tend to bear this out.

Likely works to the structures will include excavation of spoil, localised brickwork repairs (primarily repointing) to part of the invert[9] and lock sides, replacement of bywash weirs and channels, and construction of new wing and approach walls. In addition, new lock gates, paddle[10] stands and paddle gear, signage and monitoring equipment will be required, together with footbridges across the tails of some locks.

[8] A canal pound is the section of water between two locks. The level of each pound is set by the overflow ("bywash") weir at the downstream lock.
[9] A lock invert is usually a shallow inverted arch of brick or concrete which forms the base of the chamber and serves to prevent the walls moving into the chamber at their base.
[10] Paddles are the penstock valves which provide a means of controlling the flow of water into and out of the lock chamber.

The proposed locks are likely to be constructed to a traditional form, but in more modern materials, such as reinforced concrete and sheet piling. A recent example of this type construction is Curdworth Top Lock, which was constructed as part of the M6 (Toll) works in 2002.

Figure 2.1 – A Modern Lock – Curdworth Top Lock

The Trust had proposed a deep lock of more unusual construction to drop the canal the 4.7m from the new aqueduct over the M6 (Toll) road to the original pound level. This proposal is not incorporated in the feasibility design because of the need to create additional embankments to accommodate excavated material (see section 2.1.2). This is discussed in more detail at the appropriate point in the route description (refer to section 2.8.5).

2.1.4 Bridges

Detailed discussions of each bridge structure are included in the route and engineering sections below.

Each proposed road and rail crossing location has been visited by an experienced bridge engineer, to assess the options for the major structures. The requirements for the three culverts (at Darnford Brook, Pipehill, and Crane Brook) have been addressed by a similarly qualified watercourse engineer.

Recent crossings of a similar nature to the major road and rail crossings have been reviewed and recommend suitable structures which can be constructed economically given the constraints of each site. Atkins rail team have given advice as to likely Network Rail requirements for the crossing under the Lichfield – Birmingham railway, and suitable techniques which will enable the canal to be taken under the railway whilst minimising the impact on railway operations.

All of the bridges require a water depth of 1.5m below the specified pound level and the air draft (headroom above water level) should generally be 2.5m, with an absolute minimum of 2.0m. The levels in our alignment have been designed so this can be achieved with an assumed construction depth from road surface to soffit of bridge of 1m (or more).

Most of the bridges have been priced on the basis of providing 4m wide navigation and a 2m wide towpath. If the channel is any narrower, to ensure water can flow around the boat (avoiding a "piston" effect), the space below the towpath should not be infilled but should offer additional waterspace. This could be achieved either by cantilevering a concrete towpath slab from the sidewall of the bridge, or by constructing the towpath on columns to create waterspace beneath it.

2.1.5 Rights of Way and Farm Accesses

Public rights of way and existing farm access routes have been taken into account where these are either visible on the ground or shown on mapping. In a few locations, short diversions of rights of way or accesses have been devised to avoid the necessity of expensive structures.

2.1.6 Maintenance Access

In the context of what is essentially a completely new canal, maintenance access should be considered at design stage. Whilst the minimum standard agreed for the towpath width is 3m, as stated above, there should be at least one access to each lock where the towpath is capable of bearing the loads imposed by maintenance plant. The ability to use small (e.g. 5 tonne) crawler cranes for lock maintenance at many locks on the Shropshire Union Canal has transformed the time taken to repair or replace lock gates etc., since such access was provided. It is therefore suggested that a 4 metre wide towpath, together with suitably designed bank protection, should be provided between the following points:

- Cappers Lane to Lock 30;
- Darnford Lane to Darnford Lift Bridge;
- Fosseway Lane to Lock 18;
- Wall Lane to Lock 13 to 17;
- Coppice Lane to Lock 12;
- Moat Bank Lane to Locks 11 and 10;
- Sewage Pumping Plant access (off A5 westbound) to Lock 9B;
- Barracks Lane to Lock 6;
- Barracks Lane to Locks 5 to 1.

See section 2.2 for details of the proposed lock locations.

In addition the scheme assumes that negotiation will be undertaken (possibly as part of land purchases) to provide access over third party lands to the following structures / sections of the canal:

- Darnford Bridge Farm to Lock 29;
- Boley Park southern car park to Lock 28;
- Existing Trust compound area to Locks 26 and 27;
- Boat Inn to towpath at Lock 9A;
- From un-named Farm Lane east of Boat Inn to Lock 8;
- Through gravel pit compound to Lock 7.

2.1.7 Statutory Utilities and Service Diversions

A complete search of all statutory undertakers' plant along the proposed line of the canal and approximately 500m to either side was undertaken. The full results have been supplied to the Trust in digital format. Where the presence of Statutory Undertakers' plant forms a potential problem for the restoration, or where the costs of diversion might be significant, details are given in the Route and Engineering descriptions below.

The main concentrations of services are as follows:

- Overhead HV electric supply pylon and cables at Darnford, to the east of the A38 (T);

- Piped land drainage / surface water in the bed of the canal and lock inverts from lock 23 to lock 26;
- Substation and gas governor / valve adjacent to Cricket Lane crossing;
- Sewage pumping station and electricity pole south of A5 trunk road (Watling Street) crossing;
- Water pipe crossing alignment on steel beam west of Boat Bridge (A461 crossing).

2.1.8 Demolition and Site Clearance

One of the Trust's guiding principles in promoting restoration of the canal has been to avoid the requirement for demolition of any existing permanent structures. This has been achieved by careful use of the planning and modelling tools available, together with an approach which re-uses the original alignment at pinch points where appropriate, and includes deviations from the original route where necessary.

No domestic property (i.e. houses) will have to be demolished to enable the restoration to take place. There will have to be some amendments to access (and potentially to gardens) to four houses near Ogley Junction. One of these is already owned by the Trust.

The canal and towpath pass very close to former BCN Company Cottage No. 268 (now a private dwelling) just north of the proposed Fosseway Lane Bridge, but it is anticipated that use of the original alignment for the canal, together with the application of modern retaining methods to the towpath, will avoid the need for any modifications to the building. Suitable precautions to protect the structure may be required during construction. The structure could, for example, be surveyed immediately prior to any construction work commencing adjacent to it, and then monitored during the works to ensure that no movement takes place.

Site clearance will generally be straightforward but will include much removal of brush and semi-mature trees, and the windows for undertaking this work will be constrained by regulations regarding nesting birds. Unless works on each phase are scheduled to commence between November and early January, it would be wise to let separate site clearance contracts for execution between November 1st and January 31st to avoid disturbing nesting birds.

Where possible the scheme includes new woodland planting areas (which could particularly target planting of black poplar), and new boundaries will be formed of mixed species hedgerows of indigenous species. In both cases it is recommended that plants should be of local provenance. This should mitigate the loss of habitat resulting from clearing vegetation.

2.2 Phasing

2.2.1 Rationale

The phasing of the scheme has been considered carefully by the study team. It would be better to progress the restoration from bottom (Huddlesford Junction) to top (Ogley Junction). This is not usual in canal restoration because of the difficulties in providing water supplies, but does have the following advantages:

- A small scale, achievable first phase;
- The main destination, Lichfield, is reachable from the canal network after the second stage;
- The point of connection until completion of the whole of the restoration will be Huddlesford Junction on the Coventry Canal, a location where there is 10 to 20 times as much passing canal traffic as at Ogley Junction at the other end of the canal;
- The last stage will involve three of six major bridge crossings and the restoration or construction of 13 locks – this is a very significant expense and it will be easier to justify funding this with much of the restoration already complete.

Interim water supplies are potentially available on the top pound of each of the phases except for the first phase (the supply for this will be back-pumped around one lock), and possibly the third phase (where supplies may have to be back-pumped around two locks). Once established, these interim supplies could be formalised as permanent feeders which would reduce the requirement for feed water from the Wyrley and Essington Canal when the restoration is complete. A more detailed treatment of water supply options is given in section 2.3, below.

The proposed phasing is therefore as tabulated below:

Phase No.	Description	Length	Locks	Bridges	Water supply
1	Huddlesford Junction to The Moorings, Darnford	1.7 km	1 (restoration of existing lock)	2 (Existing: 1 minor road, 1 accomm.)	Back pumped from Coventry Canal level
2	Darnford Bridge – Borrowcop Locks Canal Park	1.5 km	5 (2 already part restored, 3 new locks)	3 (New: 1 trunk road, 2 other roads)	Water from existing land drainage pipe in channel
3	Cricket Lane – Lock 18[11] (Fosseway)	2.3 km	6 (all new structures)	5 (New: 2 other roads, 1 railway bridge, Existing: 2 A roads)	Surface water from new development balanced in canal and pumped from below Lock 20
4	Lock 18 and Fosseway Lane Bridge – Pipehill Pumping Station[12]	2.3 km	6 (all refurbished existing locks)	2 (New: 2 other roads)	Pumped abstraction from Pipehill Brook[13]
5	Coppice Lane Bridge – Ogley Junction	4.2 km	13 (9 refurbished existing locks, 4 new locks)	8 (New: 1 trunk road, 5 other roads, 2 accom.; Existing: 1 motorway, 1 other road)	From Wyrley and Essington Canal (BCN Wolverhampton Level)

Table 2.1 – Proposed Phasing of Restoration

2.2.2 Early Wins

Two schemes have been identified which could produce “early wins”, particularly in terms of the awareness of the Trust’s objectives. These could both be completed within months of being funded and would serve to gain public notice and support for the Phase 1 and Phase 2 restoration projects as a whole.

The first scheme is the Trust’s plan to re-water the canal at Borrowcop between Locks 25 and 26. This will involve providing a liner, filling a few final gaps in the waterway walls and opening out the culverted watercourse between the two locks to fill the canal. The works are currently costed at

[11] Lock 18 is actually included in Phase 4
[12] Phase 4 should also include the construction of some or all of the bulk earthworks (almost entirely embanked) for phase 5 to optimise earthworks balance and therefore reduce tipping costs.
[13] Subject to an application for Consent and Environment Agency approval.

around £75,000 to £100,000. Virtually all of the work involved will be required as part of the Phase 2 restoration, so little effort would be wasted, and the prospect of the Trust managing an area of water space after so many years of slowly accumulating land and building structures to keep the line intact is an attractive one.

A further project, again targeted at generating publicity and goodwill for a relatively low outlay, is the creation of a Lichfield Canal Walk. This would join the various publically accessible sites with a walk using minor roads and existing rights of way. Special signage and interpretation could be provided. As the restoration evolves the route could be progressively re-aligned onto the newly restored towpaths, bringing with them their users. There are clearly synergies with the existing Darwin Walk and Heart of England Way – the Canal Walk would share sections of the alignment of both of these established walking routes.

2.3 Water Supply

This section quantifies the water supply requirements for the restored canal and discusses various options for supply. The following sections deal with Long Term Water Requirements (i.e. on completion of the whole restoration from Huddlesford to Ogley Junction) and Interim Water Requirements (before completion of the whole restoration).

2.3.1 Long Term Water Requirements

The water supply required for the canal can be subdivided into three separate issues:

- Water required to fill the canal initially on completion of restoration works;
- Water required to offset losses through evaporation, bed losses and lock gate leakage – these are called Residual Losses;
- Water required to enable boats to move up and down the canal – this is called Lockage Water

It is assumed that the works will be timed to allow a sufficient period for filling each phase, either by taking advantage of higher natural flows in winter, or by abstracting the normal lockage water flow in addition to the residual loss water prior to opening the section after restoration or maintenance. This report therefore only considers water to replace residual losses and lockage water.

Water feed rates on British Waterways network are measured in units of megalitres per day (Ml/d).

Residual Losses

British Waterways have confirmed that an average figure of 1.75 megalitres per kilometre per week, (0.25 megalitres per kilometre per day), based on their research, would be appropriate for analysis of water feed requirements. Using this figure, the residual losses are calculated to be as shown in the table below.

Phase of Restoration	Length (m)	Residual Loss (Ml/d)
Phase 1: Cappers Lane[14] to Darnford	1,070	0.27
Phase 2: Darnford to Cricket Lane	1,500	0.38

[14] Cappers Lane is taken as the start of this section because below this point BW already supplies water from the Coventry Canal to address residual losses on the Lichfield Canal through the Lichfield Cruising Club moorings. In fact, the restoration work is likely to reduce these losses even though the surface area of the canal bed will be greater, because a liner will be installed. This effect has been ignored as it is likely to be relatively small, and difficult to quantify.

Phase of Restoration	Length (m)	Residual Loss (Ml/d)
Phase 3: Cricket Lane to Lock 18	2,300	0.58
Phase 4: Lock 18 to Coppice Lane	2,300	0.58
Phase 5: Coppice Lane to Ogley Junction	4,200	1.05
Totals	*11,370*	*2.84*

Table 2.2 – Residual Water Losses

Lockage Water

The amount of lockage water lost overall depends on the flow and number of boats using the canal, the size of the deepest lock passed by each boat, and the location of any feeders to the canal.

For the purposes of this aspect of the study, the flow of boats (see section 5.2.3) has been simplified as follows:

- Huddlesford to Cricket Lane: 2,000 through journeys, 1,000 journeys to or from the marina (to / from Lichfield or further afield) as above, and 2,000 out and back journeys (to / from Huddlesford or further afield) – total 5,000 boat movements.
- Cricket Lane to Lock 18: 2,000 through journeys as above, 1,000 journeys to or from the marina (to / from Lichfield or further afield) as below, and 800 out and back journeys (to / from Huddlesford or further afield) – total 3,800 boat movements;
- Lock 18 to the connection point for a marina (assumed to be between Locks 6 and 9A): 2,000 through journeys as above and 1,000 journeys to or from the marina (to / from Lichfield or further afield) – total 3,000 boat movements;
- Ogley Junction to marina connection point: 2,000 through journeys and 1,000 journeys to or from the marina (to / from Ogley Junction or further afield) – total 3,000 boat movements.

To simplify the calculations a conservative assumption is made that the deepest lock chamber has a rise of 3.5 metres and dimensions of 25 metres long and 2.4 metres wide. This equates to 210m³ or 0.21Ml per lockage. On the basis of past experience it is assumed that on an average summer day around 0.6% of all annual boat movements occur, and that this is the design criteria (the Hatherton Canal feed water assessment was undertaken on the same basis).

Section of Canal	No. of boat movements per day	Lockage water requirement (Ml/d)
Huddlesford to Cricket Lane	50	10.50
Cricket Lane to Lock 18	38	7.98
Lock 18 to Coppice Lane	30	6.30
Coppice Lane to Ogley Junction	30	6.30

Table 2.3 – Lockage Water Requirements

Overall Requirements

Ideally water would be fed to the points where it is needed to avoid over-reliance on the feed from the Wyrley and Essington Canal (and therefore the Wolverhampton Level of the BCN system) at Ogley Junction. This would mean that the following feeds would be required once the canal is complete:

- At Cricket Lane, sufficient water to cover residual losses as far as the current extent of supply by BW at Cappers Lane, and additional lockage water (over and above that coming down from further up the canal towards Ogley Junction) to cover the extra number of lockages made below Cricket Lane – i.e. 0.65 Ml/d for residual losses and (10.50 – 7.98) = 2.52 Ml/d lockage water, giving a total of 3.17 Ml/d;
- On/to the pound below Lock 18, sufficient water to cover residual losses as far as the next water source (taken to be at Cricket Lane), and additional lockage water to cover the extra lockages made below this point – i.e. 0.58 Ml/d for residual losses and (7.98 – 6.30) = 1.68 Ml/d lockage water, giving a total of 2.26 Ml/d;
- At Pipehill (effectively Coppice Lane as these locations are on the same pound), sufficient water to cover residual losses as far as the next water source (below Lock 18) i.e. 0.58 Ml/d for residual losses. No additional feed water is required because there is no difference in the number of boat movements above and below this feeder;
- At Ogley Junction, sufficient water to cover residual losses as far as the next water source (Pipehill Brook) and enough feed water to cover all lockages between the Junction and the next water source – i.e. 1.05 Ml/d for residual losses and 6.30 Ml/d for lockage, giving a total of 7.35 Ml/d.

These requirements are summarised below:

Feed Location	Residual Loss Water Ml/d	Lockage Water Ml/d	Total Feed Req'd Ml/d
Cricket Lane	0.65	2.52	3.17
Below Lock 18	0.58	1.68	2.26
Pipehill Brook	0.58	0.00	0.58
Ogley Junction	1.05	6.30	7.35
Total	2.86[15]	10.50	13.36

Table 2.4 – Total Feed Water Requirements

It should be noted that the feed locations given are essentially the lowest point at which the feed required can be fed into the canal – there is, in theory, no reason why the entire feed could not be supplied at Ogley Junction if sufficient water was available there, and bywashes etc. were sized accordingly.

For reference the maximum average flow over a 10 hour period in summer (all lockages and 10/24ths of the residual loss water) would be of the order of 324 litres per second. This could be accommodated in a 450mm diameter concrete pipe laid at a gradient of 1:100, or more typically for a bywash culvert, a gradient of 1:14 (fall of 2.5m in 35m) would necessitate a pipe of 350mm diameter or greater.

2.3.2 Interim Water Requirements

Assuming the feeds described above are implemented as part of each phase of the works, the water supply constraints for operation prior to completion of Phase 5 will be as follows:

Phase 1: Navigation available from Huddlesford Junction to Darnford

The number of boats able to lock onto the Darnford pound will be limited by the capacity of the back-pumping installation at Lock 30. This is unlikely to be a practical constraint, given that boat numbers will probably be relatively few.

[15] The discrepancy between this figure and the total given in Table x is due to rounding errors.

Phase 2: Navigation available from Huddlesford Junction to Cricket Lane

Sufficient water will be available for 13 boat movements per day.

Phase 3: Navigation available from Huddlesford Junction to below Lock 18

Sufficient water will be available for eight boat movements per day above Lock 25 and for 21 boat movements per day below Lock 25.

Phase 4: Navigation available from Huddlesford Junction to Pipehill

There will be no long term supply of lockage water at Pipehill for the reasons outlined above. This is therefore the only location where more water will be required in the interim case than in the long term. Each boat movement will require around 0.19Ml of water, and so to enable six boat movements per day a lockage water feed of 1.15Ml/d will be required. As 0.58Ml/d of water is required to compensate for residual losses on the section to Lock 18, the total feed required for six boat movements a day would be 1.73Ml/d.

Any negotiations toward obtaining consent to abstract water from the Pipehill Brook should be undertaken with this interim feed requirement in mind. If pumping were undertaken on a 24/7 basis in summer, the flow rate would need to be 20 litres/second.

2.3.3 Supplies from Existing Canal System

The restored Lichfield Canal will join the existing canal system at Huddlesford Junction on the Coventry Canal (Phases 1- 4 of the restoration will only connect to the British Waterways network at Huddlesford) and ultimately at Ogley Junction on the Wyrley and Essington Canal when the restoration is completed as Phase 5 is finished.

Phase 1 of the restoration will make limited use of water from the Coventry Canal. Residual losses are unlikely to increase significantly as a result of the opening of Phase 1 because the entire section will be fully lined as part of the restoration replacing a potentially more porous existing bed between Huddlesford Junction and Cappers Lane. Because of the out and back nature of the trip from Huddlesford Junction to Darnford, any water back-pumped at Lock 30 from the Coventry Canal would quickly be returned as boats locked back towards Huddlesford.

Feed from Ogley used to be main supply for the canal prior to abandonment, although a small groundwater abstraction at Sandfields was also known to have been used. As identified above the anticipated peak daily feed required at Ogley Junction in the summer is estimated to be around 7.35 Ml/d.

The decision not to rely entirely on feed from Ogley Junction has been made for the following reasons:

- It would make a phased approach to restoration starting at the Lichfield end of the canal unfeasible because there would be no water supply until the end of the work. In other words, if the phased approach from the Lichfield end is adopted other supplies of water will have to be found and where possible using them permanently would reduce the burden on British Waterways' existing water resources;
- It is wasteful of water on the upper sections of the restored canal, because more boat movements are projected at the Lichfield end of the canal than in the upper sections;
- The Trust's other restoration project, the Hatherton Canal, is also dependent on water resources from the Wyrley and Essington Canal and it would be beneficial in terms of the feasibility of the Hatherton Canal restoration to minimise the Lichfield Canal's reliance on the Wyrley and Essington for water supply.

There is understood to be limited additional capacity on the Wyrley and Essington at present – this is to be looked into by a separate joint study between British Waterways and the Trust. There are several potential sources of additional supply or existing supplies where it may be possible to

increase feeds on or above the Wolverhampton Pound (the same level as the Wyrley and Essington Canal) and these should each be investigated.

2.3.4 Supplies from Groundwater

Groundwater abstraction has been considered both as a means of providing supply either on a temporary basis for the initial phases of restoration and for the longer term to augment any feed taken from the existing network at Ogley Junction.

Included in the data supplied by the Trust to the study team was a 1926 record of Sandfields Water Works "pumping 15 million gallons pa into the canal from their own drop wells". If this was undertaken over the dry summer months only this would equate to a feed of around 0.2 megalitres to 1.0 megalitres per day, and may have been sufficient in commercial carrying times to provide some additional feed for boats undertaking out and back trips to Lichfield from the Coventry Canal, and to reduce the demand on the Wyrley and Essington Canal for feed water.

There have been problems in the past with over abstraction of groundwater in the area west of Lichfield, particularly affecting Leamonsley Brook. South Staffordshire Water discusses this on their website:

"In the 1980s it was identified that the water levels in the Stowe and Minster Pools in Lichfield were falling. This was causing a great deal of concern to local residents. In 1989 a study by the Environment Agency highlighted Leamonsley Brook as one of the top forty low flow watercourses in England and Wales. The importance of the Brook and the Pools, in terms of conservation, could not be overlooked.

The problem arose due to a lack of water flowing through Leamonsley Brook, the only supply to Stowe and Minster Pools. The Brook, a feature of Beacon Park, could not deliver sufficient flows to the pools while groundwater was being abstracted from its catchment area.

During 1992, whilst looking for a lasting reduction in groundwater abstraction, the Agency, in conjunction with Lichfield District Council, sank an augmentation borehole to pump water out of the aquifer and discharge it directly into the Brook achieving something approaching a natural flow. However, this solution was effectively 'robbing Peter to pay Paul', taking water from the same aquifer that was causing the problem. It could not be regarded as a permanent solution.

After consultation with the Environment Agency and Lichfield District Council, South Staffs Water agreed to reduce the amount of water it is allowed to abstract from the Lichfield area and sought no financial compensation for doing so. This target reduction was around 20% of total Lichfield abstraction or 6 million litres a day.

A thorough study of all the options available was undertaken. Using a specially designed computer model, the Environment Agency and the Company, looked at five different ways of achieving a reduction in water abstraction from the Lichfield aquifer. It was agreed that the best solution would be to stop pumping water from Hanch Tunnel at Sandfields Pumping Station and to reduce abstraction from two pumping stations near the City, at Pipe Hill and Trent Valley. By far the biggest contribution to the reduction comes from the closure of Sandfields Pumping Station. This was served by Hanch Tunnel, South Staffordshire Water's first source of water.

These reductions were put in place in September 1997. However, because of the way in which water levels in aquifers react, the full benefit of this reduction may not be seen until 2017."

In this context, it would seem unlikely that any of the first four phases could be supplied by abstracting groundwater, and, given the likely availability of pumped groundwater from an existing

British Waterways owned pumping station at Bradley[16] (south of Wolverhampton and on the same canal level as the Wyrley and Essington Canal at Ogley Junction), it would not be economic to construct a pumping station in the vicinity of Ogley Junction. Provision of feed water from the pumping station at Bradley would be via the British Waterways network and is discussed above under section 2.3.3.

The use of groundwater pumped from local aquifers for supply is not pursued further in this study.

2.3.5 Supplies from Main Surface Water Drainage

Four watercourses cross or run along the route of the canal. These are:

- Darnford Brook, which crosses twice, at Darnford Lift Bridge just upstream of Lock 30, and at Darnford Bridge Farm, just upstream of Lock 29;
- A culverted land drain which also accepts storm water flows and currently occupies the former bed of the canal running from Chesterfield Road in the west to a point around 150m east of Lock 26 where the culvert leaves the proposed alignment;
- The Pipehill Brook, on a long pound between Locks 12 and 13;
- The Crane Brook, between the proposed location for a re-sited Lock 7 and Lock 6.

A fuller understanding of the dry weather flows in each of these watercourses will be required if they are to be used as supplies, particularly with regard to ensuring that there is sufficient base flow left in the water course to sustain water quality and habitats – this is beyond the scope of the current study, but a visual assessment has been made and it may be possible to abstract water from the Crane Brook and from Pipehill Brook. It is recommended that a dialogue is opened with the Environment Agency to explore the options, and this could be taken forward as part of the water supply study mentioned in section 0. Neither watercourse is above the level of the canal within a reasonable distance so any abstraction would have to be pumped into the canal. Fortunately the distances and head rises are not large, so low powered pumps with sustainable sources of power (wind, solar or hydraulic) and low-cost (night time) mains backups would be suitable.

The use of water from the culverted land drain is more straightforward – the Trust has already obtained Severn Trent Water's approval for opening out the culvert and is understood to be in negotiations with the Environment Agency as to whether consents are required. Treatment of the water to maintain water quality in the canal may be required; however this is likely to be limited to installing a petrol / oil interceptor at the inlet point.

It is unlikely that a supply from Darnford Brook would be of any great use as it lies between Lichfield and Huddlesford Junction, well below the main destinations.

2.3.6 Water Supply Strategy

An outline water supply strategy has been developed to cover the various phases of restoration and this is summarised below:

- Phase 1 – to be supplied from the Coventry canal by means of a temporary back pumping installation at Lock 30;
- Phase 2 – will use water obtained by opening out the culverted land drain and allowing the canal channel to take the base and storm flows. The excess water (storm water plus some base flow if required by the Environment Agency will be discharged via a new weir back into the remaining section of pipe between Locks 26 and 27. This is believed to outfall into

[16] How any additional pumping costs (most notably electricity supply costs) would be met remains to be agreed, but it is hoped that they could be covered from the additional revenue generated from moorings and potentially additional license fees for boats based on the Wyrley and Essington and Lichfield Canals.

Darnford Brook. A petrol / oil interceptor may be required at the inlet point. The back pumping installation at Lock 30 would no longer be required and would be removed;

- Phase 3 – will rely on either pumped storm water from balancing areas associated with adjacent developments via a relocated interceptor or collect storm water and highway run-off from Fosseway Lane and other areas above canal could be collected, run through a suitable petrol / oil interceptor and into the relatively long pound above Lock 19. If Lock 19 were constructed in such a way that the pound level above it could fluctuate by up to 300mm, then there would be a storage capacity of up to 3,780m³, enough to supply 18 lockages in period of drought before locks 18 and 19 would have to be closed (this restriction would only apply in the short term until the next phase of the restoration was completed);
- Phase 4 – will use a pumped abstraction from Pipehill Brook just upstream / downstream of culvert – note that the water requirement is relatively low;
- Phase 5 – on completion of the restoration the phase 2 and 3 supplies will be retained to cover out and back traffic and losses below Lock 18. The remainder of the water requirements would be supplied from British Waterways' Wyrley and Essington Canal at Ogley Junction, although, if back pumps were fitted to the proposed bottom level controlled feed culverts on Locks 2 to 6 (see section 2.8.8) and at Lock 7, water could be abstracted from Crane Brook to reduce the reliance on British Waterways' existing supplies.

2.4 Route and Engineering: Phase 1 – Huddlesford Junction to the Moorings, Darnford Lane

The first proposed phase of the restoration is a comparatively simple section which has already seen significant work by the Trust, including the construction of a lifting accommodation bridge near Lock 30 and a new highway bridge across Cappers Lane. The key issue on this section is providing replacement off-line moorings for Lichfield Cruising Club, to give sufficient space for through navigation on the section of the canal from Huddlesford Junction to Cappers Lane Bridge.

2.4.1 Huddlesford Junction to Cappers Bridge

At Huddlesford Junction, the Coventry Canal is oriented roughly north west – south east. The Lichfield Canal forms an oblique junction with the Coventry Canal. A turnover bridge south of the junction connects the Coventry Canal towpath (on the east side of the canal at this point) to the former towpath of the Lichfield Canal (on the south side). This is now gated and forms a pedestrian access to the former canal cottages in the angle of the junction, now the cruising club's facilities buildings.

Huddlesford Junction[17]

About 30 metres along the Lichfield Canal from the junction is a small floating bridge which gives access to moorings on the north (off) side of the canal. There are also moorings on the south side of the canal, giving a total of 3,000 feet of moorings. The canal widens about 400 metres beyond the junction into a winding hole suitable for 50 foot long boats, and then passes under Watery Lane Bridge (an existing accommodation bridge).

Watery Lane Bridge[18]

[17] Aerial photograph courtesy of Lichfield and Hatherton Canals Restoration Trust Limited

Beyond the bridge is a further, section of moorings about 100 metres long which leads to the present end of the navigation. The Cruising Club has constructed a slipway here on the line of the canal and a diesel winch enables boats to be hauled out by club members for repairs. A polytent has also been provided to provide rudimentary cover from the elements for these repairs.

LCC moorings from Cappers Bridge, showing the covered slipway

Cappers Lane crosses the canal 20 metres beyond the slipway and the Trust has recently constructed a bridge (with support from the European Regional Development Fund) to carry the road over the canal. A new road access and car park / unloading area are provided for the Cruising Club and service the north side of the moorings and slipway area.

Cappers Bridge from Cruising Club car park / service yard

[18] Photograph by Phil Sharpe, from LHCRT's website http://www.lhcrt.org.uk/lich.htm, used with permission

The navigation is largely complete, apart from the last 20m to and under Cappers Bridge, which require bank protection and excavation of infill to be carried out. The main challenge in this section is providing alternative accommodation for some or all of the cruising club's moored boats to give sufficient width for through navigation. The Club has around 3,000 feet of mooring along the Lichfield Canal and this presently accommodates around 55 boats.

The site suggested by the Cruising Club for the alternative off-line moorings is a field on the south side of the canal and immediately south west of the Club House and access road. The field is about 450 metres long in total (along the canal) and between 40 and 95 metres wide, in the direction perpendicular to the canal. The total area is around 2.9 hectares. The field is bounded on the north west side by the canal and on the south east side by Darnford Brook, which flows in a tree lined channel around a metre to one and a half metres below the canal water level.

The proposed site for the moorings is currently shown on Environment Agency flood maps as being almost entirely within the flood plain of the Darnford Brook.

Figure 2.2 – Environment Agency Flood Map for Huddlesford Area

This map is understood to be based on the Environment Agency's most recent flood risk mapping exercise. Despite assurances received in 2004 by the Cruising Club from the Agency, it is thought unlikely that the EA would consent any scheme which would result in a loss of flood plain. Any development (i.e. basin construction) in this area would require compensatory volumes to be excavated elsewhere in the same floodplain on a level for level, volume for volume basis. This will not be easy, so the mooring proposal will have to be designed to minimise the waterspace and service land area that will be above existing ground level, to assist with this process. It is particularly important to ensure that areas of the moorings where the proposed water or ground level is above existing ground level, the change in levels is as small as possible, because large changes in levels will give very significant problems in providing compensating volumes (and considerably increased costs).

The layout shown on Proposal Map 1 is one of a number of possible options which would address flood risk issues and are capable of gaining regulatory support. Examples of similar "lay-by" mooring schemes, are Galgate Marina on the Lancaster Canal[19], and (on a much smaller scale) the moorings at Kidderminster illustrated below (although these are angled rather than perpendicular to the line of the canal).

[19] See BWML's marina plan at: http://www.bwml.co.uk/marina/5/galgate+marina/plan/

Echelon moorings at Kidderminster[20]

Proposal Map 1 shows two lay-bys, one suitable for 20 boats of up to 72' in length, and a further 20 between 50' and 70' in length, and the other suitable for 20 boats at 50' in length. Each pair of boats would be served by a 1.2m wide finger pontoon 12, 10 or 8 metres long. The total width of the mooring including the canal would be twice the length of the design boat length at that point.

The moorings on the Lichfield Canal would have increased capacity (up from 3,000 feet to 3,660 feet and from 55 boats to 60 boats), assuming the club also continue to manage the 72' moorings on their Coventry Canal frontage. The ability to provide full length moorings for more of their members could be a considerable advantage to the Club resulting from this scheme.

The floating bridge would probably have to be replaced with a fixed footbridge to divert the towpath to the north side of the canal past the moorings, and the approaches to Watery Lane Bridge would need to be altered so this could be used as the turnover bridge at the west end of the mooring site, returning the towpath to the south side. Environmental and landscaping improvements are shown on Proposal Map 1 to help "soften" the impact of the proposed moorings.

One potential disadvantage to this scheme is that the club house would be close to and potentially accessible from the towpath, while it is currently secluded and relatively secure. The moorings could, however, be afforded a similar level of security to the present arrangement because they would all be off-side and access could be controlled by a discreet gate and security fence at the north east and south west ends of the site.

There are clearly other alternative layouts for the moorings and these should be explored by undertaking an options study at the outline design stage in consultation with the Cruising Club. These options could take into account the Cruising Club's desire to provide some moorings "alongside" banks of a side arm rather than wholly providing moorings on finger pontoons.

2.4.2 Capper's Bridge to the Moorings

A short section of the canal from the Lichfield Cruising Club slipway to a point about 25 metres south west of the newly constructed Cappers Bridge is infilled, and will have to be excavated and lined. Works may be required to repair or replace the waterway walls either side of the bridge

[20] Photograph from www.tuesdaynightclub.co.uk, used with permission

(throughout the study, it has been assumed that 50% of waterway walls which are currently buried will have to be rebuilt / replaced for the purposes of cost estimates).

Cappers Bridge[21]

Proposal Map 2 shows the next section of the canal, which remains in water, although at a reduced level. This section continues to the bottom of lock 30, past a house and the lock cottage. It is proposed that the towpath for this section should follow the south side of the canal to minimise the impact of the restoration on the house and cottage. The south bank is currently in use as a farm track, and the towpath would either have to be constructed to accommodate this traffic, or a parallel track provided on the field side of the proposed hedge boundary.

The chamber of lock 30 is extant and will be restored, probably involving brickwork repairs and possibly construction of a new by-wash channel. This lock will be provided with a small pumping station to pump water up from the Coventry Canal level to provide a supply for Phase 1. This installation will have to be operated and maintained until Phase 2 is completed. Sustainable sources of electricity for this installation should be investigated, including the options of solar panels, and/or possibly a small wind turbine. The installations could be situated on the north (offside) of the canal west of the lock which would offer both security and a south facing aspect. An electrical supply to make up any shortfall, or to allow excess generated power to be input to the grid, could be taken off the spur supplying the house and cottage east of the lock.

The pound level downstream of the lock is determined by weirage on the Coventry Canal, but is approximately 63.6m AOD. The lock would have a rise of around 2.2 metres, making the upstream pound level 65.8m AOD.

West of the lock, the course of the canal and the location of the waterway walls is visible on aerial photographs. The original route of the canal would be followed for about 240 metres to a lift bridge which has already been constructed by the Trust. Some piling for waterway walls was undertaken in this section in 1999, but the piles are inadequately supported and some have been displaced. It is likely that this section of piling will either have to be tied back with anchors piles and tie bars or removed and re-installed.

[21] Photograph courtesy of Bob Williams, LHCRTL.

Darnford Lift Bridge

The towpath will switch sides at the lift bridge (it will be on the south side of the canal east of the bridge and on the north side west of the canal, as far as lock 27 south of the A51).

Immediately beyond the lift bridge, Darnford Brook will cross under the canal (the direction of flow is west to east at this point). The culvert for this crossing has also already been constructed and appears to be adequately sized.

Darnford Brook Culvert – Downstream Headwall

Another 40 metres along the canal alignment, initial earthworks and piling (see comments above), have been undertaken to prepare for a winding hole suitable for full length boats. This is located at the point where the proposed canal alignment diverges from the original alignment, just north east of the remains of lock 29.

This lock is not included in the restoration proposal – it is not on the proposed line and could not be used anyway due to the need to keep the canal at the 65.8m AOD level until it has passed under Darnford Lane. The lock will remain in its current state in a small copse, which cannot be made publicly accessible.

Remains of Lock 29, to be left in current state in offside woodland[22]

The canal will pass to the north of the remains of lock 29, and run parallel to and just south of Darnford Brook. A further 350 metre long section, which has been partly excavated but not piled, leads through Darnford Moors Golf Course to Darnford Lane and the interim terminus for Phase 1. The terminus is located adjacent to the Moorings Restaurant and the golf clubhouse and it is envisaged that access arrangements could be made which would make use of their pathways and car park approach to give access to Darnford Lane in the short term, to mutual benefit.

End of the excavated channel just north east of Darnford Lane

[22] Photograph courtesy of Bob Williams, LHCRTL.

This complex has been selected as the terminus to Phase 1 as it offers a number of advantages:

- One mile and one lock from Huddlesford Junction giving a cruising time of 30 to 40 minutes each way which will make the round trip attractive to passing boats on the Coventry Canal, particularly if a novel lunch stop is intended;
- A “destination” is offered at the end of the restored section, with opportunities to eat, drink and watch both golfing and boating activity;
- Darnford Lane offers a “jumping off” point for walking to local services – Boley Park with a Co-operative store and public house is around 15 minutes stroll away;
- Access is also available into Lichfield town centre, which is about half an hour away on foot by minor and estate roads.

As an alternative to the back pumping option, it might be possible to arrange a pumped supply of water from the brook at Darnford. Again power supplies would have to be considered, and the Environment Agency would have to grant a license for the abstraction.

The estimated supply of water required for phase 1 is 0.4 megalitres per day to cover residual losses, and (assuming 5 return trips per day in summer) 1.2 megalitres per day to cover lockage, giving a total of 1.6 megalitres per day. This equates to a feed of 18 litres / second assuming pumping is continuous. If pumping were to stop, say due to breakdown or drought, water would be lost from the Darnford pound at the rate of around 140mm per day if lock use were allowed to continue, or at a rate of about 50mm per day if navigation were not permitted.

2.5 Route and Engineering: Phase 2 – Darnford Bridge to Borrowcop Locks Canal Park

The second phase of the restoration is again comparatively straightforward (except for two major structures), and incorporates the Borrowcop section which has already seen significant work by the Trust. The work undertaken to date includes restoration of Locks 26 and 25, and construction of waterway walls. The main engineering works required in this phase are the installation of navigable culverts under the A51 Tamworth Road and the A38 trunk road. Both of these crossings are described in greater detail below.

2.5.1 Darnford Bridge to A38

The works required to this section are shown on Proposal Map 4.

The restoration is almost all off the original line, due to the need to cross the A38 at the west end of the length. This section of about 500m in length crosses a large field set to pasture. The proposed canal will generally be in a shallow cutting as it crosses the field. This section of canal will all be approximately 11m wide with a vertical sided waterway wall on the towpath side and a more natural sloping bank on the offside. The towpath will be on the north side of the canal.

Darnford Brook, looking south from Darnford Lane. Canal will be to the left.[23]

A new bridge will be required at Darnford Lane, with a 4m channel width and 2m towpath width. The lane is a two-way single carriageway local road with junctions adjacent to the location of the proposed carriageway crossing. The proposed water level for the canal at the crossing is 65.8m AOD, which would give a soffit level of 68.3m AOD. The existing carriageway is at 69.0m AOD, so either the construction depth will have to be reduced to 0.7m or the carriageway locally raised by around 0.3m if the 2.5m headroom requirement is to be met. Reducing the headroom in the culvert above water level to 2.2m would give the full 1.0m construction depth without requiring any carriageway raising. 2.0m of headroom could be provided for the towpath by reducing freeboard to 200mm through the bridge. It would be practicable to raise the local road to accommodate the structure requirements.

At this location a reinforced concrete box culvert could be constructed using precast sections that are installed following excavation of the existing ground beneath the road. The concrete faces of the culvert could be hidden using brickwork facing on the wing walls and abutment. The construction method would necessitate a road closure to enable the construction of the culvert. The site is constrained by the existing culvert to the northwest, golf course to the northeast and road junction to the southeast.

The structure would require parapets and associated approach safety fence in accordance with current standards, this may require a departure from standards for the adjacent junction and farm access.

The canal alignment would then run along and to the north west of the minor road linking Darnford Lane, Darnford Bridge Farm and Tamworth Road for around 180m, curving gently to the west.

At this point, a new lock (replacing the old lock 29 north of Darnford Bridge which is to be abandoned), will be required. This has been located to minimise the visual impact of the canal. The lock will have a downstream water level of 65.8m AOD, with a rise of 1.8m lifting the canal to an upstream water level of 67.6m AOD, which is suitable for the crossing of the A38 trunk road.

The canal will continue across a large field to cross over Darnford Brook about 110m west of Lock 29. The vertical alignment proposed here is a compromise, due to the need for the canal water level to be low enough to permit a crossing under the A38 trunk road without any amendments to the road. The canal water level at the crossing will be 67.6m AOD, and the existing brook level is

[23] Photograph courtesy of Bob Williams, LHCRTL.

probably around 68m AOD. The brook crossing will therefore have to be a very carefully designed inverted siphon, capable of self priming and self cleaning to prevent silt accumulation, and probably with an additional parallel relief culvert in case of blockage in the main culvert. The Environment Agency will have to be consulted at an early stage to agree design principles for this structure.

The proposed alignment continues across the field in a westerly direction, passing just south of an overhead power pylon (the canal will pass under the cables this supports). Liaison with the electricity transmission company will be required at an early stage to ensure any construction constraints are established prior to detailed design of this section of the canal.

The boundary and embankment of the A38 trunk road lie about 75m further west along the proposed canal alignment.

View of the A38 and Darnford Brook from the A51 showing proposed canal alignment

Consideration has been given to the impact the canal in this section will have on access to various parts of the large field it crosses, and access improvements are shown on the Proposal Map. Small areas will be “islanded” by the proposed canal and either the brook or the Darnford Bridge Farm access road, and it is proposed that these are purchased by the Trust along with the land required for the canal, and used for habitat improvement and environmental mitigation on completion of the main construction work.

2.5.2 A38 crossing

The A38 Trunk Road is a dual two-lane carriageway running from Birmingham to Derby and has a high traffic flow. As part of the study Atkins consulted Optima, who were, at the time of the consultation, the Highways Agency’s agents managing the A38 trunk road. They were asked about potential construction methods and confirmed that there were no insurmountable objections from the point of view of the Highways Agency, but that lane closures to facilitate construction of the crossing would not be permitted. In addition, Optima stated that carriageway levels will have to be monitored during construction of the crossing to ensure that no settlement of the road takes place.

LHCRT commissioned Trafalgar House to investigate the options for crossing the A38 and A51 in 1993 and the findings of the Trafalgar House report[24] have been taken into account in the feasibility study.

The conclusion of both Trafalgar House and Atkins' studies is that in order to construct the canal at this location the tunnel would have to be jacked under the road. This method of installing an underground crossing is not unusual but needs to be controlled carefully. A reinforced concrete box culvert is the best construction method for jacking beneath a road. The culvert is constructed adjacent to the final location of the crossing and it is then pushed using hydraulic rams through the ground formation. A steel shield is used on the front face of the culvert along with localised excavation at the face to reduce the pressure required to jack the box. Settlement of the carriageway above should be closely monitored throughout the works and is dependent upon the construction depth of the carriageway and the soil conditions in the jacking area.

Access to the works could be provided though fields (along the proposed line of the canal) from Darnford Lane. This would reduce disruption to Boley Park whilst the crossing is constructed. The land adjacent to the A38 provides a suitable place for a jacking pit to be built to allow the culvert to be constructed prior to jacking under the A38. As an alternative to jacking the complete culvert in one piece the culvert can be jacked in smaller sections. As one section is constructed and jacked under the carriageway another is installed and jacked behind it, this is continued until the full length of the structure is achieved. This method of construction requires less space to carry out the operation and is ideal where space is at a premium.

Land alongside the west edge of the A38 in Boley Park, close to the west portal of the proposed crossing

The completed crossing would be around 45m long, with a 4m wide navigable channel and 2m wide towpath. The canal water level proposed is 67.6m AOD, and the carriageway level is approximately 72.0m AOD, so a 2.5m air draft would give a carriageway surface to culvert soffit dimension of around 1.9m.

[24] A38 and A51 Trunk Road Canal Tunnel Crossings – Preliminary Report on the Recommended Construction of the Canal Tunnels, Trafalgar House Construction (Major Projects) Limited, March 1993

2.5.3 Boley Park

The proposed alignment will follow the south east boundary of Boley Park, running parallel to the A38 for about 200m between the A38 trunk road and A51 Tamworth Road crossings. This section is also shown on Proposal Map 4. Due to the levels of the A38, the canal will be in a fairly deep cutting, around 5m below the level of the park as it emerges from the A38 crossing.

A small turning basin, similar to the basins recently constructed for the Neath Canal where it crosses under the A470 trunk road, will be required adjacent to the A38 crossing portal. The basin and turn will require careful detailing with due consideration of user issues. The canal will then continue south west, parallel with the A38, for 50m past lock landing moorings to reach the proposed site for Lock 28. This section would be 11m wide, with a natural bank on the south east side.

This will be a new lock with a downstream water level of 67.6m AOD, with a rise of 2.7m lifting the canal to an upstream water level of 70.3m AOD, which is suitable for the crossing of the A51 Tamworth Road. An additional lock could have been provided as part of a staircase of two locks which would reduce the depth of the Tamworth Road crossing (possibly reducing the cost as the crossing could then be constructed in open cut rather than jacked), but this would have resulted in less than optimal lock landing provision and also could lead to operational difficulties. However a review of this decision at the outline design stage for Phase 2 would be a useful exercise.

A further section of canal upstream of the lock and around 80m long would lead to the A51 crossing. This section of canal will have vertical walls on both sides and will taper from a lock landing area 50m long and 7.2m wide to 4m wide at the entrance to the A51 crossing. The water level in this section will be around 2.5m below the level of the park.

This section of the canal has been aligned to minimise the impact on Boley Park, through which it passes, by “clinging” to the south east boundary of the park. The entire section of canal will be below the level of the surrounding parkland, and it will be important to ensure that a thorough landscape proposal is made which must address how the interface between the park and the canal is treated. Options include tree planting to soften the interface (and replace trees lost during the construction phase), and land forming using reduced and varying cutting slopes to better integrate the landform of the canal and the park, drawing the two together. Atkins have amended the original LHCRT proposal so that the towpath through this section is on the north west (park) side of the canal, and this should allow better integration and connectivity between the canal and public open space, as well as facilitating the use of the towpath as a better quality off-road route for the Darwin Walk[25], and as part of the “Trim Track” in the park.

2.5.4 A51 crossing

The A51 Tamworth Road is a two-way single carriageway running from Tamworth to Lichfield. The road is however widened at the location of the proposed canal crossing to two lanes in each direction near a traffic signal controlled junction. A further constraint is the presence of raking piles supporting the bank seat which carries the deck of the bridge taking the A51 over the A38 trunk road.

[25] The Darwin Walk is an original memorial to a unique individual: Erasmus Darwin (1731-1802). From 1756 to 1781 Erasmus lived in Lichfield and in 1985 the late John Sanders, a vice-president of the Lichfield Civic Society, had the idea of creating a 10 mile walk encircling the city to commemorate Erasmus Darwin's association with Lichfield. The walk route is parallel with the proposed canal restoration from the A38 crossing to the proposed Claypit Lane Bridge (Phase 3), a distance of around 1½ miles.

Looking west along the A51 Tamworth Road. The proposed canal culvert will cross roughly between the two galvanised street lights in the middle distance.

As noted above, Trafalgar House also reported to the Trust on this crossing, and again, Atkins has taken into consideration their findings together with input from our own specialist bridge engineers.

With suitable traffic management, the junction could therefore theoretically be reduced to one lane in each direction during construction to allow the crossing to be constructed in two halves. The level of the carriageway at this location is high compared to that of the proposed culvert, installing the culvert at this location may need temporary sheet pile walls due to the total depth of excavation. The embankment adjacent to the A38 structure at the south east corner may also need support from temporary works during construction. The alignment proposed should ensure that the raking piles discussed above are not affected by the construction of the crossing.

An alternative method of construction, which may be less costly, would be to jack the structure under the road in a similar manner to that proposed for the A38 crossing.

Looking north east along the proposed alignment from roughly the site of proposed lock 27 to the A51 Tamworth Road. The proposed canal culvert

headwall will be centre frame, with the canal water level about 2m below existing ground level in the foreground.

Access to the site and a site compound could be located on land owned by the Trust south of the crossing, accessed off Tamworth Road. The works would probably extend over the proposed location for Lock 27 (see below), which would best be constructed after the road crossing was substantially complete.

The completed crossing would be around 50m long, with a 4m wide navigable channel and 2m wide towpath. The canal water level proposed is 70.3m AOD, and the carriageway level is approximately 78.5m AOD, so a 2.5m air draft would give a more than adequate carriageway surface to culvert soffit dimension of around 5.7m.

2.5.5 Borrowcop Locks Canal Park

The section through Borrowcop Locks Canal Park is shown on Proposal Map 5.

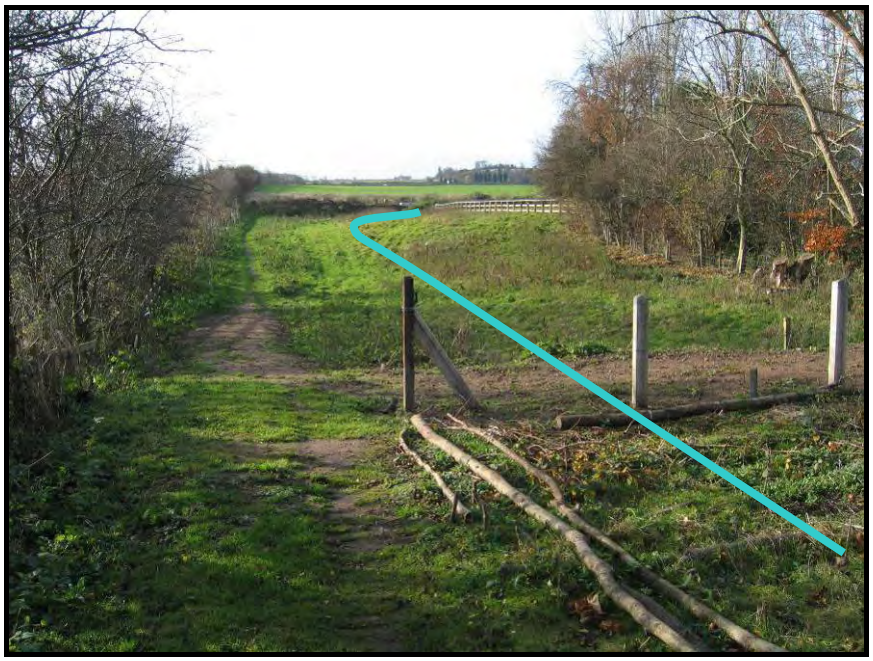
The Trust now owns or has licensed all the land required for the canal restoration between the south west end of the A51 crossing and Cricket Lane. Most of this is on the original canal alignment, and the Trust has made much progress. Locks 26 and 25 have been excavated and the structures restored. Waterway walls are nearly complete between the two locks and around 100m of new waterway wall has been constructed on the south side of the canal downstream of lock 26.

The canal bed was culverted for land drainage purposes in around 1968. The culvert consists of concrete pipes and a series of access chambers running from Cricket Lane to a manhole at the point where the proposed alignment leaves the original line to cross under the A51. Flows in the pipe consist of a combination of land drainage and surface water, and there is a base flow even in dry conditions.

The Trust is developing proposals to re-water the pound between Lock 26 and Lock 25, and this will include removing the culvert over this section and using the flows to maintain water levels in the pound. Excess flows will re-enter the existing pipe via the Lock 26 bywash structure.

The proposed restoration would involve a 50m long section of canal 7.2m wide (with vertical walls on both sides) south west of the A51 crossing to provide a lock landing for new Lock 27, which would be located half way between the A51 and the turn onto the original canal alignment.

This will be a new lock with a downstream water level of 70.3m AOD, with a rise of 2.7m lifting the canal to an upstream water level of 73.0m AOD, this level being set by the levels of existing copings downstream of Lock 26. Lock 27 would also include a towpath turnover bridge across the tail of the lock to return the towpath to the south side of the canal for the section through Borrowcop Locks Canal Park.



Proposed alignment of canal from A51 crossing to bend.

A further straight section of canal approximately 50m long would lead to a bend turning the proposed alignment to join the original line, now obliterated under the A38. At this corner, a weir would be constructed under the towpath to remove excess storm water originating in the culverted land drain from the canal. This weir would discharge into the existing manhole already mentioned.

Manhole on culverted land drain, looking towards Lock 26

Beyond the corner, the section of waterway wall on the south (towpath) side of the canal would be completed and an 11m wide channel formed with a sloping bank on the north side. Lock landings would occupy the last 50m of the south side before Lock 26.

Waterway wall on south side of pound below Lock 26 under construction, seen here on the day of the opening of the Borrowcop Locks Canal Park[26]

Lock 26 is an original lock, reskinned by the BCN company in 1844. The lock chamber has been excavated and restored by the Trust and is in good condition. Restoration works will comprise providing a new invert (base) to the lock chamber where it has been damaged to lay the culvert, and providing, installing and commissioning the necessary sills, quoins, gates, paddles and paddle gear. The lock will have a downstream water level of 73.0m AOD, with a rise of 2.4m lifting the canal to an upstream water level of 75.4m AOD, these being, as far as can be determined, the original levels either side of the lock.

Lock 26, under restoration by the Trust. The piped land drain can be seen in the bottom of the lock chamber[27]

[26] Photograph courtesy of Bob Williams, LHCRTL.

The pound between Lock 26 and Lock 25 has largely been restored by the Trust and merely needs the culvert to be removed, a liner to be installed and walls completed before it can be commissioned. The Trust has undertaken landscaping and access works in the area, and these are suitable for incorporation in the restored canal.

View of pound between Lock 25 and Lock 26, from tail bridge of Lock 25[28]

Lock 25 (Millennium Lock) is in similar condition to Lock 26 and requires the same work. This lock will have a downstream water level of 75.4m AOD, with a rise of 3.2m lifting the canal to an upstream water level of 78.6m AOD, these being, as far as can be determined, the original levels either side of the lock. This is the deepest lock proposed on the restored canal. The Trust has provided a tail bridge to give access from the car park / visitor area adjacent to Tamworth Road to the towpath.

Trust members installing new bywash culvert to Lock 25, early 2009

[27] Photograph courtesy of Bob Williams, LHCRTL.
[28] Photograph courtesy of Bob Williams, LHCRTL.

A further short pound (about 100m long) with partially restored waterway walls leads to Lock 24, an existing lock in similar condition to Locks 25 and 26. The Trust has excavated and inspected the lock, and it is now temporarily infilled to protect the structure until further works can be undertaken.

Lock 24, whilst uncovered for investigation, looking downstream.

The requirements for Cricket Lane crossing affect the proposal for Lock 24, and for the purposes of this report a worst case assumption has been made (see below), and this means that Lock 24 will have to be relocated to the west side of Cricket Lane, and this existing structure cannot be fully re-used. Instead the proposal is to underpin and deepen the top forebay and walls to the required invert level for the level upstream of lock 25 (water level 78.6m, invert level 76.8m), and to retain as much of the lock chamber as possible as a “narrows”. An additional channel or culvert parallel to the lock may be required to ensure that boats do not suffer a severe piston effect navigating through the chamber.

A further 80m of channel with two vertical waterway walls and a minimum width of 7.2m would lead to a permanent winding hole for full length boats constructed in open ground between Cricket Lane and Tamworth Road. The water level here would be 78.6m AOD and the verge about 82.0m AOD so there may be a requirement for some retaining or reinforced earth structures, and a safety barrier / parapet to protect the drop.

The winding hole would form the temporary terminus of the Phase 2 restoration.

2.6 Route and Engineering: Phase 3 – Cricket Lane to Lock 18 (Fosseway Lane)

The third phase of the restoration is also relatively straightforward, with the exception of a crossing of the main Birmingham – Lichfield “Cross City Line” railway. Almost all of the corridor is either in public ownership or already owned by the Trust, and land only needs to be acquired at one or two “pinch points”.

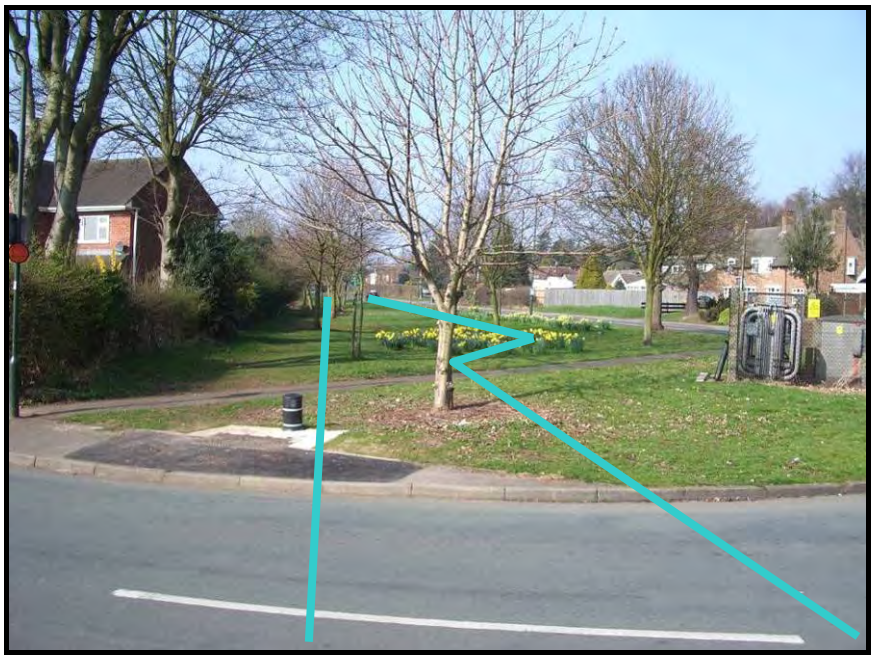
The canal runs along its former route from Cricket Lane to a point about 100m west of London Road Bridge (about 700m). Between here and the site of original Lock 19 (which cannot be used for the proposed restoration), the original line of the canal through the town has been redeveloped sufficiently to make restoration along the original corridor impractical. The Trust has successfully worked with Staffordshire County Council Highways and with the local planners to ensure that a new line for the restored canal is available. This will be parallel to and south of the Southern Bypass, generally in a reservation known as “the 40m strip”. This new section will be about

1,250m long. At the site of the original Lock 19, the canal will turn away from the bypass alignment to rejoin its original line, continuing west, parallel to the disused Lichfield – Brownhills – Walsall freight railway to Lock 18 (around 500m).

The only significant work undertaken to date is the provision of a navigable culvert under the new Birmingham Road / Southern Bypass roundabout. This was financed by the Trust and constructed at the same time as the new junction. The other main engineering works required in this phase are the installation of a navigable culvert or construction of some form of bridge to enable the canal to pass under the Cross City railway line, and the provision of a new bridge at the junction of Claypit Lane / Fosseway Lane and the new bypass, together with construction of six new locks. All of these are described in more detail below.

2.6.1 Cricket Lane Crossing

Cricket Lane is a two-way single carriageway local road off the A51 Tamworth Road. The site is constrained by an existing house close to the junction and the width of the existing area of land. The location of the existing junction may also cause problems with sight lines and approach safety fence (if required by standards) to any structure that is constructed. An electricity substation lies in the verge to the north west of the proposed crossing. There is also a gas installation on the line of the proposed canal.



Cricket Lane looking west with lines roughly identifying the proposed canal edges. The new Lock 24 will be located about 50m beyond the electricity sub-station.

It may, by the time this phase is implemented, be advantageous to the highway authority to stop up Cricket Lane at the location of the crossing, and provide a footbridge with suitable access ramps and steps in lieu of a full road crossing. The selected option for Cricket Lane will also have an impact on the location of Lock 24. It has been assumed for the purposes of this study and the cost estimates that a full highway crossing will be required as this is the greater cost option.

The likely solution for the highway crossing would be a box culvert type structure, similar to that recently constructed at Cappers Lane. Temporary works may be required to support the earthworks whilst excavation for construction takes place. As this is a local road the construction could be carried out during a road closure. The electricity and gas undertakers should be consulted in early course to establish their requirements in relation to the works and protection / relocation of their plant. An extended culvert may be required to resolve these problems.

If the bridge is constructed in advance of forming the canal channel and constructing the lock west of the crossing, the wide verge which will be occupied by the canal west of the crossing could be used as a site compound and working area, with access off Tamworth Road.

The completed crossing would be around 15m long, with a 4m wide navigable channel and 2m wide towpath. The canal water level proposed is 78.6m AOD, and the carriageway level is approximately 81.1m AOD, so a 2.5m air draft would not leave any room for construction. In this case a combination of an air draft compromise and localised raising of the carriageway between the channel line of the A51 and the first access off Cricket Lane would be required. This should just give sufficient headroom. The option of reducing the canal level downstream was investigated but rejected for this study because it would require significant modifications to one of the historic locks (Lock 25) and also necessitate additional retaining structures between Lock 25 and Lock 26.

2.6.2 Tamworth Road Section

Beyond Cricket Lane, a 50m long section of canal 7.2m wide with two vertical waterway walls would provide a lock landing area. At the towpath side boundary a structure retaining up to 3m adjacent to gardens to the south would be required through this section. On the north side, a more open cutting gradient of 1:2 could be employed beyond the electricity sub-station.

Lock 24 would, as discussed above, be a new lock structure. The downstream water level will be 78.6m AOD, with a rise of 2.7m lifting the canal to an upstream water level of 81.3m AOD, this level being determined by the clearance under London Road Bridge.

West of the lock a 180m long section 7.2m wide and with two vertical waterway walls would run along the south verge of Tamworth Road. The sides of this section would have to be supported by retaining structures, but these would be limited to 1.6m high on the north (offside) and 1.2m high on the south (towpath) side of the canal, avoiding the feeling of the canal being in a trench.

The section above Lock 24 is shown in the Trust's visualisation below, although the proposed canal levels have been amended since this was prepared and the canal is likely to be a little further below road level at this point.

Visualisation of Tamworth Road section looking west towards Lock 24[29]

[29] Artistic impression by Bob Williams of LHCRT.

The existing footpath crossing the line of the canal linking the shops on Tamworth Road with Long Bridge Road would be reconstructed with a footbridge crossing the canal at a skew to facilitate suitable disabled accessible approach ramps, using land in public ownership.

West of the footbridge the canal would continue a further 220m along its former alignment (now public open space), using the 7.2m wide construction, to reach London Road.

Section of alignment between proposed footbridge site and London Road. Culverted land drain chamber is visible in centreframe.

2.6.3 London Road and the “Pinch Point” to the Railway

London Road Bridge was rebuilt to its current form before the canal was abandoned. Reinstatement of the canal channel and towpath should therefore be relatively straightforward, requiring at worst reinstatement of the towpath wall and canal invert.

London Road Bridge from the east.

West of London Road Bridge the restored canal will run parallel to and south of the proposed Southern Bypass. Current versions of the plans have been obtained from Staffordshire County Council Highways department.

The alignment of the first 200m or so is critical: a lock and lock landings have to be fitted between London Road Bridge and a location known as the “Pinch Point”, where private gardens encroach

on the proposed bypass route and reduce the overall width available for the canal and bypass to around 17.5m. This in turn constrains the width of the canal channel to 3m over a very short section. The Trust has prepared detailed drawings for these sections and discussed their proposals with Staffordshire County Council Highways department. Atkins has validated these proposals and the agreed principles have been applied to the feasibility design and costings.

The pinch point, from the west, where the bypass and canal will have to fit between the garden on the left and other gardens just out of frame on the right

A short section of 50m at 7.2m wide with vertical waterway walls on both sides of the canal will provide a lock landing immediately east of London Road Bridge for proposed Lock 23.

Lock 23 will be a new lock structure. The downstream water level will be 81.3m AOD, with a rise of 2.7m lifting the canal to an upstream water level of around 84.0m AOD. Lock 23 would also include a towpath turnover bridge across the tail of the lock to take the towpath to the north side of the canal for the section past the “Pinch Point”.

From Lock 23, the towpath will share the footway/cycleway surface of the proposed Southern Bypass – there will be no separate towpath. The canal will taper in width over 60m from 9m to 3m wide, giving adequate space for lock landing and manoeuvring into the lock at the wider end. Both sides of the channel will have vertical walls.

The 3m wide section will be about 10m long. There is sufficient space to construct this as an in-situ reinforced concrete channel, but it is clear that temporary support works outside the corridor of the canal would be required if this construction method were adopted. It should be possible to precast reinforced concrete channel sections with “holes” in the bottom. These could be located in place at or close to existing ground levels and then the ground underneath them hydro-excavated through the “holes”, allowing the channels to gradually settle into position under their own weight. The “holes” could then be filled or plugged and if necessary, compensation grouting techniques could be employed to make any final adjustments required to the line and level of the channel, and to fill any soft spots left by the excavation process.

Staffordshire County Council Highways have agreed to construct the section of channel from just west of Lock 23 to just east of the “Pinch Point” concurrently with the bypass works, although because the bypass works are funded by housing developers, it is difficult to say in the current climate when the bypass will be delivered.

The pinch point marks the approximate location at which the proposed alignment leaves the original line, which continues across public open space to the north of the proposed bypass.

Beyond the pinch point the canal immediately widens to a full length winding hole, followed by a section 55m long which tapers from 11m to 7.2m wide, with vertical walls on both sides, which will provide a lock landing for Lock 22.

Lock 22 will be a new lock structure. The downstream water level will be 84.0m AOD, with a rise of 3.0m lifting the canal to an upstream water level of around 87.1m AOD, to match the design level of the existing Birmingham Road Culvert. Lock 22 would include a towpath turnover bridge across the tail of the lock to link the shared use section of the bypass footway/cycleway back to the south side of the canal where the towpath continues towards the railway and Birmingham Road.

Between Lock 22 and the railway, the canal will follow the south side of the bypass, roughly at the same level as the proposed road. The canal width will vary according to the space available between 7.2m and 11m.

This section of canal around 220m long, with the towpath now running on the south side of the canal, leads to the “Cross City Line” railway crossing.

Route of the canal and bypass towards Lichfield – Birmingham “Cross City Line” railway (railway highlighted in red)

2.6.4 Railway and Birmingham Road Crossings

The crossing of the Lichfield to Birmingham “Cross-City Line” Railway is probably the biggest single remaining obstacle to restoration of the canal. Just to the west of the intended crossing point, the A5134 Birmingham Road meets the completed section of the Southern Bypass at a new roundabout. As part of the works to construct this new junction, the Trust was able to fund a navigable culvert beneath Birmingham Road. The railway crossing will have to make an end-on connection to the existing navigable culvert.

Looking east across the new Birmingham Road – Southern Bypass roundabout, along the line of the Birmingham Road Culvert, to the approximate location for the railway crossing (under the catenary posts)

The Birmingham Road Culvert under construction (now temporarily buried). This is taken from a very similar viewpoint to the photo above.[30]

The proposed alignment of the canal (on an east-west axis) crosses the railway at a point where the railway is on an embankment with rail level well above the surrounding ground. Immediately north of the canal, the proposed Southern Bypass will pass under a new railway bridge to complete the link between London Road and Birmingham Road. The design water level of the existing culvert is 87.13m AOD, around 2.5 to 3.0m below the existing Birmingham Road level and the proposed level of the Southern Bypass where it will cross under the railway. The canal water level where it crosses under the railway will also have to be 87.13m AOD, as there is no space for a lock structure between the railway and Birmingham Road.

[30] Photo courtesy of Bob Williams, LHCRTL

There is clearly an opportunity for the canal restoration to “piggy back” the highway scheme. There are a number of benefits which could be derived from constructing the canal crossing at the same time as the road:

- Shared costs of Network Rail Supervision – Network Rail will almost certainly require that a supervisor acting for them would be on site full time during all works with the potential to affect the railway and its operation. Likely costs for this would be around £2,000 per week, or about £50,000 for the crossing. If works were undertaken at the same time as the road these costs could be shared or allocated solely to the road scheme;
- With the agreement of all parties, the structure could be designed to cross both the road and the canal at the same time. This could be achieved by either increasing the total span of the structure to encompass both the canal and the road, or introducing an intermediate pier and an additional span over the canal. Either of these options could potentially reduce construction costs for the canal crossing. Further investigation will however need to be carried out to look at the level and requirements of each of the structures, this may be the deciding factor in the structural constraints;
- Possibility (regardless of the selected solution) of using the same contractor to deliver the canal and road crossing, leading to economies of scale in terms of procurement, preliminaries, supervision etc, and simplifying access and compound siting;
- The option to use Staffordshire County Council Highways Department as the delivery agent / partner, avoiding the need to pay separate consultants to plan and supervise the works, and benefiting from the council’s status as a highway authority in terms of negotiating with Network Rail, public relations and community involvement etc.

For the purposes of the feasibility study it has been assumed that (for whatever reason) it is not possible to link the canal crossing and the highway scheme as described above. This assumption has been made to ensure that the restoration proposal is robust, and that the costings do not rely on assumptions regarding the co-operation of third parties.

If the crossing were constructed separately to the road crossing, a jacked box structure similar to that proposed under the A38 would be suitable as an independent structure. The location of the road structure would however need to be taken into account in the design and location of the culvert to avoid undermining or damaging any foundations. The culverted solution would not require any retaining walls adjacent to the road construction which would be required for a bridged crossing.

It is envisaged that the culvert within the railway embankment would be jacked in place in a similar manner to that proposed for the A38 structure. There is sufficient space to the east of the embankment for a jacking pit and temporary works to be installed. Throughout the construction all works would be under supervision of Network Rail, this would include a full time representative on site. Within the design process Network Rail would need to be consulted on the installation method to ensure that the jacking works would not affect the railway in terms of vibration and settlement.

The existing Birmingham Road culvert will require fitting out, including provision of fendering, a towpath, and a headwall and wing walls at the entrance.

2.6.5 Southern Bypass Section

This section of the proposed restoration links the navigable culvert already installed under Birmingham Road with the original canal alignment just south of the disused Walsall – Brownhills – Lichfield freight railway. The proposed alignment is parallel to and south of the section of the Southern Bypass constructed in 2007-08 but not yet fully open. The alignment makes use of a “40m strip” of land in public ownership, which is partly taken up by the bypass, with the remainder currently laid to grass as public open space.

The 40m strip, looking uphill along the line of the proposed flight of two or three locks

Due to the limited width available through this section, Mike Smith of the Trust and Roy Sutton from the Inland Waterways Association have prepared a detailed horizontal and vertical alignment to ensure that the canal can be fitted within the public land. This has been reviewed and refined by the study team and is incorporated, with minor changes, in the proposal. The main change made is to move away from the original staircase or two locks proposal to show three locks, each separated by a short pound of around 50m in length. This reduces the required rise in the locks from 3.8m and 3.6m to 2.5m in each lock. This has partly been done to reduce the lockage water requirements of the canal (the deepest lock elsewhere will be 3.2m or 3.5m deep[31], giving a reduction of between 9% and 19% in the lockage water requirements), and partly to make the transit of the section between the east portal of the railway / Birmingham Road crossing and Claypit Lane Bridge feel less intimidating and less like a concrete trough to boaters and towpath users.

Beyond the west portal of the Birmingham Road culvert, a 50m long section of canal 7.2m wide with vertical waterway walls will allow sufficient lock landing space downstream of Lock 21.

All three locks will be new structures. The downstream water level of Lock 21 will be 87.1m AOD (this level is dictated by the water level of the culvert already installed under Birmingham Road), with a rise of 2.5m lifting the canal to an upstream water level of around 89.6m

Lock 20 will have a downstream water level of 89.6m AOD, with a rise of 2.5m lifting the canal to an upstream water level of around 92.1m AOD.

Lock 19 will also be a new lock structure (this replaces the former lock 19 which is located in the vicinity of the railway turn – see below). The downstream water level will be 92.1m AOD, with a rise of 2.5m lifting the canal to an upstream water level of around 94.6m AOD. This level is determined by the level of existing copings downstream of Lock 18 (see below). At the top end of lock 19, the canal will be almost level with the road surface on the new Southern Bypass.

Beyond the lock, the road climbs to a summit just short of its junction with Claypit Lane and Fosseway Lane, whilst the canal will continue on the level alongside the road into a cutting which

[31] Depending on the option chosen for Locks 6 and 7 – see section 2.8.7.

will lead to the next bridge crossing. This will carry Claypit Lane and Fosseway Lane over the canal next to their junction with the Southern Bypass. As there is a second crossing of Fosseway Lane above Lock 18, it is proposed that this bridge should be named “Claypit Lane Bridge”.

Claypit Lane is a two-way single carriageway local road which joins the A461 Lichfield Southern Bypass. The location of the canal crossing is adjacent to the junction with the new A461. This local road could be closed for construction as was recently done for the construction of the bypass.

The site for Claypit Lane Bridge, looking east (downhill) towards the proposed Lock 19 to Lock 21 flight.

In order to construct a canal crossing at this location an open cut method could be used to install pre-cast concrete culvert units, the depth of the excavation for construction however is likely to need temporary works. This could be in the form of sheet piling to provide support to the adjacent Southern Bypass during construction. The sheet piled temporary works could be incorporated into the final design providing permanent formwork for the installation of in-situ culvert walls; this would remove the need to extract the sheet piles following construction.

The proximity of the A461 to the new structure could also pose problems with both safety fence design and highway sight lines requiring an extended culvert to be constructed. The bridge would have a 4m wide channel and 2m wide towpath with a 2.5m air draft. A canal water level of 94.6m AOD and carriageway level of approximately 98.7m AOD means there is sufficient headroom at this bridge.

There is a potential requirement for additional land on the south side of the proposed alignment in the cuttings east and west side of the proposed bridge. The Trust has prepared an alignment and identified three parcels of land which would need to be purchased if the cutting were battered at a 1:2 slope. If these land purchases were not practicable, retaining walls could be constructed to enable the canal to be contained entirely within the 40m strip of public land. The scheme with the battered cutting sides has been shown on the proposal maps, however, the estimate includes for the retaining structures in case the land purchases cannot be finalised.

View across Claypit Lane, looking west (downhill) towards the “railway turn”, which is located just beyond the line of conifer trees

North west of Claypit Lane the canal continues for about 300m along the bypass to a sharp turn about 50m south of the bridge (under construction in April 2009) which will carry the disused Lichfield – Brownhills – Walsall freight railway over the new Southern Bypass. This sharp turn is referred to as the “Railway Turn”.

2.6.6 Railway Turn to Below Lock 18

This section includes the sharp turn the canal will have to make to leave the Southern Bypass corridor and join the former canal alignment, and the reinstatement of the disused canal from this point to a proposed winding hole on Trust land, between the Turn and Lock 18.

The railway turn, seen from the freight railway embankment. Site clearance work is underway for the Southern Bypass, and the bottom end of the former Lock 19 has already been demolished. The proposed route for the canal is marked.[32]

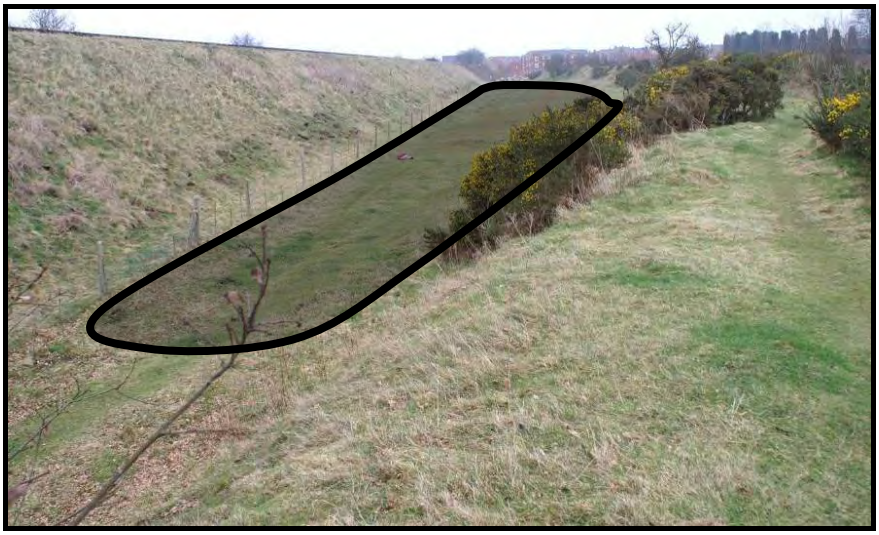
[32] Photo courtesy of Bob Williams, LHCRTL.

The Railway Turn was identified by the Trust as a potential pinch point where a wide canal channel would be required to allow full length boats to make the turn easily, but where land purchase might be difficult. Mike Smith of the Trust prepared drawings which identify the potential land take required to enable the widened channel to be constructed without any retaining structures, and these have been reviewed and validated by the study team.

The alignment shown in the Proposal Maps is the proposal without any retaining structures. However the estimate of construction costs includes for the retaining structures in order to provide a robust approach. The structures would be contained entirely within public / Trust land and would not encroach onto Network Rail's land, although their advice (and possibly technical approval) would need to be obtained before detailed design of the corner alignment and any retaining structures was undertaken.

Beyond the railway turn the canal will be restored on its original alignment south of the disused Lichfield – Brownhills – Walsall freight railway, to reach a point around 30m east of Lock 18. This section is about 650m long. This section has been partially infilled and is choked with vegetation. There is no water in the former channel. It is hoped that this section could re-use the original waterway walls, if these are found during the excavation of the channel, but a new liner would be required.

North of the canal there is a wedge of land in the Trust's ownership which lies between the offside of the canal and the boundary with Network Rail's alignment, which is on an embankment 4m to 5m high. This area was considered for use as additional water space by the Trust, which would have benefits in terms of providing additional space for moorings and also increasing the volume of water which can be stored in the pound (and thus reducing the susceptibility of the section to drought). This Study has, however, assumed that the area will be used to dispose of excavated material, which could be landscaped to form a habitat / woodland area up to 3m above the canal water level. Tipping of excavated material would have to be carefully controlled so there is no change in level at the boundary fence between the Trust's land and the railway. The final analysis of which of these options offers the best balance between costs and benefits could be undertaken at the outline design stage prior to any funding application for this phase of the works. This would enable the implications of any future changes in waste management regulations to be factored into the assessment.



Trust land west of the railway turn – the gorse covered bank to the right (south) of the Trust land is the original offside bank of the canal.[33]

[33] Photo courtesy of Bob Williams, LHCRTL.

At the end of the section of land in the Trust's ownership a winding hole should be constructed to enable boats to turn around near to the temporary terminus of Phase 3. The canal restoration should be continued beyond the winding hole to a convenient point just short of Lock 18.

To complete phase 3 it is recommended that the towpath surface is continued past Lock 18 to form a link with Fosseway Lane 150m to the west, and that the Trust's restoration of Lock 18 is cosmetically completed by installing a scrap set of bottom gates. Work around the Lock chamber to make it safe should also be undertaken – this could include simple post and rail fencing and the creation of a picnic area or similar on the lock sides.

2.7 Route and Engineering: Phase 4 – Fosseway Lane Bridge to Pipehill Pumping Station

Phase 4 of the restoration will be 1.95 km long, from just below Lock 18 to just north of Coppice Lane Bridge. This involves constructing two bridges, restoring six locks and a further bridge, and repairing an existing culvert. The easternmost 900m of the proposed route follow the original alignment, then a 500m long diversion through a deep cutting will be required to avoid "islanding" farmland either side of the site of the former Shaw's Bridge. The remaining 700m will be restored on the original line, through Pipehill Bridge and along Pipehill Embankment.

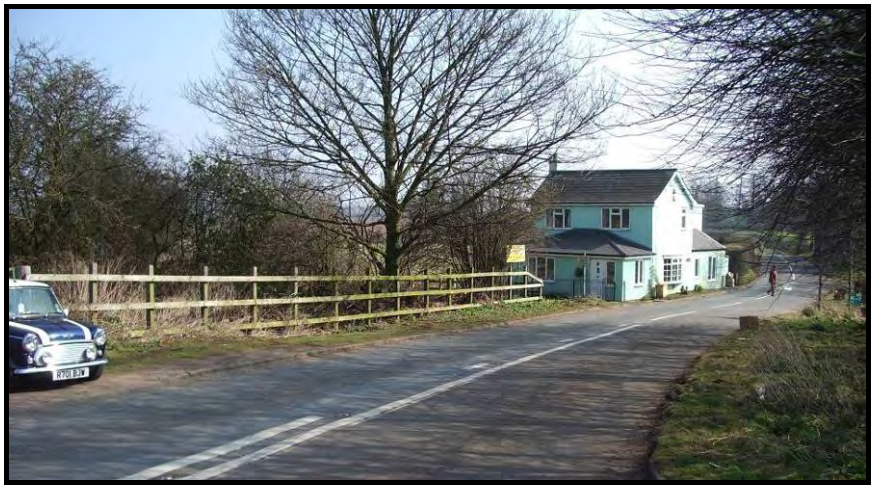
2.7.1 Lock 18 and Fosseway Lane Bridge

The restoration of Lock 18, already begun by the Trust, will be completed by providing, installing and commissioning the necessary sills, quoins, gates, paddles and paddle gear. The lock will have a downstream water level of 94.6m AOD, with a rise of 3.0m lifting the canal to an upstream water level of 97.6m AOD, these being, as far as can be determined, the original levels either side of the lock.

Lock 18, restored by the Trust, awaiting gates, paddle gear and boats.

The short section between Lock 18 (behind) and Fosseway Lane[34]

Fosseway Lane is a two-way single carriageway local road which could be closed during construction. Located between an existing railway level crossing and a cottage the canal crossing of Fosseway Lane would need to be carefully managed. The old Fosseway Lane Bridge was demolished after abandonment of the canal and will need to be rebuilt taking care with the canal amended alignment to avoid the cottage. The railway line to the north west is on an embankment at this location meaning the carriageway is elevated where the proposed canal crossing is. It should be possible, with suitable temporary works, to install the canal culvert in an open cut. This will depend on the clearances to the cottage and the level crossing signal box.



Fosseway Lane – the bridge will cross under the road by the yellow sign board this side of the cottage[35]

The channel dimensions could again be 4m wide channel and 2m wide towpath with 1.5m water and 2.5m air draft, although there may be advantage in skewing the bridge with a bigger span here to have less impact on the cottage and maintain navigability, especially as this is the

[34] Photo courtesy of Bob Williams, LHCRTL.
[35] Photo courtesy of Bob Williams, LHCRTL.

approach to the bottom of Lock 17. The canal water level is 111.3m carriageway level and the existing carriageway level is around 115.8m, so there are no headroom / vertical clearance problems at this location.

2.7.2 Third Flight (Locks 17 to 13)

The “third flight” comprises locks 17 to 13. All five locks are believed to be extant and infilled. The tops of the chamber walls of locks 15 and 14 are visible on aerial photos. Originally there were side ponds to increase the volume of water held in between each lock. This had the dual benefits of reducing the change in water level when boats locked into or out of the pound, and of increasing the speed with which the downstream chamber would fill.

This old photograph shows Lock 17, probably just prior to closure of the canal in the late 1950s. Lock 16 can be seen in the background.[36]

As far as possible the restoration should follow the original alignment of the south (towpath) side waterway wall. Restoration of the side ponds here would be feasible if the Trust could obtain the land, and in terms of heritage and historical fidelity, this would be the best option. However, the re-excavation of the side ponds and lining them would be at considerable cost, and the land take between Fosseway Lane and Wall Lane would be about three times the area of that which would be required just for the canal.

An alternative, more modern approach would be to provide modified bywash channels/culverts with downstream control[37]. This would involve creating a new inlet, parallel to the normal bywash weir but at a low level, leading to a chamber containing a valve which would be operated

[36] Photo courtesy of LHCRTL
[37] A normal bywash channel flows under upstream control (i.e. when the water level in the upstream pound exceeds the level of the bywash weir crest)

electrically depending on downstream water levels. The chamber would discharge under gravity to a point sufficiently far down the bywash channel that no water would back up the pipe into the chamber when the valve is closed. This would have a low level inlet in the upstream pound; say at 0.9m below water level. The penstock actuator would be connected to a level sensing device in the downstream pound, and would lift the penstock when downstream water levels fell below a certain point (say normal water level -75mm) and close the penstock when the downstream water levels had been recharged to normal water level. Careful set-up would be required to ensure that the system did not operate until the downstream pound was at least one lockful below its normal capacity to ensure that there would not be any wastage of water in normal operation.

This system has the advantage that a boat entering the flight from the bottom end with low water levels in the short pounds would cause a “daisy chain” effect, drawing water from each successive short pound, and ultimately from the long pound above lock 13, and avoiding the need for boaters to go to the top of the flight and “run water” which occasionally can occur at flights with short pounds. A disadvantage is that the system is more prone to paddles being left open, be it accidentally or as an act of vandalism, because the system will draw water through the flight to refill any pounds below which paddles are left open. To counteract this, the flight could be provided with water conservation locks, where boaters carry a special key to unlock padlocks preventing the paddles being opened for nefarious purposes, or the inlet from the long pound could be provided with a flow meter or level sensor, or a timed cut-out, which could be connected to a suitable telemetry system (e.g. British Waterways SCADA system), to alert staff to the problem.

This system could also be implemented if the side ponds were restored but proved not to offer sufficient capacity to deal with modern boat traffic, but a retro-fit would be somewhat more costly than installing the system while the locks are under restoration.

The locks themselves would be excavated out, and any damaged or missing brickwork and pointing repaired. The necessary sills, quoins, gates, paddles and paddle gear would be provided installed and commissioned and the water feed arrangements refurbished or constructed anew. The water levels will be determined by the existing lock arrangements, but are estimated to be as follows:

- Lock 17: downstream level 97.6m AOD, rise 2.8m, upstream level 100.4m AOD
- Lock 16: downstream level 100.4m AOD, rise 2.7m, upstream level 103.1m AOD
- Lock 15: downstream level 103.1m AOD, rise 2.9m, upstream level 106.0m AOD
- Lock 14: downstream level 106.0m AOD, rise 2.7m, upstream level 108.7m AOD
- Lock 13: downstream level 108.7m AOD, rise 2.6m, upstream level 111.3m AOD

A section of canal around 100m long will lead to Wall Lane Bridge. This will be restored on the original alignment, save possibly at the western end, adjacent to the bridge, where the alignment may be adjusted slightly to suit the detailed layout of the bridge.

2.7.3 Wall Lane Bridge to Pipehill Pumping Station

Wall lane is a two-way single carriageway local road which could be closed during construction of the crossing. The crossing is located to the south of the railway line crossing where a previous canal bridge was located; this is thought to have been removed after abandonment of the canal. From the road and verges there was little evidence of the old bridge being present, however further investigations should be carried out following removal of the undergrowth.

If a replacement structure is required then it would probably be most economic to use the precast concrete box culvert form adopted for many of the other bridges. The railway line to the north is in deep cutting at this location and the effects of installation of a culvert under Wall Lane would need to be investigated by geotechnical experts. The stability of the railway cutting would need to be

checked for the additional load of the culvert being placed on the slope and close to the foundations of the existing rail structure.

View looking north to the site of Wall Lane Bridge, showing the deep approach cutting on the east side of the bridge site.

Between the east and west sides of Wall Lane there is a significant height difference, this should be borne in mind within the design. The proposed canal water level is 111.3m and the existing carriageway level is around 116.9m, so there would be no headroom problems.

Around 60m west of Wall Lane the proposed alignment deviates from the original line, turning slightly north to follow the railway line in a deep cutting. This alignment has been selected because of the known objection of the owner of the original channel and adjacent land to having the canal split his land. The new alignment will be around 500m long, and will run alongside the disused Lichfield – Brownhills – Walsall freight railway. As both the canal and the railway are in cutting at this point there may be mutual advantage in sharing the earthwork rather than having two separate cuttings with a “ridge line” in between. It may be possible to achieve this whilst the railway is disused, or as part of any programme of works to bring the railway back into use, and early consultation with Network Rail on this issue would be advisable.

This cutting will generate significant amounts of spoil. It is proposed that the bulk earthworks for Phase 5 (particularly the raising of the embankment between Lock 8, the M6 Toll Aqueduct and Lock 6) are undertaken as part of Phase 4. This will avoid the need to take much of the spoil from Phase 4 to tip and then import material for Phase 5, both at considerable expense.

At the end of the cutting, the canal rejoins the original alignment, which would be excavated and lined, with waterway walls either being repaired or replaced, over the 110m to Walsall Road at Pipehill Bridge.

Pipehill Bridge itself still exists, with up to 18 inches of water in the disused bed of the canal either side. On the east approach there is an electricity compound, but this is unlikely to be adversely affected by the restoration proposal.

The bridge itself consists of three spans, carrying the road over the former canal, a farm track and the disused Lichfield – Brownhills – Walsall freight railway. The canal is accommodated in the southernmost span. The bridge is in very good condition, and the waterway wall on the dry abutment side is visible, although it has collapsed in a few places. Other than repairs to the waterway wall, fendering, and possibly lining of the channel, very little work is likely to be required.

Pipehill Bridge, with shallow standing water in the bed of the canal. The photo was taken standing just under the brick towpath side waterway wall, which is generally quite well preserved on this side of and under the bridge.

Beyond the bridge, in an area formerly known as Pipehill Wharf, the canal makes a sharp turn to head south west along an embankment where the surrounding ground drops away so that the embankment crest is about 5m to 6m above natural ground level after 270m. At this point, Pipehill Brook passes under the canal in a culvert. The south east (downstream) headwall is visible and appears to be in poor repair. If the culvert is in a similar condition, it will require rehabilitating, possibly by passing a smaller lining pipe or inflatable heat curing liner through the culvert. This has been allowed for in the budget. As part of these works, the feed arrangement (see section 2.3) could be installed.

Culvert carrying Pipehill Brook under the canal embankment.

The embankment continues past South Staffordshire Water's Pipehill Pumping Station, from where the surrounding ground rises so that the canal is almost at ground level at a point about 100m beyond the south west boundary of the pumping station compound.

Aerial view of Pipehill Embankment and Pumping Station from above Pipehill Bridge – winding hole location circled.

A new offside winding hole is proposed at this point to allow boats to turn around at the temporary terminus of the canal on completion of Phase 4.

It is recommended that the towpath surface is continued south west for a further 250m to form a link with Coppice Lane.

2.8 Route and Engineering: Phase 5 – Coppice Lane Bridge to Ogley Junction

Phase 5 of the restoration will be 4 km long, from 250m north east of Coppice Lane Bridge to Ogley Junction, where the restored canal will meet the Wyrley and Essington Canal. This is the most complex stage and involves constructing four road bridges, and restoring a fifth. There will be thirteen locks (four new locks and nine restored structures). A road will have to be diverted over a length of about 400m and there will be significant changes to facilitate access around the first flight (particularly Locks 1 to 3).

The route will follow the original alignment for the first 750m, to a point about 100m south west of Lock 10. A diversion of around 500m in length will then be required to avoid development on the former alignment north (a house) and south (a sewage pumping station) of the A5 trunk road (Watling Street). The remaining 2,750m will all be on the original horizontal alignment, but the canal will be raised by up to 5m above its original alignment between Lock 9A and Lock 6. This is to generate sufficient height above the carriageway of the M6 (Toll) road and also to improve the cut/fill balance of the scheme.

It should be noted that it is proposed to construct much of the bulk earthwork for this phase as part of the Phase 4 works package. This will greatly reduce the volume of material removed from

Phase 4 to landfill, and also eliminate the need to bring material in to Phase 5 from outside of the scheme.

2.8.1 Coppice Lane Bridge and Lock 12

From the end of the Phase 4 restoration around 250m of canal will be restored on its original line to reach Coppice Lane. This section runs level through ground rising towards Coppice Lane, so it is in a cutting around 3m deep just north of the road.

Coppice Lane is a two-way single carriageway local road which could be closed during construction. Lock 12 lies immediately south of Coppice Lane, and the canal will pass under the road close to an 'S' bend in the highway.

Coppice Lane Bridge – canal will pass under road just behind parked car

A navigable culvert with 4m wide channel and 2m wide towpath is proposed. A navigation sign may be required advising boaters travelling towards Ogley Junction to moor north of the bridge and check that there are no vessels already in lock 12 coming down (i.e. in the opposite direction). The culvert may need to span a greater distance than the width of the road to ensure that the proposed parapets are not constructed within the horizontal visibility required for the highway alignment. The proposed canal water level under the bridge is 111.3m, and the existing road level is around 113.7m. The road will need to be raised by between 0.6m (if a 2.0m headroom above water level is acceptable under the bridge) and 1.1m (if the ideal 2.5m headroom is to be achieved) to give satisfactory headroom – it is likely this will mean a slight horizontal realignment to give better visibility.

To the north of Coppice Lane the canal is in cutting and the open cut method could be used to install the culvert during road closures, making use of the canal bed and the adjacent field access point for a compound and for construction access respectively.

The canal track south of Coppice Lane Bridge has been infilled and topped with stone, and was recently in use as an informal haulier's depot area. The copings of Lock 12 are visible just south of Coppice Lane.

Restoration works to Lock 12 will comprise carefully excavating out the infill, repairing any sections of the lock chamber which may be damaged, and providing, installing and commissioning the necessary sills, quoins, gates, paddles and paddle gear. The lock will have a downstream

water level of 111.3m AOD, with a rise of 2.9m lifting the canal to an upstream water level of 114.2m AOD, these being, as far as can be determined, the original levels either side of the lock.

Lock 12 can be seen behind this gate adjacent to Coppice Lane

Beyond the lock the original channel will be excavated through the surfaced area and a short section which is now grassed and forms part of the garden of the house north of Moat Bank Lane Bridge. It may not be possible to obtain the full 11m wide channel at this point, but channel width should be maximised on the approach to Moat Bank Lane Bridge and Lock 11.

2.8.2 Moat Bank Lane Bridge and Walsall Road House Backs

Moat Bank Lane Bridge is a single span concrete arch bridge which is very similar to London Road Bridge and believed to have been erected at the same time. The bridge has recently been excavated out by Staffordshire County Council Highways Department to facilitate an investigation. The bridge has been infilled with gravel back to around canal water level so the underside of the deck can be accessed in future for inspections.

Moat Bank Lane Bridge from the south east.[38]

[38] Photo courtesy of Bob Williams, LHCRTL

The bridge will be used for the restored canal with minimal changes, which would include reinstating the towpath wall (if absent) and providing suitable fendering.

Immediately south east of the bridge lies Lock 11. This was partly dug out at the same time as the bridge and appears to be in excellent condition. As with many of the infilled existing locks, restoration will comprise carefully excavating out the infill, repairing any sections of the lock chamber which may be damaged, and providing, installing and commissioning the necessary sills, quoins, gates, paddles and paddle gear. The lock will have a downstream water level of 114.2m AOD, with a rise of 2.6m lifting the canal to an upstream water level of 116.8m AOD.

Lock 11 exposed recently during works undertaken by Staffordshire Highways[39]

South of Lock 11, the canal turns to the south west and runs parallel to and about 80m east of Walsall Road. The canal alignment and fields to the east have mostly been given over to use as a tree nursery. Care will be needed in the turn south of lock 11 to ensure that the alignment of the towpath side waterway wall allows a sensible manoeuvre for full length boats to access Lock 11. This should be achievable by locating and restoring or replacing the waterway wall on the original alignment.

Lock 10 lies just south of this turn. This is another original lock and it may be possible (subject to land acquisition) to restore this in a similar manner to Lock 11. If the land cannot be acquired, then a parallel alignment will be used to the east of the original canal line, and a new lock structure will be required. The downstream water level will be 116.8m AOD, with a rise of 2.7m lifting the canal to an upstream water level of 119.5m AOD.

The channel south west of Lock 10 is constrained by the boundaries of the land parcel in which it lies, and it may only be possible to provide a 7.2m wide channel. If this is the case, both waterway walls should be of vertical construction to give sufficient space for boats to pass moored vessels.

200m to the south west of Lock 10 is the site of old Lock 9. Just beyond Lock 9, a house has been built close to and partly across the line of the canal. A deviation is proposed to avoid the house. This proposed change in alignment will also enable the restored canal to pass alongside a sewage pumping station which has been built on the line of the canal immediately south of Watling Street (see below), avoiding the expense of relocating it.

Assuming that the land required to restore the original Lock 10 can be acquired, the deviation will leave the original alignment about 110m south west of Lock 10, and make a gentle ‘S’ bend so as

[39] Photo courtesy of Bob Williams, LHCRTL

to run parallel to but about 25m east of the original line[40]. This new section will be constructed to an 11m width, with a sloping bank on the offside (west). This will be planted with reeds and other marginal vegetation, and the house will be screened both by these and the existing hedge. South west of the house, the deviation will run along the edge of a field, passing close by the backs of some agricultural buildings before reaching the A5 trunk road (Watling Street).

2.8.3 Watling Street Crossing and New Lock 9

The A5 Trunk Road (Watling Street) is a dual two-lane carriageway running from Tamworth to Cannock. There were proposals for de-trunking the road as a result of the construction of the parallel M6 (Toll) road, but an enquiry to Optima (who were at the time the agents acting for the Highways Agency) by the study team has clarified the situation, and it is clear that the de-trunking proposal has been dropped. As such, Optima's Network Manager confirmed that the works would have to be undertaken without any lane closures, and monitoring of carriageway levels to ensure that no adverse settlement takes place will be required.[41]

Approximate location for A5 crossing, looking north from Wall Butts

The canal water level will be 119.5m where the canal crosses Watling Street. By keeping the crossing site as close to Muckley Corner Roundabout as possible (but without impacting on the sewage pumping station as discussed above) where the road levels are highest, the carriageway can be crossed where its level is 122.8m. With a construction depth of 1.3m, this would give headroom of the minimum allowed 2.0m. There is potentially scope for lowering the level of the canal alignment between Lock 10 and Lock 9, giving additional headroom, but this would require extensive modifications to Lock 10 (an existing structure) and potentially either further compromise on channel width over a 100m long section south of Lock 10, or the use of low retaining walls or reinforced earth batters in this section.

[40] If this land cannot be acquired, the deviation will have to leave the original alignment north of the original Lock 10, and will be correspondingly longer.

[41] This approach is not universal for trunk roads, indeed the recent Droitwich Canal crossing under the A449 was constructed with lane closures, although an adjacent lay-by was used to maintain the overall number of lanes in each direction. A similar approach might be possible using the lay-by on the north side of the A5, but for the purposes of producing a robust cost estimate, it has been assumed that this will not be possible, and that the crossing method will therefore have to be selected to avoid the need for any traffic management measures on the A5.

The towpath could be given better headroom by lowering it relative to the canal level.

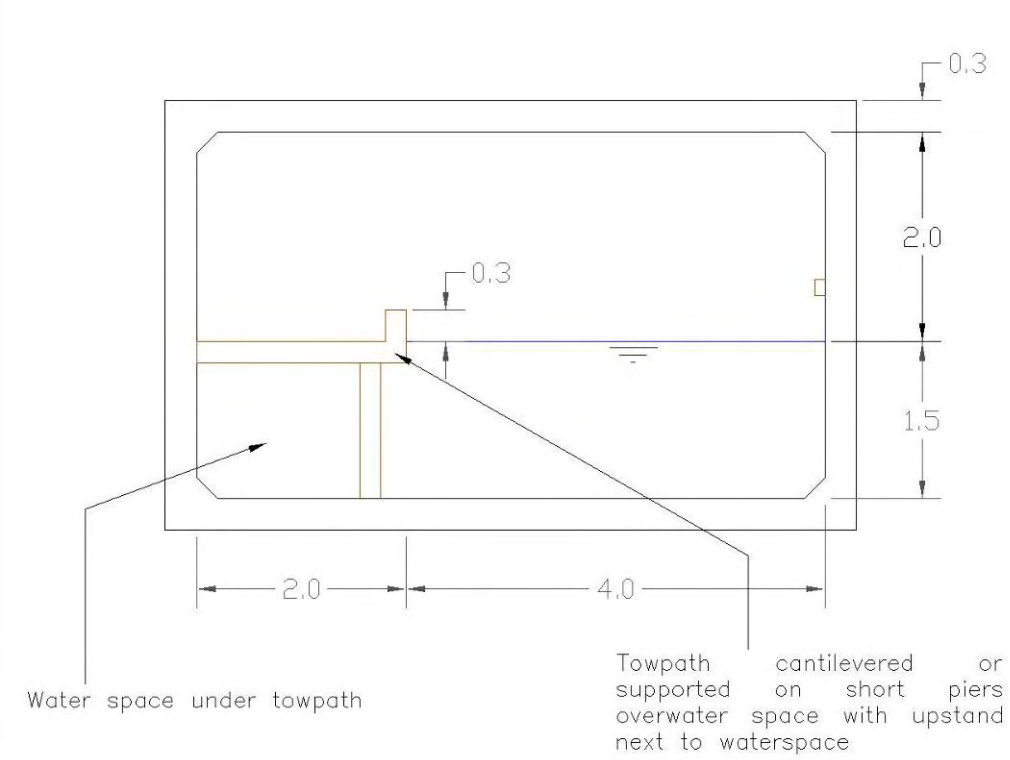


Figure 2.3 – Cross Section through bridge showing increased headroom

Given the restrictions on lane closures and the headroom issues, the best construction would be a jacked culvert, in a similar method to that of the A38 crossing.

The site has sufficient space to both the north and south to allow the culvert to be constructed and jacked under the A5, and there is access off Muckley Corner Roundabout to the Sewage Pumping Station which could be used for construction access (subject to negotiation with the owners).

2.8.4 Wall Butts and Boat Lane

South of the A5 culvert, the canal crosses an area of public open space, Wall Butts, which is being managed as heath land. A short continuation of the crossing narrows at the south end of the culvert should enable an existing electricity supply pole (probably 11kV) to be incorporated at the canal edge of the towpath without the need for relocation, but if, as suspected, this feeds the pumping station, the feeder may need to be moved or passed under the canal in a new duct.

80m south of the Watling Street crossing a new Lock 9B[42] will be constructed, replacing the one not restored adjacent to the dwelling north of the Watling Street Crossing. Siting the lock away from the crossing will give a short pound between the two to allow boats to pass and to form a lock landing (this also has the benefit of ensuring that the lock will not be built on the area adjacent to the pumping station which could require additional services diversions.

Lock 9B will be a new lock structure. The downstream water level will be 119.5m AOD, with a rise of 1.3m lifting the canal to an upstream water level of around 120.8m AOD. This level is

[42] Due to changed road levels at Boat Lane, an additional Lock, Lock 9A, will be required, making the total number of locks 31, one more than the original canal had. The numbering system has been selected to maintain the original numbers of existing locks.

determined by the need to be just below road level along Boat Lane, and to have sufficient headroom for the canal to pass under the A461 Walsall Road at Boat Bridge (see below).

Beyond the lock the canal will continue south east in a shallow cutting for a further 200m across Wall Butts to reach Boat Lane. The section of canal across Wall Butts will be particularly sensitive in environmental terms, although there are benefits from the introduction of south and east facing cutting slopes into the heath land environment. A sum has been allowed in the estimate for environmental improvement / mitigation works to ensure the canal integrates into the habitat are and enhances its potential rather than degrading it.

The canal alignment will be parallel and to the north of Boat Lane from the south west corner of Wall Butts to the A461 Walsall Road, on its former course. This land has been taken over by householders with houses on Walsall Road, whose long back gardens now extend across the former line of the canal to Boat Lane. Several householders appear to use Boat Lane as an alternative means of vehicular access to their homes.

After detailed consideration, the option put forward here is to keep the towpath on the south side of the canal (thus affording the gardens some degree of security from public areas) and to provide a lifting bridge approximately mid way between the end of Wall Butts and Boat Bridge to give access from Boat Lane to the house backs. This would connect to a 3.5m wide service road parallel to and north of the canal which would give access to each of the house backs. There are other potential solutions and detailed negotiation would be required with each of the householders prior to design of this section of the canal.

Beyond the house backs, the canal turns to an east-west orientation and will approach the site of the former Boat Bridge and the crossing of the A461 Walsall Road in a cutting up to 2.5m deep across a small field.

2.8.5 Boat Bridge and Lock 9A

Boat Bridge (the crossing of the A461 Walsall Road) was originally a hump backed bridge carrying a relatively small road over the canal. After abandonment, the bridge was removed and the hump in the road surface levelled out. The M6 (Toll) road is crossed by the A461 about 150m to the south west of the site of Boat Bridge. The works associated with the construction of the motorway have resulted in the A461 carriageway being raised back up again, this time by around 1.2m at the site of the proposed canal crossing, to give a smooth approach to the motorway bridge.

The A461 adjacent to Boat Lane is now a dual two-lane carriageway with a relatively low traffic flow. The A461 turns into a single two way carriageway to the south following the crossing of the M6 Toll.

Site of Boat Bridge, looking from Wall Lane towards the Boat Inn.

The carriageway at the crossing location could therefore potentially be reduced to single two-way to allow a navigable box culvert to be installed using the open cut half and half method. This method uses traffic management to move the traffic to one side of the carriageway to allow construction of half of the culvert before moving it back onto the constructed section to allow the other half to be built. The detailed design of the traffic management system would need to ensure that access could be maintained to both Boat Lane and to the Boat Inn for the duration of the works.

It is possible that parts of the original bridge remain in-situ – if this is the case, they should be carefully excavated and recorded as construction of the new crossing progresses.

At the west side of the A461 there is an existing water pipe which crosses over the canal location, this is supported by a steel beam structure which will need to be considered. The proximity of the public house to the south west will also need to be considered whilst excavations take place, temporary works may be required to provide ground support depending on the excavation depth and clearance.

The proposed culvert would have a 4m wide channel and a 2m wide towpath with 1.5m water and 2.5m air draft. With a minimum existing road level of 124.3m, the canal level will 120.8m giving 2.5m headroom above water level in the culvert and a culvert soffit to road surface dimension of at least 1.0m.

A 50m long and 11m wide section of channel immediately west of the culvert will form the lock landing for Lock 9A, another new lock. Like Lock 9B, this will have a relatively low rise, because these two locks will effectively replace the former Lock 9, sharing the rise between them.

Lock 9A will be a new lock structure. The downstream water level will be 120.8m AOD, with a rise of 1.4m lifting the canal to an upstream water level of around 122.2m AOD. This level is estimated to have been the original pound level below Lock 8 and should enable the 330m long section upstream of Lock 9A to be restored on its original line and level, re-using as much of the original canal structure as possible whilst maintaining a watertight seal on the walls and bed.

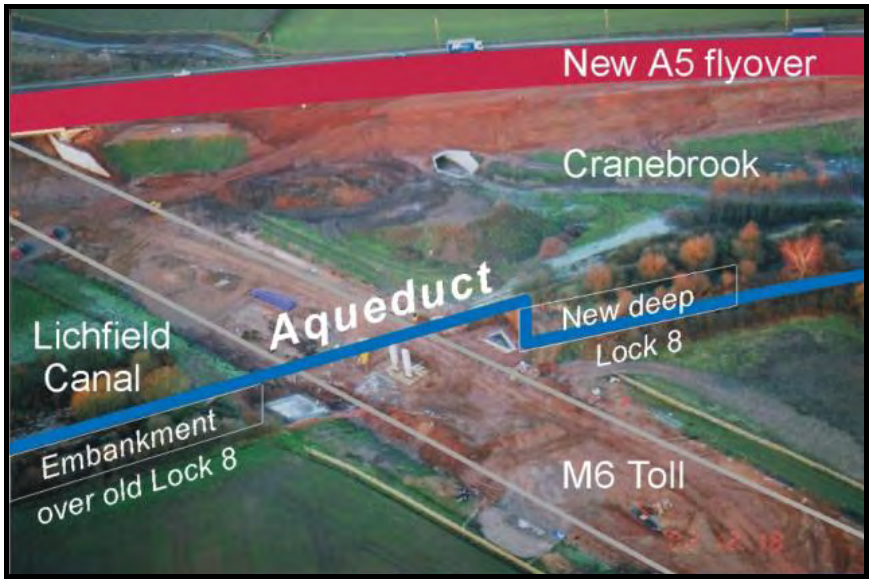
2.8.6 Eastern Approach to M6 (Toll) Aqueduct

One of the key vertical alignment decisions for the proposed restoration affects the section of the canal between Lock 9A and Lock 6. Changes to the original pound levels will be required in this

section because of the construction of the M6 (Toll) road between 2001 and 2003. The Trust's most significant achievement to date on the Lichfield Canal has been to ensure that the necessary aqueduct to cross the new motorway was constructed prior to the opening of the motorway.

The Trust had a design prepared for the aqueduct which was accepted. The Public Inquiry Inspector recommended that the road promoters should pay for the whole cost for this replacement structure, but the Secretary of State ruled that they would pay for only the foundations. Funding for the super-structure was to be raised by the Trust. Thanks to a most generous grant of £250,000 from The Manifold Trust and many donations to the David Suchet Appeal the required sum of £450,000.00 was raised in time and the Highways Agency issued a Variation Order instructing Midland Expressway Limited to build supporting columns and abutments. The pre-fabricated steel trough made by Rowecord Engineering Ltd of South Wales was craned into position on 16th August 2003, ready for the opening of the new motorway opened to traffic in December 2003[43].

The Trust's original intention with regard to levels is shown in the view below:



M6 (Toll) Aqueduct under Construction[44]

The canal was to approach the aqueduct from the east (right hand side of the picture) at its original level of 122.2m (the upstream level of the old Lock 9). A deep lock with a rise of 4.9m would lift the canal to the water level of the aqueduct trough which is 127.1m. The intention was to construct this deep lock immediately east of the aqueduct. A space has been provided in the east abutment for a plant room for the back pumping installation which it was foreseen would be required to reduce the canal's water consumption by back pumping some of the lockage water.

The deep lock would have the following disadvantages:

- Deeper than almost any other lock on the canal network – gates etc. might have to be of special design;

[43] The description of the construction of the aqueduct is based on text from the Trust's website, which gives fuller details at: http://www.lhcrt.org.uk/aqueduct.htm

[44] This aerial photograph was taken on 18th December 2002 and shows construction of the centre columns and abutments of the aqueduct with added graphics to show the line of the canal. The picture is taken from the website of the Trust who acknowledges Michael Shea of the Microlight School (Lichfield) Ltd for the photograph.

- The lock would be high in the air, with vertical walls which could be disconcerting for some users and might lead to safety issues;
- This would necessitate the use of vertical gates or powered mitre gates rather than the traditional hand operated mitred gates unless platforms for the lock quadrants could be cantilevered out from the main structure;
- Back pumping (and possibly powered gates) would cause ongoing operational costs in terms of maintenance of mechanical and electrical equipment and power supply bills.

Most critically, as part of the alignment design, it has been identified that there is a significant excess of excavated material over fill material requirements across the scheme.

The solution proposed by Atkins avoids many of the disadvantages of the deep lock and improves the cut / fill balance. This would be achieved by using two traditional locks of normal rise in place of the deep lock. These are located further to the east, meaning that the approach embankment to the aqueduct is longer and higher. However this will mean significant savings in construction cost and improved environmental benefits across the scheme as a whole, as the arisings from the cutting between Wall Lane and Pipehill Bridge (see 2.7.3) can be carted the short distance to the embankment site and placed as fill to raise the embankment rather than being taken to landfill.

The location of the two locks is determined by the horizontal alignment of the canal as it is considered best to retain the original horizontal alignment (and therefore to keep the works to roughly the original corridor of the canal, albeit with a wider “footprint”). The locks are therefore situated on a straight section of the alignment about 330m west of Lock 9A and 590m east of the aqueduct (Lock 8) and just east of Crane Brook, about 80m east of the aqueduct (Lock 7). The original locks 8 and 7 will not be used but are discussed in 2.8.7 below.

The landscape impacts of these new embankments are mitigated by the existing landform (they are to be constructed on the side of a steep hill, the presence of gravel pit and the adjacent A5 road.

Generally the canal through this section will have an 11m wide channel with a vertical towpath side wall and a sloping bank on the offside.

Lock 8 will be a new lock structure. The downstream water level will be 122.2m AOD, with a rise of 2.5m lifting the canal to an upstream water level of 124.7m AOD.

Located 510m further east along the new embankment, Lock 7 will also be a new lock structure. The downstream water level will be 124.7m AOD, with a rise of 2.4m lifting the canal to an upstream water level of 127.1m AOD, which is the design water level for the aqueduct over the M6 (Toll) road.

Immediately beyond Lock 7, the canal will cross the Crane Brook. The original canal was embanked by around 3m at this point, and the original culvert was removed and the embankment cut away at this point as part of flood routing works associated with the construction of the M6 (Toll). The proposed alignment will be on an embankment around 8m high. The overall width (from toe to toe) of the embankment will be about 55m at this point if 1:2 batters are used. This is the widest point on the footprint of the proposed alignment.

A new culvert will have to be constructed to carry the Crane Brook under the canal. Flows in the brook should already be adequately modelled for the M6 (Toll) culvert just upstream, and the canal culvert will be of similar size. A precast concrete box culvert or “Armco” type corrugated steel culvert would be suitable. Construction can share the access and compound used for lock 9 – this could possibly be located in the gravel pit compound south of the A5.

2.8.7 M6 (Toll) Aqueduct to Barracks Lane crossing

The M6 (Toll) will be crossed using the aqueduct already constructed for the purpose. The approach embankments will need to be tied in to the structure on either side.

The M6 (Toll) Aqueduct, seen from the A5, looking south east. The approach embankment on the left gives an idea of the original canal level below Lock 8.

West of the aqueduct, the canal will continue with the water level at 127.1m AOD. This will require the old approach to be raised from the original water level of 122.2m AOD. Close to the west end of the embankment lie the remains of lock 8. This used to raise the water level from 122.2m AOD to around 124.7m AOD. The top water level of this structure will still be well below the bed level of the proposed alignment (about 125.6m), so it is proposed that the structure is excavated and details of it recorded before burying it permanently under the new western approach embankment for the M6 (Toll) Aqueduct.

A pound of around 190m in length lay to the west of Lock 8 at a water level of about 124.7m AOD. This will also be buried by a new embankment which will raise the water level by about 2.4m to the 127.1m AOD level of the aqueduct. North of this embankment a long thin area of waste ground has been identified as a possible spoil tip for material arising from elsewhere within the scheme, and the landowner has indicated that he would be prepared to allow levels in this area to be made up. No allowance for this has been made in the costs estimates, again in an attempt to ensure that costings are robust and not dependent on favourable actions by third parties.

The former Lock 7 will be excavated and details below the level of the top sill recorded, prior to infilling the chamber and forming a new invert at the top cill level. The lock chamber will be retained as a narrows in the canal, with suitable interpretation explaining the changes in levels. It may be necessary to provide a (non-navigable) alternative channel, possibly roughly on the alignment of the old bywash, to enable water to flow around boats as they move through the narrows.

West of the former Lock 7, the proposed canal water level is the same as the original level. A section of channel approximately 200m long between the former Lock 7 and Lock 6 will be restored to its original condition.

Between Lock 6 and Lock 5, Barracks Lane, a busy single carriageway country road linking the A5 and the A461, crosses the canal alignment. The former bridge must have been severely hump backed, but modern highway standards would not permit such an arrangement as suitable forward visibility cannot be maintained. It is therefore proposed that Barracks Lane should be realigned from the old Lichfield Road roundabout over a length of about 450m. The new alignment will cross the canal just below Lock 6, giving sufficient headroom and adequate visibility.

The bridge and approach roads could therefore be constructed in a green field site using an open cut method prior to closing the existing road. Because of the proximity of Lock 6 it is proposed that the new bridge should have a minimum span of 9m, to cross a 7m wide channel and 2m wide footway. This will allow boats exiting the lock and heading towards Lichfield to pass boats moored on the lock landing under the bridge waiting to pass up the locks towards Ogley Junction.

The bridge will therefore be likely to be constructed of precast concrete deck planks with in-situ infill on reinforced concrete abutments, or a steel deck on reinforced concrete abutments.

The site can be accessed from both sides, using the parts of the fields that will be islanded by the new road alignment for site compounds with access off Barracks Lane or the Barracks Lane / Old Lichfield Road roundabout.

On completion, land between the old and new alignments north of the canal could be sold, potentially Warren House Farm (an equine veterinary practice) could benefit from this as it would form a relatively small pasture with direct access across the severed north end of the old road alignment. This section of road would be retained to maintain access to the farm complex.

On the south side of the canal the land between the old and new roads could be retained by the Trust or passed to British Waterways. Proposal Map 16 shows an indicative scheme for a habitat area, car park and visitor facilities including a picnic area which could include interpretation and serve as a focus for educational visits at this end of the restored canal. The severed road would form a connection to the towpath on the level here, giving access for maintenance vehicles to Lock 6 to the east, and for maintenance vehicles (to Locks 5 to 1) and the owner of the house adjacent to Lock 4 to the west.

2.8.8 Ogley Locks

West of Barracks Lane, the canal climbed in a straight line through a flight of five locks to reach Ogley Junction. As Barracks Lane is to be realigned, discussion in this section will include Lock 6 as well; this will, in future, be more clearly part of the flight.

Lock 6 is currently located in waste ground surrounded by fields to the east of the current Barracks Lane alignment.

Locks 5 is located south of Warrenhouse Farm, and north of open farmland. Locks 4 and 3 are located south of open farmland. The short pounds between Locks 4 and 3 and Locks 3 and 2 originally had side ponds to store sufficient water in the pounds. These have been partly infilled and landscaped, and two houses have been built on land formerly forming the banks between the side ponds, one 25m south west of Lock 4 and the other just south of the former towpath and 25m west of Lock 3. Alternative access to both properties can be provided along an over-widened towpath surface from Barracks Lane, and a link could also be created across a tail bridge to Lock 3 to serve these properties. This would be accessed from Lichfield Road.

Lock 2 is buried in land currently used by Grasmere Garden Centre. A temporary building stands roughly on top of the lock, but the study team has been advised that this is not at present in use. An access route could be constructed through the garden centre for their use at the same time as the canal restoration to replace their current route which uses the former line of the canal.

Lock 1 is located in the front gardens of a pair of BCN cottages. The cottage nearer to Ogley Junction has already been purchased by the Trust. Access to the north lock side and a new private car park for the two cottages could be provided on the north side of the canal with a footbridge over the tail of the lock giving access to the cottages no more than 30m from the parking area.

It is thought that septic tanks have been installed in the chambers of both Locks 2 and 1, and these will have to be removed and replaced with a suitable sewage systems such as a biodigester.

Aerial photo of the Ogley Locks Flight, running centre bottom to top right on the picture. Ogley Junction is at the bottom, Barracks Lane and Lock 6 right at the top.[45]

The restoration of all six locks will comprise carefully excavating out the infill, repairing any sections of the lock chamber which may be damaged, and providing, installing and commissioning the necessary sills, quoins, gates, paddles and paddle gear. The original bywash arrangements will be restored or replaced, and in addition five new bywash/feed pipes will be installed connecting each of the short pounds with the pound above, as described for the Locks 17 to 13 in section 2.7.2. The water levels will be determined by the existing lock arrangements, but are estimated to be as follows:

- Lock 6: downstream level 127.1m AOD, rise 2.5m, upstream level 130.6m AOD
- Lock 5: downstream level 130.6m AOD, rise 2.7m, upstream level 133.3m AOD
- Lock 4: downstream level 133.3m AOD, rise 3.1m, upstream level 136.4m AOD
- Lock 3: downstream level 136.4m AOD, rise 2.5m, upstream level 138.9m AOD
- Lock 2: downstream level 138.9m AOD, rise 2.5m, upstream level 141.4m AOD
- Lock 1: downstream level 141.4m AOD, rise 2.9m, upstream level 144.3m AOD

About 20m beyond Lock 1 is the existing channel of the canal which is still in water, currently forming part of the boatyard occupying Ogley Wharf, and leading through the existing cast iron turnover bridge to Ogley Junction, where the restored canal will connect to the Wyrley and Essington Canal.

[45] Photo by Tom Holford, courtesy of LHCRTL

Ogley Junction, turnover bridge and sign pointing the way!

2.9 Cost Estimates

An initial budget estimate of the construction costs for the scheme detailed above and shown on the proposal maps has been produced in order to give a base point for cost-benefit analysis.

The costs estimates exclude land purchase costs.

2.9.1 Methodology

The budget estimate has been prepared using quantities taken off the base drawings prepared to enable the Proposal Maps to be developed. Computer models of the existing ground topography and proposed alignment was developed as described in section 2.1.2. These models were used to calculate earthworks volumes, with hand adjustments to reduce inaccuracies due to the limitations of the models.

Earthworks costs are based on Atkins experience with current contract rates and on price database rates[46] – this is particularly important with respect to the rates for disposal of material off-site as this activity represents about 11% of the total estimated construction costs. In calculating disposal costs, it has been assumed that 10% of the total volume of excavation arisings will be contaminated and will have to be landfilled as unacceptable material, and that the remainder of material to be taken off-site is inactive / inert and will therefore attract a much lower gate price at landfill.

It should be emphasised that if synergies can be developed sufficiently in advance with other projects (such as flood bank raising, noise bunds, etc.) which require large volumes of material, then a waste management exemption can be registered and inactive / inert material, and in some cases even material with some contamination can be re-used rather than taken to landfill. This would reduce the overall cost of the scheme.

Most other costings are based on previous experience of similar canal works (locks, water control structures, etc.), or on Atkins internal database of prices for structural works.

[46] "Spons Civil Engineering and Highway Works Price Book", edited by Davis Langdon, 2008 (twenty-second edition)

2.9.2 Construction costs

The “raw” construction costs developed using the methodology above are net of preliminaries and design and supervision fees. These are factored in at the rate of 20% for contractor’s preliminaries and 15% for fees and disbursements.

A detailed breakdown of the costs is given in Appendix A.

2.9.3 Operation and maintenance costs

Operation costs and maintenance costs have been assumed in the cost-benefit analysis to be self-funding (i.e. job creation and indirect benefits to the local economy balance the costs) and are not therefore separately identified.

However, for reference, on a heavily locked canal such as the Lichfield canal, maintenance costs will comprise general maintenance (figures supplied by British Waterways for other schemes indicate a figure of around £8,000 per kilometre per year), and lock repairs and renewals, which will cost about £40,000 per lock. It is normal to allow a lifecycle of 30 years for lock gates, paddles, etc., although quoins and pintles can last much longer. With 31 locks, it would be reasonable to assume that, on average, one lock per year will require gate renewals at a materials cost of around £25,000[47] and a labour and plant cost of £10,000. It could be assumed for the budgeting purposes that gate renewals will commence fifteen years after the completion of Phase 3.

Thus, until fifteen years has elapsed from the completion of Phase 3, estimated annual maintenance costs will be equal to the distance completed in kilometres multiplied by £8,000. If the whole canal is completed in this timescale, the maintenance cost on completion will be of the order of £96,000 per annum. Once lock gate renewals commence, this figure will rise to around £131,000 per annum.

[47] Note that generally lock gates for canals in the West Midlands are made at British Waterway’s Bradley Repair Yard, located south of Wolverhampton.

3. Environmental Issues

Full consideration has been given to assessing and ensuring the feasibility of the proposals in terms of environmental issues. These can broadly be divided into issues of the built environment (heritage and landscape), and those of natural heritage (ecology and habitat).

The key principles applied when developing the restoration proposals for the canal have been to avoid damage to the existing environment, to try to enhance and improve access to existing built and natural heritage and to ensure that the proposals make provision for mitigation on at least a like-for-like basis where adverse environmental impacts cannot be avoided.

3.1 Heritage

3.1.1 Items of Built Heritage

Many items of built heritage survive either visible, or in the case of locks, many have been infilled and are not immediately apparent. These are listed in Table 3.1, below.

3.1.2 Impact of Restoration Proposals and Means of Mitigation

It is hoped that some sections of waterway wall may survive and be sufficiently well preserved that they can be incorporate (with repairs) into the restoration, however it has been assumed for the purposes of the cost estimate that all the vertical walling will be replaced with sheet piles. The table below lists the structures which are believed to survive from before abandonment, and gives an indication of the proposed treatment of the structure.

Structure	Treatment
Watery Lane Bridge	Retain, modify for use as turnover bridge
Lock 30	Retain, excavate and restore to use
Lock 29	Retain in current partly demolished condition (off the proposed line of restoration)
Locks 28 and 27	Any remains will not be affected by restoration (off the proposed line of restoration)
Locks 26 and 25	Retained and excavated and partially restored at present. To be returned to use.
Lock 24	Has been excavated by the Trust and infilled again. Chamber to be retained as a narrows on the canal, which will pass through at the low level. Modifications required to remove top sill and deepen and underpin top wingwalls and forebay.
Locks 23 to 20	Either buried in public open space or already lost to development. Any remains will not be affected by restoration (off the proposed line of restoration)
Original Birmingham Road Bridge	Retained – unaffected by restoration – off the proposed line
Lock 19	Excavated recently as part of Southern Bypass construction and downstream end demolished. Remains to be excavated and recorded prior to demolition as this lock is partly on the line of the proposed restoration at the “Railway Turn” pinch point.

Lock 18	Retained and excavated and partially restored at present. To be returned to use.
BCN Cottage No. 268 (Fosseway Lane)	Retained in private ownership and to be protected whilst canal is restored.
Locks 17 to 13 (the “Third Flight”)	Retain, excavate and restore to use. It may be possible, subject to land acquisition, to restore and interpret at least one of the former side ponds.
Wall Lane Bridge	If structure is found to be infilled but extant it is to be restored (subject to detailed engineering feasibility)
Pipehill Bridge	Retained and reinstated to original condition (only requires relatively minor repairs)
Pipehill Brook Culvert	Only remaining original culvert. To be repaired, possibly by lining. As much of original structure to be retained as possible. Second, parallel structure may be required.
Lock 12	Retain, excavate and restore to use. Some copings visible at present.
Moat Bank Lane Bridge	Recently Staffs Highways removed infill, inspected, and replaced infill with gravel. To be excavated, repaired as required and re-used.
Lock 11	Recently partially excavated by Staffs Highways as part of Moat Bank Lane Bridge investigation. In good condition and to be retained, excavated and restored to use.
Lock 10	To be retained, excavated and restored to use (subject to land acquisition – if land cannot be purchased lock will remain in existing condition, infilled and off-line, replace by a new structure)
Lock 9	Any remains will not be affected by restoration (off the proposed line of restoration)
Lock 8	Lock structure will remain in situ but will be buried under a raised canal embankment – necessary to give suitable level to connect to M6 (Toll) Aqueduct. Structure to be excavated and recorded prior to infilling and bank raising.
Lock 7	Retained. Lock restored to use with much reduced “rise”, recording and infilling the lower part of the chamber and bottom forebay, and providing new / raised approach walls at the bottom end, or infilled to top cill level and retained as a narrows (not an operational lock) with suitable interpretation.
Lock 6	Retained and either excavated and restore to use to original rise (in this case Lock 7 will be a low rise working lock) or deepened by extending the lock walls downwards and underpinning, providing an new invert and rebuilding the bottom cill and forebay (if Lock 7 is to be non-operational). This will depend on investigations to establish the practicality of deepening Lock 6 (in terms of the gauge at low water level) to be undertaken prior to the outline design for Phase 5.
Locks 5 to 3	Retain, excavate and restore to use, updating bywash arrangements to provide for downstream control of feed

	water
Locks 2 and 1	Retain, excavate and restore to use, removing the buried septic tanks from the chambers and providing alternative biodigester sewage treatment for the cottages
BCN Cottage Nos. 271 and 272	Retained in private ownership and to be protected whilst canal is restored. (NB: one of the cottages is in the ownership of the Trust)
Turnover bridge at Ogley Junction	Retained in use as at present

Table 3.1 – Existing Heritage Structures and Effect of the Restoration Proposals

As can be seen from the Table, only one structure (Lock 19) will be destroyed as a result of the restoration proposals. Significant alterations will be required to Lock 24, Pipehill Brook Culvert and Lock 7. Lock 8 will be buried under the proposed alignment after excavation and recording. The majority of the remaining structures need only restoration and minor alterations to reinstate them to their role as canal infrastructure.

A number of structures will not be on the line of the new canal, and generally the approach is to leave these in their current condition, possibly with some historical interpretation where the remains are publically accessible, as a remnant of the contraction and dereliction that befell the canal network between 1945 and 1970.

3.2 Ecology / Natural Heritage

As part of the study, Atkins has reviewed the potential ecological impacts and constraints to the restoration of the Lichfield Canal.

The preliminary ecological constraints commentary which follows is intended for advice only in respect of project design, site layout and/or site investigation and is not for use as part of a supporting statement to a planning application nor within an Environmental Impact Assessment. This report has been prepared by an environmental specialist and does not purport to provide legal advice. The Trust may wish to take separate legal advice. Further ecological advice will be required prior to intrusive site investigations.

This section of the feasibility report comprises ecological information obtained from a desk study and review of existing information and lists the ecological constraints to the proposed restoration of the canal. The legislation relevant to the potential ecological constraints due to plants and animals associated with the project is listed in the legislation table overleaf.

Species	Legislation (England	Offences	Licensing procedures (England)
Bats ***European protected species***	Conservation (Natural Habitats &c.) Regulations 1994 (as amended) Reg.39	Deliberately[48] capture, injure or kill a bat; deliberately disturb[49] a bat; or damage or destroy a breeding site or resting place used by a bat. The protection of bat roosts is considered to apply regardless of whether bats are present.	A NE licence in respect of development is required. • *European Protected Species Guidance Note* (NE 2009) • *Bat Mitigation Guidelines* (English Nature 2004) • *Bat Workers Manual* (JNCC 2004)
	Wildlife and Countryside Act 1981 (as amended) S.9	Intentionally or recklessly obstruct access to any structure or place used for shelter or protection or disturb[49 above] a bat in such a place.	Licence from NE is required for surveys (scientific purposes) that would involve disturbance of bats or entering a known or suspected roost site.
Otter ***European protected species***	Conservation (Natural Habitats &c.) Regulations 1994 (as amended) Reg.39	Deliberately[48 above] capture, injure or kill an otter; deliberately disturb[49 above] an otter; or damage or destroy a breeding site or resting place used by an otter.	Licences issued for development by NE. • *European Protected Species Guidance Note* (NE 2009)
	Wildlife and Countryside Act 1981 (as amended) S.9	Intentionally or recklessly obstruct access to any structure or place used for shelter or protection or disturb[3] an otter in such a place.	No licence is required for survey. However, a licence would be required if the survey methodology involved disturbance.
Great crested newt ***European protected species***	Conservation (Natural Habitats &c.) Regulations 1994 (as amended) Reg.39	Deliberately[48 above] capture, injure or kill a great crested newt; deliberately disturb[49 above] a great crested newt; deliberately take or destroy its eggs; or damage or destroy a breeding site or resting place used by a great crested newt.	Licences issued for development by NE. • *European Protected Species Guidance Note* (NE 2009) • *Great Crested Newt Mitigation Guidelines* (English Nature 2001)
	Wildlife and Countryside Act 1981 (as amended) S.9	Intentionally or recklessly obstruct access to any structure or place used for shelter or protection or disturb[3] a great crested newt in such a place.	Licences issued for science (survey), education and conservation by NE.
Badger	Protection of Badgers Act 1992	Intentionally kill, injure or take a badger; disturb a badger in its sett; or intentionally or recklessly damage, destroy or obstruct access to a badger sett. It is not illegal to carry out disturbance activities in the vicinity of setts that are not occupied.	Licences for development activities involving disturbance or sett interference or closure are issued by Natural England. Licences for activities involving watercourse maintenance, drainage works or flood defences are issued under a separate process. A licence may be required for any work within the vicinity of a sett that is likely to cause disturbance to badgers. Licences are not granted from December to June inclusive because cubs may be present within setts. • *Badgers & Development* (NE 2007)
Water vole	Wildlife and Countryside Act 1981 (as amended) S.9	Intentionally kill, injure or take water voles; intentionally or recklessly damage, destroy or obstruct access to any structure or place used for shelter or protection or disturb a water vole in such	No licence is required for survey in England or Wales, unless you are likely to commit an action that is otherwise illegal. There are currently no licensing purposes that explicitly cover development activities or

[48] Deliberate capture or killing is taken to include "accepting the possibility" of such capture or killing.
[49] Deliberate disturbance includes in particular any disturbance which is likely to impair their ability to survive, to breed or reproduce, or to rear or nurture their young; or in the case of animals of hibernating or migratory species, to hibernate or migrate; or to affect significantly the local distribution or abundance of the species to which they belong. Lower levels of disturbance, not covered by the Conservation Regulations, remain an offence under the Wildlife and Countryside Act, however a defence is available where such actions are the incidental result of a lawful activity.

Species	Legislation (England	Offences	Licensing procedures (England)
		a place.	activities associated with the improvement or maintenance of waterways. However when a proposed lawful activity has no opportunity to retain water voles within a development site and their translocation would result in a conservation benefit then a licence from NE may be obtained. • *The Water Vole Conservation Handbook* (R. Strachan & T. Moorhouse, Wildlife Conservation Research Unit, 2nd Edition 2006) • England: Water voles and development licensing policy -NE Technical Information Note TIN042 2008- http://naturalengland.communisis.com/naturalenglandshop/docs/ne86.pdf • Wales: Water Voles – Guidance for recent legislation changes (2008) http://new.wales.gov.uk/topics/environmentcountryside/consmanagement/conservation_biodiversity/watervoles/?lang=en
White-clawed crayfish	Wildlife and Countryside Act 1981 S.9(1) (part) only	Intentionally take from the wild.	Licences issued for survey by Natural England. No licences in respect of development are available. Trapping and removal of crayfish for maintenance or development activities in a watercourse requires a conservation licence from Natural England and a permit from the Environment Agency.
Adder Common lizard Grass snake Slow worm	Wildlife and Countryside Act 1981 S.9(1) (part); S.9(5)	Intentionally kill or injure any common reptile species.	No licence is required. However an assessment for the potential of a site to support reptiles should be undertaken prior to any development works which have potential to affect these animals.
Breeding birds	Wildlife and Countryside Act 1981 (as amended) S.1	Intentionally kill, injure or take any wild bird; intentionally take, damage or destroy the nest of any wild bird while that nest is in use or being built; intentionally take or destroy the nest or eggs of any wild bird. Special penalties are liable for these offences involving **birds on Schedule 1** (e.g. most birds of prey, kingfisher, barn owl, black redstart, little ringed plover). Intentionally or recklessly disturb a Schedule 1 species while it is building a nest or is in, on or near a nest containing eggs or young; intentionally or recklessly disturb dependent young of such a species.	No licences are available to disturb any breeding birds in regard to development. Licences are available in certain circumstances to damage or destroy nests, but these only apply to the list of licensable activities in the Act and do not cover development. General licences are available in respect of 'pest species' but only for certain very specific purposes e.g. public health, public safety, air safety.
Japanese Knotweed Giant Hogweed	Wildlife and Countryside Act 1981 S.14	Plant or otherwise cause to grow in the wild.	Any Japanese knotweed/giant hogweed contaminated soil or plant material is classified as controlled waste and should be disposed of in a suitably licensed landfill site, accompanied by appropriate Waste Transfer documentation, and must comply with section 34 of the Environmental Protection Act 1990. • *The Knotweed Code of Practice* (Environment Agency 2006)

Table 3.2 – Table of Legislation regarding Ecological Constraints

3.2.1 Ecological Constraints and Impacts

The proposed route of the canal is shown on the Proposal Maps.

The Multi-Agency Geographic Information for the Countryside (MAGIC) website (www.magic.gov.uk) and the Nature-on-the-Map website, maintained by Natural England, (www.natureonthemap.org.uk) were reviewed for information on nationally and internationally designated sites of nature conservation importance and statutorary local nature reserves within 1km of the boundary of the proposed canal route. It should be noted that, although the entire canal is within the Lichfield District Council boundary, some parts of the search areas are under the jurisdiction of Walsall Metropolitan Borough Council.

Information on locally designated sites of nature conservation importance (Site of Importance for Nature Conservation (SINC) and Sites of Local Importance for Nature Conservation (SLINC) was obtained from the Unitary Development Plans for Lichfield District Council and Walsall Metropolitan Borough Council.

A previous assessment of the Environmental Issues associated with the proposed canal restoration was reviewed (Ed Sharkey, February 2000).

There are no internationally important sites for nature conservation (Special Areas of Conservation, Special Protection Areas or Wetlands of International Importance) within 1km of the proposed canal route.

The Chasewater Heaths Sites of Special Scientific Interest (SSSI) is in the area of British Waterways Chasewater Reservoir, around 1.5 km upstream of Ogley Junction. The reservoir feeds the Wyrley and Essington Canal and sustains recreational use including watersports. The use of water from Chasewater Reservoir to feed the canal is understood to be subject to an agreement between British Waterways and Natural England, and any changes to water use (to provide additional feed water for the Lichfield Canal) would have to be undertaken within the terms of the agreement to ensure that there was no adverse impact on marginal habitats within the SSSI due to changes in water levels.

The Cannock Extension Canal SAC and SSSI lies approximately 3.75 km from the proposed scheme. No direct impacts on the SSSI are anticipated. However the use of the canal could potentially result in an increase in traffic of boats on the Cannock Extension Canal, with the potential for increased disturbance to key species (floating water-plantain). This issue is dealt with more fully in the recent “Hatherton Canal Restoration – Supplementary Feasibility Report” [Atkins, February 2009].

There are no other nationally important sites for nature conservation (National Nature Reserves) within 1km of the proposed canal route.

A number of non-statutory Sites of Importance for Nature Conservation (SINC) are present on or close to the route of the canal, which are listed in Table 3.3, below. It was not possible to obtain the necessary information from Lichfield District Council during the study period to enable designations to be identified.

Sites of Importance for Nature Conservation
Canal corridor at Cappers Lane
Land at Pipe Hill
Pipe Hill Wharf
Pipe Hill canal corridor
Pipe Hill

Table 3.3 – Non-Statutory Sites of Importance for Nature Conservation (SINC)

The key ecological constraints to the proposed restoration are summarised in Table 3.4, below

Feature/ constraint	Potential impacts
Protected Species and Invasive Weeds	
Badger	Potential for badgers to be present within the scheme. Proposals could result in loss of/ disturbance to badger setts and loss of foraging habitat.
Bats	There are a number of mature trees within the scheme which could support roosting bats. Proposals could result in loss of/ disturbance to bat roosts and affect foraging/ migration routes.
Great crested newts	Standing water bodies within 500 m of the scheme have potential to support great crested newts. Great crested newts can use terrestrial habitats up to 500 m from a breeding pond. Proposals could result in loss of/ disturbance to breeding ponds and terrestrial habitat.
Otters	There is a limited possibility that otters may be occasionally present on the Wyley & Essington and Coventry Canals and on minor watercourses in the vicinity of the proposed route. Proposals could therefore affect their resting places.
Water voles	Water bodies within the scheme could support water voles. Proposals could result in loss of/ disturbance to habitats and resting places.
Crayfish	Water bodies within the scheme could support white-clawed (native) crayfish or non-native species. Proposals could result in taking of white-clawed crayfish and affect their local conservation status, or could result in encouraging the spread of non-native crayfish.
Reptiles	Habitats within the scheme are likely to support common reptile species (grass snake, slow worm, common lizard). Proposals could result in harm to these animals and loss of habitats.
Birds	Habitats within the scheme are likely to support a number of bird species. Proposals could result in harm to birds, destruction of nests and loss of habitats.
Invasive weeds	Potential for Japanese knotweed and giant hogweed to be present within scheme. Proposals could encourage the spread of these species.

Feature/ constraint	Potential impacts
Habitats	
Open water	Proposals will disturb areas of existing open water, but will result in an overall significant gain in open water habitats
Hedgerow	A number of sections of hedgerow will be lost.
Woodland, trees and scrub	Areas of woodland and scrub, which predominantly comprise trees that have colonised the route of the canal since sections have been infilled, will be lost.
Grassland, ephemeral and tall ruderal vegetation and heath	Much of the proposed route is covered by rough grassland or tall ruderal vegetation (e.g. nettle, willow herb etc.), which will be lost. The majority of the grassland is likely to be neutral grassland of limited ecological value, although areas of acid grassland and species rich neutral grassland may be present. Some areas of short, ephemeral vegetation may also be present. The land within Wall Butts may support a range of heathland species in addition to grassland and ephemeral vegetation.

Table 3.4 – Key Ecological Constraints

3.2.2 Consultation Undertaken

The proposals have been discussed in outline with Lichfield District Council. Previous applications for related works have been refused on the basis of a lack of supporting ecological information. Further discussion with Lichfield DC's Biodiversity Officer will be required.

Natural England has been informally consulted with regards to their concerns relating to the proposals. The key potential issues identified were:

- The need to consider the proposal in conjunction with proposals for the Hatherton Canal to demonstrate that the combined proposals are viable as a whole;
- Source of water supply and effects of water levels at Chasewater;
- The need to demonstrate recognition of potential presence of protected species to be present and requirement to undertake surveys at appropriate stages.

Further consultation should be undertaken with Lichfield DC's Biodiversity Officer and the Staffordshire Wildlife Trust.

Data on protected and locally notable species should be requested from the Staffordshire Ecological Record Centre.

3.2.3 Requirements for Further Environmental Assessment

Ecological Impact Assessment

A detailed Ecological Impact Assessment should be carried out to identify and assess the ecological features and impacts associated with the proposed scheme and to determine appropriate mitigation. This could form part of a statutory Environmental Impact Assessment (EIA). This would normally accompany a planning application.

As part of Ecological Impact Assessment, ecological surveys of the site will be required which would include:

Extended Phase 1 habitat surveys to provide information on the habitats in the survey area, identify notable plant species and habitats and assess the potential for protected/ notable fauna to occur in or adjacent to the site. Evidence of protected species would be searched for within and adjacent to the site.

Further detailed ecology surveys will be required to determine mitigation and licence requirements in relation to legally protected species prior to site investigation or construction works.

All bodies of water within 500 m of the scheme should be assessed for their potential to support great crested newts and determine whether surveys for the presence/ absence of great crested newts are required. If great crested newts are found to be present, further survey work and a licence from Natural England may be required.

Other specialist protected species surveys may be required if the extended Phase 1 surveying identifies the possible presence of protected species in or adjacent to the site. Where the proposed works affect protected species further surveys and licences may be required.

Environmental Impact Assessment

A statutory Environmental Impact Assessment (EIA) will be required under the Town and Country Planning (EIA) (England and Wales) Regulations 1999 as infrastructure developments including canalisation are listed under Schedule II. An EIA is a procedure for ensuring that the likely effects of new development on the environment are fully understood and taken into account before the development is allowed to go ahead. A screening opinion will need to be sought from the local planning authority to confirm this and a scoping opinion can be sought to establish the required scope of the Environmental Statement (ES) before its preparation is begun. It is recommended that the whole development, not just the works that fall under the Regulations, is subject to the EIA.

Because the works are phased Strategic Environmental Assessment (SEA) will be required for the whole project which will then be supported by EIA for each works package: it is possible that the size and character of some work packages (for example, a single bridge) may not require the EIA if this is highlighted in the SEA. This mechanism is intended to prevent phased projects that as a whole require an EIA from bypassing the system with small phases which individually do not require one.

It should also be noted that canal schemes are generally positive enhancements of the environment and this should be reflected in the SEA and EIA. Careful preparation of these documents will do much to ease the grant of planning permission for the scheme.

The EIA regulations require that certain statutory consultees e.g. English Heritage, Conservation Officer, Natural England, are consulted about the proposals. It is also recommended that non-statutory consultees with knowledge of the local environment and the general public are consulted about the environmental issues during the preparation of the Environmental Statement. The Environment Agency (EA) will need to be consulted with particular reference to the water resources and quality issues, as well as potential requirements for abstraction licences, transfer licences and waste licensing and exemptions.

3.2.4 Proposals for Mitigation of Impacts of Restoration

Detailed proposals for certain sites have been made and are shown on the Proposal Maps and described in sections 2.4 to 2.8. The following more generic mitigation recommendations can be applied throughout the scheme:

- Loss of hedgerow: it is recommended that all hedgerows to be removed should be assessed for their quality. It is recommended that hedgerows of high ecological value are translocated. Poorer quality hedgerows should be replaced elsewhere within the scheme wherever possible, using locally sourced native species appropriate to the location. Consideration

should be given to maintaining the connectivity of hedgerows and other linear habitat features. Note that hedgerows may support breeding birds.

- Loss of trees/ woodland: Trees should be replaced elsewhere within the scheme wherever possible, using locally sourced native species appropriate to the location. Notable trees should be retained wherever possible. Tree protection measures should be employed where trees are to be retained in the vicinity of works. Note that trees may support roosting bats and breeding birds.
- Loss of grassland, ruderal, ephemeral and heath habitats: Areas of habitat with significant ecological value will be identified during ecological surveys. These habitats should be protected and enhanced wherever possible. Where habitats cannot be retained in situ, they should be translocated if possible, or replaced by habitat creation.
- Birds – Removal of any vegetation for any purposes should be undertaken outside the bird breeding season (1 February to 30 September). Active nests and their associated vegetation should remain until young birds have left the nest and the nest is no longer in use.
- Great crested newts – No works can be undertaken on the route of the proposed canal without further ecological advice in relation to great crested newts.
- Badgers – No works should be undertaken, which could disturb an active badger sett without a licence from Natural England.
- Bats – No works may be undertaken which could affect a bat roost or disturb roosting bats without a licence from Natural England. All mature trees likely to be affected by the proposed works should be surveyed by a bat specialist prior to the commencement of works.
- Invasive weeds – the spread of Japanese knotweed and giant hogweed is strictly controlled under current UK legislation. If present they should be treated in accordance with “The Knotweed Code of Practice; Managing Japanese Knotweed on Development Sites” [Environment Agency, 2006] and Netregs guidance from the Environment Agency.
- Sites of Importance for Nature Conservation (SINC) – no works should be undertaken within locally designated sites for nature conservation without prior consultation with the relevant Local Planning Authority. It is considered likely that compensation would be required for any habitats affected. Requirements for compensation would be determined through the planning process. In some places this may be possible through the translocation of vegetation during construction works.

3.3 Flood Risk

The Environment Agency’s online flood maps have been consulted to establish likely areas of flood risk. Phase 1 of the proposed restoration lies within or close to the flood plain of Darnford Brook between Huddlesford Junction and Lock 30, and also includes two inverted syphon culvert carrying Darnford Brook under the canal (one of these has already been constructed). Phase 4 of the restoration will include repair of the existing culvert which carries the canal embankment over Pipehill Brook – there are flood plain areas upstream and downstream of the crossing. In Phase 5, a culvert will be constructed to carry the canal over Crane Brook, and there is flood plain shown downstream but not upstream of the crossing point. This may be a result of the removal of the old culvert which is understood to have been undertaken as part of the M6 (Toll) flood risk mitigation works.

The overall impact of the canal on flooding is therefore likely to be small, with the exception of the proposed Lichfield Cruising Club moorings and the three culvert sites. The moorings and likely requirements to compensate for any development in the flood plain are discussed in detail in section 2.4.1. Careful sizing of new culverts and other measures including potentially

compensating for the loss of flood plain would be used in more detailed design stages to ensure that there will be no adverse effect on flood risk.

3.3.1 Flood Risk Assessment

Methodology

Flood Risk Assessments are prepared in accordance with Planning Policy Statement 25: Development and Flood Risk, Environment Agency standing advice, and following the guidance given in CIRIA Report Development and Flood Risk – Guidance for the Construction Industry. The CIRIA report recommends a tiered approach to flood risk with three levels of assessment that are defined below.

Level 1 – Screening Studies

Screening studies are undertaken to identify whether there are any flooding issues related to a development site which may warrant further consideration.

The objective of the screening study is to:

- Develop an understanding of the potential flood risk to a development site.
- Agree with the Local Planning Authority what aspects of flood risk would need to be addressed in a more detailed flood risk assessment.

Level 2 – Scoping Studies

Scoping studies are to be undertaken if the Level 1 study indicates that the site may lie within an area which is at risk of flooding or that the site may increase flood risk due to increased runoff, to confirm the possible sources of flooding which may affect the site.

The scoping study should include the following objectives:

- Assessment of the availability and adequacy of existing information.
- Qualitative assessment of the flood risk to the site, and the impact of the site on flood risk elsewhere.
- Assessment of the possible scope for appropriate development design and to scope additional work required.

Level 3 – Detailed Studies

Detailed studies are undertaken if the Level 2 study concludes that a quantitative analysis is required to assess flood risk issues related to the development site.

The detailed study should include:

- Quantitative assessment of the potential flood risk to the development.
- Quantitative assessment of the potential impact of development site on flood risk elsewhere.
- Quantitative demonstration of the effectiveness of any proposed mitigation measures.

It is recommended that a Stage 2 Flood Risk Assessment for the scheme is carried out in early course. This will help to scope the detailed design work and will assist in determining whether a Stage 3 Flood Risk Assessment will be required.

3.3.2 Preliminary Assessment of Flood Risk

A brief review of the risks has been undertaken and the findings with regard to the proposed alignment are outlined below:

Combined Canal and Flood Channels

Unlike several other proposed canal restoration schemes, there are no combined canal and flood channels within the scheme.

Combined Watercourse and Canal Tunnels

There are no combined watercourse and canal tunnels within the scheme.

Water Quality

There are not thought to be any additional risks to local fluvial water quality as a result of the proposed canal restoration. The use of water from culverted land drains and the use of the canal to balance surface water drainage flows are alternative routes / means of conveyance of existing flows to their current outfall points. The proposed provision of oil interceptors and penstocks at the points where these flows enter the canal should result in adequate protection of water quality within the canal, and enhacement of the quality of water entering local watercourses at the existing culverted land drain and surface water discharge points.

Health and Safety Considerations for Canal Users from Fluvial Flood Events

There are no significant likely risks to canal users from fluvial flood events resulting from the restoration of the canal. The canal water level between Huddlesford Junction and Lock 30 appears to be above the maximum flood level, as far as can be determined by comparing the contouring derived from the ground model used for feasibility design and the extent of the flood plain.

Watercourses and Canal Crossings

The canal will cross watercourses at four points:

- Darnford Brook, adjacent to Darnford Lift Bridge – using the existing inverted syphon culvert;
- Darnford Brook, between Darnford Lane and the A38 – a inverted syphon culvert is proposed as insufficient headroom is available for a gravity culvert due to the required canal water level to permit a crossing under the A38;
- Pipehill Brook, near Pipehill Pumping Station – the existing culvert is to be repaired, and if this is not possible without reducing its capacity, a second culvert may have to be provided to ensure that the existing capacity is maintained;
- Crane Brook, just east of the M6 (Toll) road, and south of the point where the brook crosses the A5 – the original culvert has been removed and a new, longer culvert will be required which would have adequate capacity to convey the 100 year + 20% storm peak flow.

Road and Rail Crossings

A number of road and rail crossings are required and these will be suitably engineered to ensure that the canal will not pose a flood risk to adjacent infrastructure.

4. Planning

4.1 Introduction

The proposed route of the restored Lichfield Canal falls wholly under the jurisdiction of Lichfield District Council. The Development Plan for Lichfield District incorporates these documents:

- Staffordshire and Stoke-on-Trent Structure Plan (2001) 1996-2011
- West Midlands Regional Spatial Strategy (2004)
- Lichfield Local Plan (1998) 1998-2001
- Staffordshire and Stoke-on-Trent Minerals Local Plan 1999

The most relevant document for the proposed canal restoration is the Local Plan, which presents the local land use planning policies and incorporates the more strategic policies of the Structure Plan. There are a number of relevant policies in the Local Plan, which are described further below. The canal development proposal should be assessed against these Local Plan policies to establish whether it conflicts or actively supports them.

The emerging Local Development Framework, when adopted, will replace the Local Plan for Lichfield and will help to ensure that Lichfield is developed in the correct way. The Core Strategy, currently in the process of being prepared, will form a key part of the Local Development Framework for Lichfield District. It will contain a vision and strategic objectives for the District as well as Core Policies that will set the basis for directing change in the District for the next 15-20 years.

4.2 National Planning Policy

Government planning policy is set out in Planning Policy Guidance Notes (PPGs) and Planning Policy Statements (PPSs). The primary drivers of current Government planning policy guidance stem from the Government's objectives to promote sustainability, encourage the re-use of brownfield land and focus major new development in locations accessible by a range of modes of transport. The main guidance of relevance to the proposed restoration is considered to be as follows:

- PPG2 Green Belts;
- PPS7 Sustainable Development in Rural Areas;
- PPS9 Biological and Geological Conservation;
- PPG13 Transport;
- PPG15 Planning and the Historic Environment;
- PPG16 Archaeology and Planning;
- PPG17 Sport and Recreation;
- PPG21 Tourism;
- PPS25 Development & Flood Risk.

Government policy on canals and waterways stems from the Integrated Transport White Paper (ITWP) published in 1998 and a following up document ‘Waterways for Tomorrow’ published in 2000.

4.2.1 Waterways for Tomorrow

This guidance is intended to provide more detailed policy direction on waterways but the overarching objectives of how waterways and canals can contribute are applicable to the Lichfield canal such as:

- Leisure and recreation – waterways and canals are used for leisure and recreation including boating, angling, informal recreation as well as towpaths and other waterside paths provide local and long distance walking and cycling routes and access to the wider countryside;
- Natural environment – canals and waterways are important environmental and ecological resources providing wildlife corridors and habitats and species listed as national priorities under the UK Biodiversity Action Plan;
- Regeneration – waterways and canals provide an important catalyst for local urban and rural regeneration and tourism for local communities. Restoration can provide environmental enhancement, improved health, safety, green commuting routes and safety;
- Water supply and drainage – waterways and canals provide both a source of water and a means of supply;
- Heritage and education – canals and waterways represent examples of innovative civil engineering from the industrial revolution. The Lichfield Canal alignment is a historic asset, the canal having been fundamental to much of the local industrial development of the time, and many of the structures survive today.

According to Waterways for Tomorrow, the Government sees inland waterways and canals as an important asset for future generations to enjoy and utilise and is keen to see them maintained and developed in a sustainable way and to maximise their economic, social and environmental benefits.

4.2.2 National Planning Policy Guidance

PPG2: Green Belts 1995 (Amended March 2001)

This PPG outlines the history and extent of Green Belts and explains their purposes. It describes how Green Belts are designated and their land safeguarded. Green Belt land-use objectives are outlined and the presumption against inappropriate development is set out.

The use of Green Belt land has a positive role to play in fulfilling the following objectives:

- to provide opportunities for access to the open countryside for the urban population;
- to provide opportunities for outdoor sport and outdoor recreation near urban areas.

Canals are generally seen as not in conflict with Green Belt objectives: in addition, the canal would enhance opportunities for recreation and for access to countryside for urban residents. However proposals for associated development such as a marina would be in conflict with PPG2 objectives and would require justification of need and appropriate mitigation.

PPS7: Sustainable Development in Rural Areas, 2005

PPS7: Sustainable Development in Rural Areas was published in 2005 and provides advice on managing the countryside and rural areas, including the rural economy, in a sustainable way. The main objective of PPS7 is to raise the quality of life in rural areas while still developing these areas in a sustainable way. Leisure, tourism and other land-based activities which help to protect open countryside and diversify the economy are particularly supported in rural areas.

PPS7 recognises that locally valued areas are seen as important but should not prevent development that is sustainable and in scale with the landscape from occurring. PPS7 supports the Lichfield Canal restoration strategy to a certain extent as it aims to bring diversification to the

urban fringe rural economy while still ensuring countryside remains open and features of heritage and nature conservation value are protected.

PPS9: Biodiversity and Geological Conservation, 2005

PPS9: Biodiversity and Geological Conservation was published in September 2005 and aims to ensure that planning, construction, development and regeneration projects should have minimal impacts on biodiversity and geology and enhance biodiversity where possible. To this end development that would cause adverse harm to international, national and local designated sites such as SSSI's, SPA's, as well as non-designated sites such as ancient woodlands and other important flora and fauna, should not normally be granted planning permission.

Canals are seen as networks of natural habitats which enable species to move around the countryside and therefore should be protected where possible. Important features, such as rivers, river banks and canals are recognised in PPS9, because of their continuous structure, or their function as stepping stones, are essential habitats for the ecosystem and for migration, dispersal or genetic exchange. The restoration of the canal therefore could facilitate the objectives of PPS9 in creating an ecologically valuable wildlife corridor, linking individual areas of biodiversity value that exist at present. Conversely, particularly where the canal runs close to designated sites and important habitats, the proposal could conflict with the objectives of PPS9 in preserving and protecting these areas, particularly in the short term during the construction period.

PPG13: Transport, 2001

PPG 13: Transport advises that there is a need to integrate transport at the national, regional and local level to promote more sustainable transport choices, more sustainable modes of transport and to promote accessibility (paragraph 4). A key objective is to promote accessibility to jobs, shopping, leisure facilities and services by public transport, walking and cycling. PPG13 advises that great care must be taken to minimise the impact of any new transport infrastructure projects and improvements to existing infrastructure, on the built and natural environment. This includes the potential impacts caused during construction. Overall the restoration would contribute to encouraging non-road movement and improving accessibility.

In relation to the use of waterways/canals for transport or transport-related activities, it advises local authorities to seek to re-use disused wharves and basins, to retain boatyards and other services in connection with water-based recreation and to protect and enhance the waterways where possible (Annex B, paragraph 12). In addition, PPG13 advises that disused waterways should be protected where possible, through safeguarding land within development plans to ensure that routes are not severed by new development where there is a reasonable degree of certainty of the restoration project proceeding during the lifetime of the plan (Annex B, paragraph 13).

PPG15: Planning and the Historic Environment, 1994

The policy guidance states that new development, wherever possible, should be kept away from listed buildings, conservation areas and other historic sites. However, in each case, a suitable balance should be struck between conservation, other environmental concerns, economics, safety and engineering feasibility. There should always be a presumption in favour of preserving nationally important archaeological remains, whether scheduled or not, and their settings, 'in-situ'. Archaeological excavations for the purposes of preservation by record may be an acceptable alternative. Given that much of the historic environment in this instance is related to the canal this should not prove problematic.

The restoration of the Lichfield Canal offers the opportunity to preserve and interpret elements of the route itself, as well as remaining historic structures. As an interim phase before restoration is complete, there is significant potential for linking interpretation and education elements to the route and to other local initiatives.

PPG16: Archaeology and Planning, 1990

PPG16 sets out the Government's policy on archaeological remains on land and how they should be preserved or recorded both in an urban setting and in the countryside and provides guidance on the handling of archaeological remains and discoveries under the development plan and development control systems.

PPG17: Sport and Recreation, 2002

PPG17 defines open space and includes canals, waterways and river corridors as important assets for sport and recreation including fishing, boating and walking/cycling along the towpaths. PPG 17 recognizes that urban parks, open spaces, sport and recreation facilities all underpin people's quality of life. The guidance confirms that well designed and implemented planning policies for open space, sport and recreation are fundamental for delivering broader Government objectives, including supporting an urban renaissance, promotion of social inclusion and community cohesion, health and well being, and for achieving sustainable development.

PPG21 Tourism, 1992

PPG21 outlines the economic significance of tourism and its environmental impact, and therefore its importance in land use planning. It states that the planning system should facilitate and encourage development and improvement in tourist provision, while tackling any adverse effects of existing tourist attractions. Chapter 4 expects structure and local plans to play their part in protecting key tourism assets (paragraphs 4.11 and 4.12) and to identify ways in which tourism can contribute positively to other objectives such as economic development, conservation and urban regeneration (paragraphs 4.11 and 4.14).

PPS 25: Development and Flood Risk, 2001

This national guidance note highlights canals as having capacity to flood, but also as being a potential means of alleviating flooding. They have some ability to store water and as they can cross river catchments boundaries, water could be accepted in one flood risk area and discharged in another lower or no risk area. Given the topography of the proposed canal route, it is unlikely to be subject to flooding, except in the vicinity of Darnford. Refer to the section on flood risk.

4.2.3 British Waterways Policy

BW is not permitted to add any waterway to its portfolio that is not predicted to be self-sustaining in the future. The following areas of relevance and criteria are used by BW to determine the priority given to proposed restoration schemes:

Economic – the impact of the scheme in terms of employment and other economic activity, taking account of the need for economic regeneration of the local area.

Social – the potential impact of the scheme in terms of promoting social inclusion and community capacity building in the vicinity of the waterway, taking account of need (as measured by the index of Multiple Deprivation).

Market – the potential use of the waterway by boating and towpath visitors and opportunities for creating new business enterprises.

Need

Local support – the degree of local authority, community and waterway interest group support for implementing the project.

Financial Sustainability – the potential availability of funding both to implement the scheme and for managing the waterway afterwards. We wish to ensure that no additional long-term financial liability to BW will arise from schemes.

Environment & Heritage – The degree to which the scheme will benefit, secure, or at least have limited adverse impact upon the natural environment, cultural heritage and landscapes of the waterway.

Technical feasibility – the degree of difficulty for implementing the project from an engineering, water supply and land assembly perspective.

'Pressure valve' – the degree to which opening up the waterway will relieve pressure on recreational resources (including other waterways) in the vicinity.

Network

Network extension – the degree to which the canal extends or links up parts of the network[50].

Assessment

The Lichfield Canal presents opportunities to meet the above criteria as follows:

- The opportunity for marina and other development to provide revenue stream to BW from which they can fund the maintenance and operation of the canal, and which would alleviate pressure on moorings in the region;
- The provision of an alternative route through the Birmingham & Black Country area and the creation of new cruising options in the Birmingham area;
- The provision of an alternative to a congested route via the Trent and Mersey Canal;
- The opportunity to promote social inclusion and contribute to regeneration.

4.3 Regional Planning Policy

4.3.1 Staffordshire and Stoke-on-Trent Structure Plan 1996-2011 (Saved Policies September 2007)

In August 2006 the Department for Communities and Local Government (DCLG) issued a 'Protocol for handling proposals to save adopted … policies…' to advise all Local Planning Authorities in England about how they would assess any requests to save policies in their 'saved' local plans beyond 28 September 2007 (the date 3 years from commencement of the Planning and Compulsory Purchase Act 2004). DCLG aimed to ensure that only relevant and up to date policies remain after September 2007 and only remain until they are replaced by policies that are adopted as part of the new Local Development Framework.

The Staffordshire and Stoke-on-Trent Structure Plan deals with a number of different issues concerning both the use and restoration of canals. The policies outlined below must all be adhered to when considering the restoration of the Lichfield Canal.

Policy T4: Walking states that 'greater priority will be given to pedestrian movement by… maintaining, developing and promoting a network of paths and bridleways for recreational use based upon the existing rights of way network, canal towpaths and disused railway lines unlikely to be required for rail use in the future.' As indicated in Policy T5: Cycling, canal towpaths will also be promoted to provide safe and easy to use / access cycleway, thus promoting more sustainable travel.

Within Policy T10: Freight Transport it is demonstrated that priority will be given to 'reducing the environmental impact of long distance freight movements by… supporting proposals to increase the movement of freight by pipelines, canals rivers, which do not have significant detrimental effects on the local environment or recreational activities.'

[50] For details of the extension and linking up of the network resulting from full restoration of the Lichfield Canal, refer to the map included as Figure 1.2 – Black Country Canals Network.

Although the Lichfield Canal and its proposed route do not lie within a Conservation Area, it must be noted that Policy NC19: Conservation Areas refers to fact that Conservation Areas represents outstanding parts of the built environment, including canals. It cannot be ruled out that such an area could be designated as a Conservation Area and any additional development and in the area would thus be required to adhere with relevant regional and local policy relating to Conservation Area.

Policy R5A: Water Areas and Rivers outlines the preference for more effective use of existing and new water resources (including canals) for sport, recreation and / or wildlife and education subject to the need to maintain supplies of water for domestic / industrial use and subject to environmental considerations.

Policy R7: Canal Facilities details the "Vision" for canals and canal-related development in the locality.

'New canal facilities and associated services, such as moorings, service facilities, marinas, hire and trip boat facilities, information points, restaurants and heritage attractions should be sited in or adjacent to towns, villages and canal junctions, subject to the need to protect the countryside and Conservation Areas. Canalside development should contribute positively to the function and appearance of canals, wherever possible, providing new life for redundant buildings. The wildlife value of canals is recognised and will be conserved and enhanced.'

Canals contribute significantly to the heritage of Staffordshire and Stoke-on-Trent and provide a distinctive focus for recreation and tourism activities. Many canals are already protected as Conservation Areas with consideration being given to extend coverage. Improvements to provision of visitor and interpretations services on the canal network are sought, whilst ensuring conservation of their scenic, architectural and historic character. Their value as wildlife habitats and open space corridors, often penetrating right into the heart of urban areas is recognised.

Policy R8: Restoration of Canals outlines the Authorities' support for canal restoration in the area in light of the benefits to the canal system itself, urban regeneration and the impact on the nature conservation value of the land and any extant water.

The restoration of former canals can provide wide-ranging benefits, both operations and environmental. Parts of the canal system in south Staffordshire are currently disconnected cul-de-sacs … where restoration of the former links would provide the opportunities to recreate through routes of recreational and potential economic value. Through urban areas, canal restoration can form the focus for imaginative and wide-ranging urban regeneration schemes. The routes of disused canals which have potential for restoration should be protected from adverse developments which would hinder their possible reconstruction.'

'However, the line of the disused canal may have acquired an enhanced nature conservation or environmental value by virtue of the particular circumstances along the former route. This enhanced value will need to be assessed in consideration of any redevelopment proposal. In any restoration scheme, the water source for the canal should be identified at an early stage in the planning process and an assessment made of the potential impact on existing water resources. '

4.3.2 West Midland Regional Spatial Strategy

The full West Midlands Regional Spatial Strategy (formerly RPG 11) was initially published by ODPM in June 2004. The document is currently undergoing a Revision process with an Examination in Public being held in April / May 2009 where an independent Panel will review the Draft Revision and will make recommendations to Government.

Policy PA10: Tourism and Culture identifies the need for development plans to include policies that encourage the support of future development and success of key regional tourism and cultural assets of which the canal network is one. Furthermore the development of sustainable tourism should be encouraged and the cumulative impact of tourism on environmental assets

should be evaluated. Thus any proposals for the restoration of the Lichfield Canal should promote its environmental benefits and its ability to become a sustainable tourist attraction for the region.

In order to adhere with Regional policy and in turn Local policy, proposals / plans for the Lichfield Canal will need to identify the facilities needed to support it. These may include, for example, accommodation, improvements to public transport, Regional footpaths or cycle routes, alterations to the rights of way systems and opening up of inland waterways. Particular attention should be given to promoting links between urban areas and the countryside.

Policy PA11: The Network of Town and City Centres highlights Lichfield as one of the 25 strategic town and city centres across the Region which will be the focus for…uses which attract large numbers of people including major cultural, tourist, social and community venues. This policy is thus giving Lichfield the opportunity to develop its tourist attractions, the canal being potentially one of these.

Policy QE4: Greenery, Urban Greenspace and Public Spaces details the need to ensure that adequate protection is given to key features such as parks, footpaths and cycleways, river valleys, canals and open spaces.

Exploring the regeneration potential of the canal network is highlighted in Policy QE5: Protection and Enhancement of the Historic Environment which aims to identify, protect, conserve and enhance the Region's diverse historic environment, maintaining local character and distinctiveness. The value of conservation-led regeneration is also promoted and thus inclusion of this method within proposals would prove beneficial.

The proposals for the restoration of Lichfield Canal would comply with Policy QE6: The Conservation, Enhancement and Restoration of the Region's Landscape by detailing how the scheme would protect, and where possible enhance man-made and historic features that contribute to the character of the landscape and townscape and local distinctiveness.

Policy QE9: The Water Environment highlights the multi-function importance of canals as they contribute to the quality of landscapes and townscapes while providing important habitats, recreational facilities, opportunities for education, and often proving attractive to developments assisting in regeneration. The support of the Environment Agency and other related agencies is encouraged to 'maintain and enhance river and inland waterway corridors as key strategic resources, particularly helping to secure the wider regional aims of regeneration, tourism and the conservation of the natural built and historic environment.'

Finally, Local Authorities are being encouraged by Policy T3: Walking and Cycling to provide for greater opportunities for walking and cycling by making use of canal towpaths in order to promote sustainable travel.

4.4 Local Planning Policy

4.4.1 Lichfield District Local Plan 1998 (Saved Policies September 2007)

The Lichfield District Local Plan identifies the city itself as being of high environmental quality, containing a Conservation Area of national importance for historic and architectural interest. Furthermore, Lichfield is geographically well placed in relation to the transport network and possessed the opportunity to promote these qualities in order to create a wider range of jobs through tourist related employment. The proposals for the restoration of the Lichfield Canal would clearly help to fulfil these aspirations by providing an attraction that will benefit the city in a number of different ways.

Together with proposals for growth the plan also proposes to improve environmental conditions in the residential areas to the north of the City. Through conservation policies and city centre improvements it is proposed that the quality of the environment of the city be maintained and enhanced where possible. The retention and improvement of historic buildings and the character of the city is important for its own sake but also in promoting Lichfield as a place to live and work.

The restoration of the Lichfield Canal will assist with these proposals by providing a feature that will enhance the environmental quality of the area and will provide an element of local distinctiveness. In addition the canal will satisfy the Local Authorities' requirement for the improvement of recreation provision in the area.

Policy Emp 11: Wyrley and Essington Canal is the only policy within the Local Plan that deals directly with the canal. It outlines that the District Council supports proposals to re-establish the Wyrley and Essington Canal, Ogley Branch and will assist in its implementation through development control powers and land reclamation.

'A project to re-open the former Wyrley and Essington branch canal from Huddlesford near Lichfield to Ogley Hay is being developed by the Lichfield and Hatherton Canals Restoration Trust. In view of the likely tourism benefits of such development it is considered that the proposal should be supported. The proposals will modify the line of the original route where necessary, to take account of existing or proposed development, particularly where the route passes through Lichfield.'

Other policies that affect the land around the proposed route for the restored canal are detailed below.

Adjacent to the A461 and the eastern end of the proposed canal route in a parcel of land that is covered by Policy B22: Recreation Zones. Within this zone Policies E2, E4, R2 and R3 will apply to new building and recreation proposals.

The boundary of the Green Belt (dealt with at Policy E4) lies to the south of the proposed route of the restored canal. This policy states that 'except in very special circumstances permission for development in the Green Belt will not be given for the construction of new buildings or the change of use of existing buildings or land for purposes other than those listed below where such development would not conflict with the purposes of including land in the Green Belt:

- Agriculture or forestry;
- Essential facilities for outdoor sport, outdoor recreation, cemeteries and other uses which preserve the openness of the Green Belt. The proposed building must be the minimum size necessary for the satisfactory operation of the use;
- Limited infilling or redevelopment of major existing developed sites in accordance with policy EMP5;
- Replacement dwellings which conform to the criteria set in policy DC7;
- Limited affordable housing for local community needs within existing villages which conforms to criteria in Appendix 1;
- Limited extension or alteration of existing dwellings in accordance with Policy DC5;
- Re-use of buildings which are of permanent and substantial construction and which is consistent with policy DC4.'

The restoration of the canal and any associated development will need to adhere to this policy and planning permission would only be granted where the openness of the Green Belt is maintained.

Policy L49: Framework Open Space covers Darnford Park which lies north of the proposed canal route west of the junction between the A38 (T) and the A51. New development other than for recreation and open space purposes will not be permitted. Proposals for buildings on framework open spaces within the green belt will need to comply with Policies E4, R2 and R3.

An area of development restraint is identified on land south of Wordsworth Close / Byron Avenue[51] in accordance with Policy E5A. Within this area the Council will not grant planning permission for any development that would prejudice any decisions regarding its long terms future. During the Plan period permission for development will not be given for the construction of new buildings or the change of use of existing buildings for purposes other than:

- Agriculture, forestry or other uses appropriate to a rural area;
- Outdoor sport and recreation where particular regard will be had to the scale of any related built development in order to retain the character of the area.

4.4.2 Staffordshire County Council Local Transport Plan 2006-2011

This document highlights the importance of inland waterways by illustrating how Staffordshire County Council places a large amount of importance on the inland waterways and recognises the value of canal restoration in terms of the impact it makes not only in terms of economic development but in enhancing social fabric and providing opportunities for healthy living and recreation. This is enshrined in a variety of ministerial statements, planning documents (PPG13) and Local Authority Plans. Whenever possible, the Council will support such restoration projects.

Staffordshire County Council states that it is working with British Waterways, Persimmon Homes, Lichfield District Council and the Trust to secure provision of the Lichfield Canal alongside Lichfield Southern Bypass Phases 2 and 3.

4.5 Emerging Lichfield District Council Local Development Framework

4.5.1 Local Development Scheme [LDS]

This document sets out a timetable for the documents that the Local Authority will be producing as part of the Local Development Framework. It incorporates a list of the policies from the Lichfield District Local Plan that have been saved and will be replaced by policies within the Local Development Framework. Local Plan Policy EMP 11; Wyrley and Essington Canal (as identified above) is one these policies. Thus it appears that the Local Authority are not dismissing this policy and will continue to review its worth and implementation through the Local Development Framework process.

4.5.2 Core Strategy Preferred Options

The Core Strategy is the key Local Development Framework (LDF) document. It is a strategic District-wide plan that will put the key strategies and policies in place as part of the process of replacing the current Local Plan. It will guide the way Lichfield District develops in the future. This will influence the physical environment, the way people live and work and will help deliver the needs of the District's residents, employers, retailers and visitors.

The Preferred Options part of the strategy was released for consultation in December 2008 and the full Core Strategy document is expected to be published for formal consultation in May 2009.

Following recent consultation a number of issues have been raised by local residents and will be considered in the ongoing development of the LDF documents. These issues include:

- Protection of the character of Lichfield City from large scale development pressure;
- Lichfield Southern Bypass remains incomplete;
- Lichfield City is a popular destination for day visitors but there is a desire to encourage longer stays;

[51] Referred to in the emerging LDF as "Land South of Lichfield", but commonly known as Berry Hill

- Lichfield City's role as a strategic centre in terms of services, facilities, retail and employment;
- Transport movement and accessibility.

It is likely that the proposed restoration of the Lichfield Canal and its ancillary developments will be able to aid Lichfield in addressing some of these issues, in particular by promoting Lichfield as a destination for long-stay visitors and improving transport movement and accessibility.

The Core Strategy document combines a "vision" and a number of "objectives" for the district which the Local Authority will aim to progress towards using the suite of documents that will make up the LDF. The canal restoration proposals could potentially aid in the pursuit of fulfilling the Vision and a number of the objectives, as outlined below:

Draft Core Strategy Vision

Lichfield District will retain and enhance its urban and rural environment while accommodating growth.

The countryside will be rich in wildlife and more accessible as a recreational and biodiversity resource through a better connected footpath network and a greater level of informal rural recreation opportunities… the varied rural initiatives and the designation of new local nature resources will together provide varied recreation, education and tourism opportunities…

Spatial Objective 13

Spatial objective 13 is "To protect and improve the quality and diversity of the natural environment."

Spatial Objective 14

Spatial objective 14 is "To protect and enhance the District's built environment assets, its historic environment and local distinctiveness."

Spatial Objective 15

Spatial objective 15 is "To increase attraction of Lichfield District as a tourism destination through provision of a greater variety of accommodation, the development of new attractions appropriate in scale and character to their locations and the enhancement of existing attractions."

4.6 The Way Forward

In order to defend the proposed alignment of the Lichfield Canal against any alternative development, there are a number of stages that the Lichfield and Hatherton Canals Trust must go through.

Firstly it is important to continue promoting the canal restoration and the proposed route through the Local Development Framework process. Lichfield District Council have indicated that in order for reference to the canal to be made, an Evidence Base is required (a range of information informing the LDF) which should provide "Evidence" that the choices made by the plan are backed up by background facts. It is envisaged that this feasibility study itself will be incorporated into the Evidence Base.

The Core Strategy (as outlined in Section 5.0) will provide an overall vision for Lichfield, setting out how the area and places within it should develop and a delivery strategy for achieving strategic objectives for the area that focus on key objectives. Although it is uncertain whether the entire restoration of the canal will be complete within the plan period (to 2026) it is still important to ensure that the canal and its proposed route are highlighted within this document to enable protection of the canal corridor against alternative development. It is understood that representations have already been made in response to the Lichfield LDF Core Strategy Preferred Options Document, which was released for consultation at the end of 2008. Following this

consultation period, the Draft Core Strategy will be published for consultation in May 2009. It will be necessary to make representations to this document also.

It will also be necessary to make representations to all relevant Development Plan Documents (DPDs) that are released for consultation for the LDF. This will include the Land Allocations and Site Development Policies DPD, which will commence during July 2009 with Issues and Options scheduled for December 2009. This document will identify requirements for the development of sites and areas that will contribute to the Core Strategy. Representations will need to be made to this feasibility study with the intention of the inclusion of the canal restoration as an allocation within the LDF.

It is possible that the Local Authority will require the production of an Area Action Plan (AAP) for the Lichfield Canal and the surrounding area. An AAP is an optional DPD and is aimed at establishing a set of proposals and policies for the development of a specific area. Such a document should establish a vision for the canal restoration and regeneration of the surrounding area. Furthermore it should provide land use proposals and policies to guide development and protect valuable environmental, social and economic assets, as well as provide a viable plan for achieving regeneration and demonstrate implementation methods. The production of such a document is likely to require input from the Trust and their consultant team and will further cement the future of the project.

Development consent in the form of planning permission will need to be sought from the local planning authority, according to Town and Country Planning Act 1990. The proposals should consider all of the policy documents detailed above. It is recommended that there is early consultation with the local planning authority to gain an understanding of what is and is not likely to be acceptable. The planning authority will determine the planning application in accordance with the statutory Development Plan, unless other material considerations are more appropriate.

Although the scheme will be in the LDF as a single project, it is likely that it will be delivered in phases over a long period of time, possibly ten years or more. It would be theoretically possible to submit a single planning application for the whole scheme so long as work starts within five years and never stops for more than five years. However, this causes some problems as any variations to the scheme would then need to be subject of further planning applications. In addition, other restorations have found that submitting a single, all enveloping application encompasses elements that may not need planning permission (for example, works already completed that need some refurbishment) and can attract unnecessary objections. For this reason we suggest that each phase or even each work passage is the subject of a separate planning application.

The Town and Country Planning (EIA) (England and Wales) Regulations 1999 stipulate the requirements for Environmental Impact Assessments (EIA). This is discussed in more detail in section 3.2.3.

4.7 Development Potential

The restoration of the Lichfield Canal is anticipated to provide a focus for new development within the area and act as a catalyst for both urban and rural regeneration.

Restoration of the canal can present possible opportunities for enhancing the environment largely associated with the potential urban regeneration.

Today's canals are important to an area for a number of reasons including the development potential they offer and the focus they provide for waterside development. Furthermore they offer leisure, tourism and recreation facilities whilst offering value in terms of nature conservation, educational and heritage. Finally the canals offer benefits in terms of providing a "vehicle" for sustainable travel via safe and secure towpaths.

In line with Lichfield's strategy for development of the area there are likely to be a number of diverse demands placed upon this canal corridor. These demands can partly be attributed to its

proximity and / or links to the urban area where it can readily be accessed by relatively large sections of the community.

It is necessary to consider the following principles, which should underpin future development in the area surrounding the canal:

- Promoting further pedestrian access to the canal network, including access suitable for use by persons with disabilities;
- Continuing to encourage a wide range of good visitor attractions;
- Introducing additional mixed use schemes with a residential element;
- Protecting and enhancing buildings of architectural / historical importance; and
- Continuing to improve the quality of the environment in a sustainable way with street / canal enhancements, information / interpretation facilities and the creation of new focal spaces / squares.

In order to inspire and stimulate creativity for new development related to the canal it will be necessary to create a “Vision” for the area in addition to a number of objectives which will act as a measure for the success of restoration. Essentially a “Vision” for the area could be aiming to achieve a sustainable, attractive, diverse, high quality and accessible environment.

When considering development surrounding the restored canal route, it is important to consider several issues which will be important no matter what type of development takes place. Firstly, all development should respect the habitat and landscape characteristics that the canal provides. Development must respect and respond to the landscape character as well as to the existing biodiversity of the canal area. All developments should be permeable[52] and easily accessible by a number of transport modes. The contribution that the canals and their towpaths can make in achieving more sustainable patterns of movement is significant.

Prior to considering land uses individually there are several general benefits that canal restoration can provide to the community and people living and working in and around the canal corridor:

- Reuse of key canalside sites in an important urban location;
- Development of new homes on previously used land in a desirable and sustainable location;
- The revitalisation of an area currently lacking activity and interest with new residents and business activity;
- Improved pedestrian routes and canalside open spaces;
- Opportunity to enhance the canalside and provide better linkages between the Canal and the City Centre.

In line with Lichfield District Council’s and local community’s aspirations for the City, the restoration of the Lichfield Canal could stimulate local development in a number of ways:

- Residential development;
- Government policy on mixed use and diversity – inclusion of commercial uses as part of mixed-use development proposals;
- Offices (B1 uses) particularly for start-up and small businesses;
- New community or social facilities such as doctors’ surgeries, clinics and child care facilities as part of residential developments;

[52] A permeable development is one which is easy to enter and leave at a number of points and can be crossed by clear and accessible routes;

- Pub / restaurant and café uses;
- New canal-related tourist development incorporating moorings.

4.7.1 Residential Development

The emerging Local Development Framework proposes a large residential development described as “Land South of Lichfield”[53] which lies immediately to the south of the proposed route for the restored canal. The location of this proposed development and the location of the canal are mutually beneficial, as the restored canal is likely to provide an excellent environmental setting for new dwellings with the presence of safe and secure canal towpaths to allow access on foot and by cycle to other parts of Lichfield. Furthermore there is the likelihood that Lichfield District Council may be able to obtain further funding required for the canal restoration through Section 106 Agreements signed when planning permission is obtained for residential development.

It is possible that the restoration of the Lichfield Canal will encourage development on plots of land adjacent to it, opening further parts of Lichfield for redevelopment. By encouraging residential development the canal will help to contribute to the total residential provision requirements of the Local Authority, amounting to some 1650 dwellings on new sites in South Lichfield before 2026. The canal can have a role to play in facilitating these developments, as it is possible, subject to careful and detailed design, for it to accommodate drainage run-off both as a means of conveyance and with some balancing effect.

Any residential development proposed should come forward as part of mixed-use developments within the local area, with the canal providing an excellent sustainable means of accessing any employment areas.

There is a well established “property premium” for canal front housing, and it will be advantageous to utilise available land which lies immediately adjacent to / land nearest to the canal itself for residential development to enable properties to benefit from views of the canal and its associated landscaping. Furthermore, by allowing the canal, its towpath and surrounding areas to be overlooked 24/7 a safer and more secure environment will be provided for pedestrians and cyclists wishing to use this route.

It is also important to consider the use of any previously developed land for redevelopment prior to the use of greenfield land.

4.7.2 Employment

The Local Authority should seek to utilise canal restoration and regeneration in assisting diversification and / or intensification of any employment opportunities within the local area. There are a number of sites which lie again to the south of the proposed route of the restored canal and could be utilised as employment sites, possibly B1 (office), B2 (industrial) and B8 (warehouse and storage uses).

The canal route follows the alignment of the A51 thus adjacent sites would have excellent access to the strategic road network making uses such as B1 and B2 ideal.

Providing a mix of traditional and other employment generating uses including retail, leisure, catering and creative industries and tourism will benefit the area hugely by potentially allowing it to be used throughout the day and night.

Market factors at the time of proposals should determine the exact location of employment generating land uses that will capitalise on the character and unique heritage. It will also be necessary to protect any employment uses that are related to traditional canal industries and ones that support the canal’s continued use (e.g. the boat yard at Ogley Junction)

[53] This land is commonly known as Berry Hill.

Employment uses which will support the tourism industry associated with the restored canal (see below) would also be beneficial including hotels and bed and breakfasts, shops and cafes / restaurants.

When reviewing the feasibility of employment in an area there will be a need to consider how businesses that continue to operate within the site can be accommodated within new development proposals.

4.7.3 Tourism

Consultation through the LDF process has highlighted that Lichfield is believed to be a popular destination for day visitors but there is a requirement to encourage longer stays. By developing the tourist industry alongside the restoration of the Lichfield Canal, alongside some careful and creative marketing it should be possible to make Lichfield a destination for visitors who wish to stay for longer than one day.

It will be necessary to identify the canal and its surrounding uses as a visitor “honey-pot” whilst ensuring the visitor numbers can be accommodated and managed. The presence of a number of access points with parking and appropriate seating and information will encourage visitors.

Parcels of land immediately adjacent to the canal and within walking distance of the centre of Lichfield should be allocated as service points for future boat users, thus encouraging boaters to moor and stay and directing them towards the attractions of the City Centre. Long-term moorings, including residential and visitor moorings should be incorporated.

The “water” element of the canal should be maximised through the use of a restaurant boat, water taxis and boat trips where appropriate, which will encourage use by tourists.

Services and facilities to support any visitors should be provided, including pubs and cafes.

It will be necessary for the tourist and visitor numbers to be maximised for the canal to have a significant economic benefit in the locality. This can be done through the promotion of cultural heritage with an attractive canalside environment. By providing a multi-use recreational and leisure towpath and by providing local parking and access to public transport (i.e. local bus stops) the canal will be accessible to all. A number of hotel and catering uses can be focused on the canal by locating them in an environmentally attractive position adjacent to the canal whilst basing them around the local cultural heritage (e.g. Industrial Revolution).

There are a number of locations along the proposed canal route that could accommodate significant new areas of open space alongside the canal bank which, providing safe footpaths and cycleways are incorporated, could also be associated with adjacent residential uses.

The proposed route of the Lichfield canal through greenbelt and the historic city of Lichfield will benefit development around the canal. Development can be rooted in the existing local built and natural heritage and tourism opportunities.

There is great potential to further develop a network of pedestrian routes with additional signage and interpretation facilities to guide the public along the canal network from key nodes and vantage points, and from new development opportunities.

As stated above it is likely that Lichfield District Council would wish to see an Area Action Plan / Development Framework / Supplementary Planning Guidance produced for the restoration of the canal and the regeneration of the surrounding areas. Such documents will deal with the development in great detail, outlining design and access issues, in addition to recommending particular types of development for different areas. However, at this stage it is important to remember that the appearance of all new buildings will be required to respect and enhance the character of the surrounding environment, taking into consideration historic fabric and landscape character. Designs that crowd the canal bank with tall or windowless facades or long unbroken frontages should be avoided.

Development layouts must be designed so that they balance consideration of the needs of new occupants with the needs of neighbouring businesses.

Development encouraged adjacent to the canal should be designed to allow the free flow of pedestrians through and around the development onto the canal towpath and towards the wider network. The areas surrounding development and the canal should be enhanced through landscaping, including habitat creation and public art at suitable locations.

5. Socio-Economic Benefits

Within this section we investigate the likely social and economic benefits arising from the full restoration of the Lichfield Canal. The proposed restoration of the Lichfield Canal would create a valuable facility for the local area. However, these intangible benefits cannot readily be valued any more than an urban park or a rural footpath can be valued. It is the economic benefits to the canal corridor that will form a key justification when seeking funds to progress the scheme. This section evaluates these economic benefits and compares them with the capital cost of the scheme to give an indication of value for money.

The benefits arising from the canal restoration relate to the potential for:

- Water-based recreation activities, such as hire and privately owned boats, trip and restaurant boats, canoeing and angling;
- Land-based recreation activities, such as walking, cycling, horse riding, sightseeing, picnicking and bird watching;
- Development opportunities associated with canal restoration, including the provision of facilities for use of the canal;
- Expenditure on construction and maintenance of the canal, in addition to the boats and other facilities associated with the use of the canal.

The primary economic benefits will arise from an increase in visitors to the area, and an increase in the amount of money visitors spend whilst in the area. At point of purchase, all this money is spent within the local economy; however, some goes on to be recycled within the local economy as well, in that outlets servicing visitors use local labour and local suppliers. This gives a multiplier effect in that for every pound spent in the local economy, more than a pound's worth of value is gained. In calculating costs and benefits, we have not used this multiplier effect, but its presence should be noted, as it means that the overall economic benefit is greater than described in this report. The level of spend within the local economy and the multiplier affecting how much remains within it is dependent on what opportunities for spending there are within the local area.

In addition to benefits from visitor expenditure, there is an economic benefit from the construction phase of the work, as local labour and plant will be used in much of the construction. This is also considered without a multiplier, again meaning that actual economic benefits are greater than described in this report.

As well as the economic benefits of the scheme there are, as mentioned above, intangible social effects to be gained from increase in access to recreation areas and changes in the local environment. While various methodologies do exist for valuing these social benefits in financial terms, this report will not attempt to quantify them.

The scheme has been examined in terms of engineering and environmental feasibility and costs, with options for localised variants included and phasing of restoration identified. For the purposes of this study we have concentrated only on new revenue to be generated by the scheme. We have not included existing revenue from operations (for example, existing marinas). It must be noted that figures used in calculations are based on UK averages or studies carried out elsewhere, adjusted where possible to take account of local data. These figures are based on the existence or development of spending opportunities in the canal catchment area. Potential future development opportunities are limited in comparison to some other schemes and are primarily associated with development of land south of Lichfield.

The route varies in character from rural in the vicinity of Huddlesford and west of Lichfield to urban areas of varying quality. The presence of the City of Lichfield adjacent to the route will add to the

opportunities for visitor expenditure and multi-purpose trips as well as increase the overall visitor attraction.

The length of canal proposed for restoration is from Huddlesford Junction on the Coventry Canal to Ogley Junction on the Wyrley and Essington Canal. While the Coventry Canal is a busy leisure route for boaters, reaching part of several through routes and reaching saturation point at times in Summer, the Wyrley and Essington Canal is very quiet, being a dead end off the very lightly used northern waterways of the BCN.

5.1 Overview of Assessment Assumptions

In assessing economic effect we have relied on a range of previously published studies as well as our own experience. BW has, over the last decade, developed a tourism and leisure demand model which has been applied to a number of different canal and waterway projects to test its validity. Where appropriate we have based our calculations on the assumptions contained within this model.

The first step is to estimate the number of potential canal users. This is broken down by type (boaters, cyclists, anglers etc.) Where possible this is drawn from available data (boat licenses, pedestrian counters) for similar projects, but this data often does not exist or is several years out of date. 'Proxies' are therefore used, such as national survey data.

Expenditure associated with additional visitors of different types is calculated through estimating activity patterns. Average spend per head estimates drawn from national and local surveys are then applied to these visitor numbers to obtain an overall expenditure figure. For this study we have used expenditure figures used by BW in their 2006 'Economic Evaluation of the Restoration of the Kennet & Avon Canal' as set out in Table 5.1 below, adjusted where appropriate to match known local conditions on the Coventry Canal and the BCN.

Visitor Type	Expenditure Category	Expenditure	Source / Rationale
Moored Boats: Boat related expenditure	Boat running costs (excl. Licence fee & moorings) per annum	£927.91	Private Boating Price – Demand Study, 1997 (BW/EA), Inflated
	Mooring fees per annum	£698.73[54]	Private Boating Price – Demand Study, 1997 (BW/EA), Inflated
Moored Boats: Non-cruising visits	Non-cruising visits spend per visit	£11.74	BW Log Book Survey, 1993, Inflated
Moored Boats: Cruising Trips	Mean spend/person/day	£10.06	BW Log Book Survey, 1993, Inflated
Visiting Boats: Cruising Trips	Mean spend/person/day - private	£10.06	Hire Boat Survey, 1990, Inflated
	Mean spend/person/day – hire	£14.19	Hire Boat Survey, 1991, Inflated
Hire Boats	Av. Cost/hire (£s)	£811.64	Shoulder rates for 7-day hire of 4-berth boat
	Cruising spend per person	£14.19	1990 BW Hire Boat

[54] This average figure includes on line moorings and end of garden moorings, however it is unlikely that restoration of the Lichfield Canal would create significant numbers of new on line or end of garden moorings and so a more typical marina rate of £1,500 will be used

	per day		survey, Inflated
Trip Boats	Av. Cost per trip	£5.31	Average cost based on BW System
Day Boats	Boat hire cost per day	£55.90	Based on Day boat operations on BW system
	Cruising spend per person per day	£11.73	UKDVS 2002/3 'water with boats' category
Canoeing	Visitor spend per visit	£3.41	BW Owners of Unpowered Boats Survey 1995, Inflated
Angling	Visitor spend per trip (incl. travel/permits)	£6.93	BW Survey of Individual Anglers, 1996, Inflated
Cycling	Visitor spend per trip (incl. travel/permits)	£7.47	BW K&A Towpath Survey 2005
Informal Visitors	Visitor spend per trip	£4.87	BW Day Visit Survey 2004
Overnight (Holiday) Visitors	Visitor spend per day (incl. travel/accommodation)	£58.63	UK Tourism Survey 2004

Table 5.1 – Summary of expenditure by user type[55]

To convert predicted boat numbers into a figure for the number of canal visitors, we use similar assumptions to this recent BW study, which are based on various British Waterways reports and statistics. These assumptions are:

- Hire boats: There are 23 7-day hires per boat per year, with average craft occupancy of 4.1 people. We have assumed, for the purposes of this study, that private boats have the same occupancy rate.
- Trip boats: Average craft capacity is assumed to be 40 people, with an average occupancy rate of 70%. An average of 450 annual trips is assumed (2 trips per day over a 25-week season, plus 4 trips per day at weekends).
- Day Boats: Assumed to be hired for an average of 115 days per year, with average craft occupancy of 4.1 people per boat.

Employment directly resulting from visitor expenditure is calculated using standard industry multipliers. 1 full-time equivalent (FTE) job is assumed to result from each £34,000 of expenditure on tourism and leisure, and 1 FTE is assumed to result from each £68,000 expenditure on boating materials and supplies. These figures are those used in the analysis of the Kennet & Avon report.

Calculating visitor numbers takes account of additionality (that is, the additional spend resulting from restoration, not the total spend) assumptions as for the Kennet & Avon Study[56] and assumes that 80% of cycling and informal day-visits would take place elsewhere in the local area in the absence of the canal restoration programme (20% of day-visits are thus net additional as a result of the canal). In the case of overnight visitors, only 15% of visits would be made to the sub-region

[55] Source: BW/ECOTEC
[56] Reference required

in the absence of the canal. All boating and angling activity is assumed to be additional to the canal and its corridor.

5.2 Water-Based Recreation

Boat use tends to be split fairly evenly between hire boats and private boats: that is, canal trips are roughly 50/50 hire/private although private boats make up around 90% of the boating stock. Given the range of routes available in the Lichfield Canal's potential catchment area (a range that will become even more complex should the Lichfield Canal's sister project, the Hatherton Canal, be opened) calculating boat movements is not straightforward. We have based estimates on BW 2005/6 lock usage figures collected for the main lock flights in the area, as shown in Table 5.2 below. This table attempts to match lock movements with possible through routes of boats, based on estimated traffic on the various rings and routes and discussions with BW. The darker shading indicates routes where boats are more likely to divert through the Lichfield Canal.

	Audlem	Gailey	Wolver-hampton	Farmers Bridge	Lapworth	Hatton	Taddebigge	York St.	Stourton	Atherstone	Curdworth	Fradley	Wychnor
Warks Ring (1)				700	700	700				700	700		
Warks Ring (2)						1,100				1,100	1,100		
West Midlands		1,200	1,200	1,200							1,000	1,200	
Stourport (1)			700				700	700					
Stourport (2)							500	500	500				
East Midlands										1,000			1,000
Knowle Ring				500	500								
Stour-bridge			200						200				
Four Counties	4,000	4,000											
Out and back[57]	1,100	1,400	1,200	0	2,400	1,000	0	2,000	1,000	3,200	0	8,300	7,000
Total	5,100	6,600	3,300	2,600	5,000	2,800	2,600	3,200	1,700	6,000	2,800	9,500	8,000

Table 5.2 – Lock movements in the area around the Lichfield Canal (2005/06)[58]

The map below shows the locations of the various counter used relative to the canal network.

[57] Other routes not included in ring figures in rows above
[58] Source: British Waterways lock usage figures for 2005/06

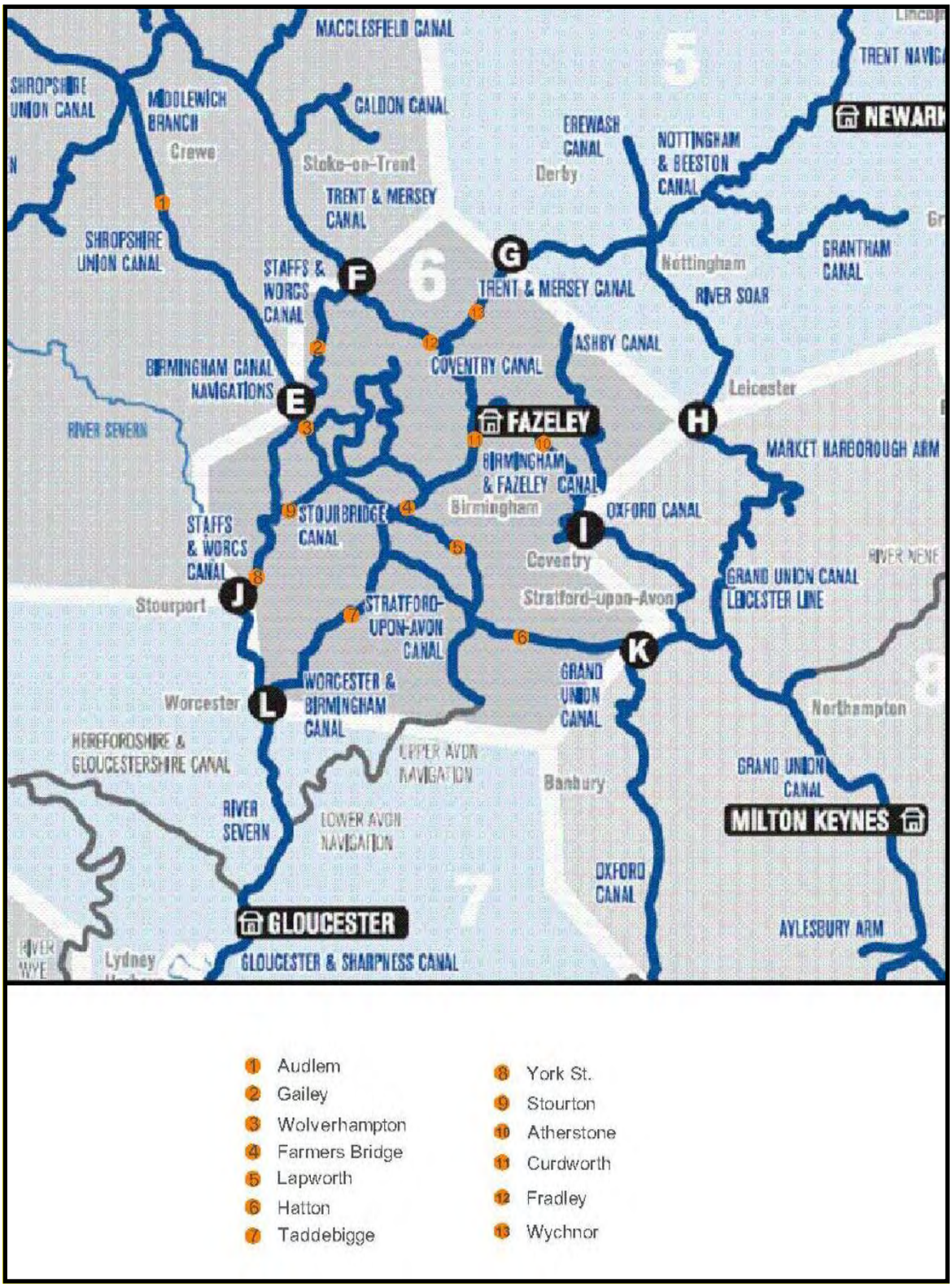


Figure 5.1 – Map Showing Boat Counter Locations

It should be noted that the number of movements is based on the number of times the lock is operated, with an allowance made for lock operations made when no boat is in the lock (for example: to set the lock). Only the recorded total movements figure is a factual record, the movements on individual routes are estimates based on surveys, market experience and discussions with BW.

In addition, the Lichfield canal is slightly unusual in that it provides both a through route and a logical out and back route (logical with a defined destination as opposed to simply turning round at a convenient point). As well as navigating the through route in either direction boaters may well choose to navigate from Huddlesford to Lichfield and turn back, either as part of a through route along the Coventry Canal or as an out and back from their starting point. Boaters are unlikely to reach Lichfield as an out and back from Ogley junction unless they are based on the Wolverhampton Level of the BCN, as descending over twenty locks to turn round and then ascend the same number, whereas the climb through between four and seven locks from the Coventry would be an attractive option.

5.2.1 Cruising Destinations / Points of Origin

There are many factors that contribute to the level of use of a cruising route, but among the most significant are being a through route, rather than out and back, and being part of a multiplicity of routes. Beyond this there are localised hotspots where weekend cruising is popular, for example the Trent and Mersey near Fradley (which also fulfils these two criteria) but it remains true that for enduring high levels of use along the whole route being on a cruising ring is imperative. The only major holiday route that is not part of a cruising ring is the Llangollen Canal, which has its own particular appeal with features such as the Pontcysyllte Aqueduct.

The following locations are within one day (seven hours) of Huddlesford Junction and thus Lichfield is potentially a weekend/long weekend out and back cruise.

- Branston Lock (Trent and Mersey Canal towards Burton)
- Meadow Lane (Four miles past Rugeley on the Trent and Mersey Canal towards Stoke on Trent
- Atherstone Bottom Lock (Coventry Canal towards Coventry)
- Curdworth (Birmingham and Fazeley Canal towards Birmingham)

Within this range are a number of permanent moorings and marinas including the large marinas at Barton Turns and Alvecote, and the Shakespeare Classic line hire base at Barton Turns.

It should be noted that Curdworth and Meadow Lane are also on cruising rings created by the Lichfield Canal.

The following locations are within 3 days travel (21 hours) and would make a good week/ten day return trip to Lichfield:

- Colwick (Downstream of Nottingham on the River Trent)
- Hardings Wood Junction (Trent and Mersey Canal beyond Stoke on Trent) *[59]
- Stockton Brook (Caldon Canal) *
- Stretton Aqueduct (Shropshire Union Canal) **[60]
- Bratch Locks (Staffordshire and Worcestershire Canal) **
- Coventry (Coventry Canal)
- Hillmorton (Oxford Canal)
- Tardebigge Top Lock (Worcester and Birmingham Canal) *
- Snarestone (current terminus of the Ashby Canal)

[59] Locations starred are on or can be accessed via on a moderately attractive circular route (out one way, back another) via the Birmingham Canal Navigations
[60] Locations with two stars are on or can be accessed via a very attractive circular route

- Hockley Heath (Stratford Canal via Birmingham)
- Kinsgwood Junction (Grand Union Canal via Stratford Canal)
- Delph, Near Dudley (BCN) **
- Great Northern Basin (Erewash Canal)
- Pilnings Lock (River Soar, upstream, of Loughborough)

In addition, all of the Wyrley and Essington Canal is accessible within this cruise range, demonstrating that the two closest rings (via Great Haywood Junction and via the Birmingham and Fazeley Canal) can be completed in 21 hours plus the transit time for the Lichfield Canal. Elsewhere we calculate this as being eight hours.

The cruising range for a week's return trip includes several large marinas such as Willington (350 spaces), Beeston, Pilnings and Alvechurch and includes the following major hire boat bases.

- Shakespeare Classic Line
- Anglo-Welsh, Great Haywood
- Canal Cruising Company, Stone
- Black Prince, Stoke on Trent
- Viking Afloat, Gailey
- Napton Narrowboats, Wolverhampton
- Water Travel, Wolverhampton
- Countrywide Cruisers, Brewood
- Norbury Wharf Narrowboat Hire, Norbury Junction
- Anker Valley Cruisers, Atherstone
- Ashby Boat Company, Market Bosworth
- Rose Narrow Boats, Ansty
- Viking Afloat, Rugby
- Willow Wren, Rugby
- Clifton Cruisers, Rugby
- Alvechurch Marine, Alvechurch
- Anglo-Welsh, Tardebigge

5.2.2 Cruising Rings

The Coventry Canal at Huddlesford is part of two established cruising rings, the West Midlands Ring and the East Midlands Ring.

The West Midlands Ring takes in the Coventry Canal (detached portion) to Fradley, the Trent and Mersey Canal to Great Haywood, the Staffordshire and Worcestershire Canal to Wolverhampton and then the BCN back to the Coventry Canal at Whittington near Huddlesford. This cruise is a relatively easy week depending on the energies of the crew. However it has few variants other than using an existing parallel route through the northern BCN for which there is no incentive at present. A restored Lichfield Canal would effectively divide the West Midlands Ring in two.

The East Midland Ring is much longer and takes in parts of Leicestershire via the River Soar and Grand Union Canal. This route typically is a two week cruise and is indivisible. Some choose to

lengthen the cruise further by adding the Ashby Canal from the Coventry as an out and back branch to the route. Some users of this route may be tempted with an out and back to Lichfield from Huddlesford.

Due to the complexity of the BCN there are a very large number of cruising rings available that would incorporate a trip though the Lichfield Canal and this will increase with the opening of the Hatherton Canal as well. However, many of these are only minor variants and the lack of use of the Northern BCN indicates clearly that the simple availability of a variety of routes does not indicate that they will necessarily be used. In practice there are four or five variants of routes to Ogley Junction and two to Huddlesford Junction: these are

Ogley Junction to

- Wolverhampton Locks (Using the Wyrley and Essington);
- Netherton Tunnel (using either Rushall or Walsall locks then Ryders Green);
- Central Birmingham (leading to Worcester or the Stratford Canal);
- Birmingham and Fazeley (Using Rushall and Perry Barr Locks or Rushall, Ryders Green and Farmers Bridge).

Huddlesford Junction to

- Fazeley Junction;
- Fradley Junction.

The shortest circular routes involving the Lichfield Canal involve Fradley Junction and Wolverhampton Locks or Fazeley Junction and the Birmingham and Fazeley Canal. The route via the Birmingham and Fazeley would take 27 hours and would be a leisurely week or a more energetic 4-day break. The route via Fradley and Wolverhampton would take 38 hours and would be a moderate to leisurely week. While it would take longer than the other option, sites such as Shugborough Hall and Park could be visited in addition to the attractions of Lichfield.

Some holidaymakers may choose to undertake a route via Fradley and Netherton Tunnel rather than via Wolverhampton, thus taking in more of the Staffordshire and Worcestershire Canal. This would be a fairly energetic route and it is likely that users of this route may prefer the Birmingham and Fazeley for the return as this would be more direct. Nevertheless some will go through Lichfield and Stourbridge. Indeed some may undertake a route via Lichfield, Wolverhampton, Stourbridge and central Birmingham.

The cruising options for one, four, and seven day routes from Huddlesford Junction are shown on the maps below.

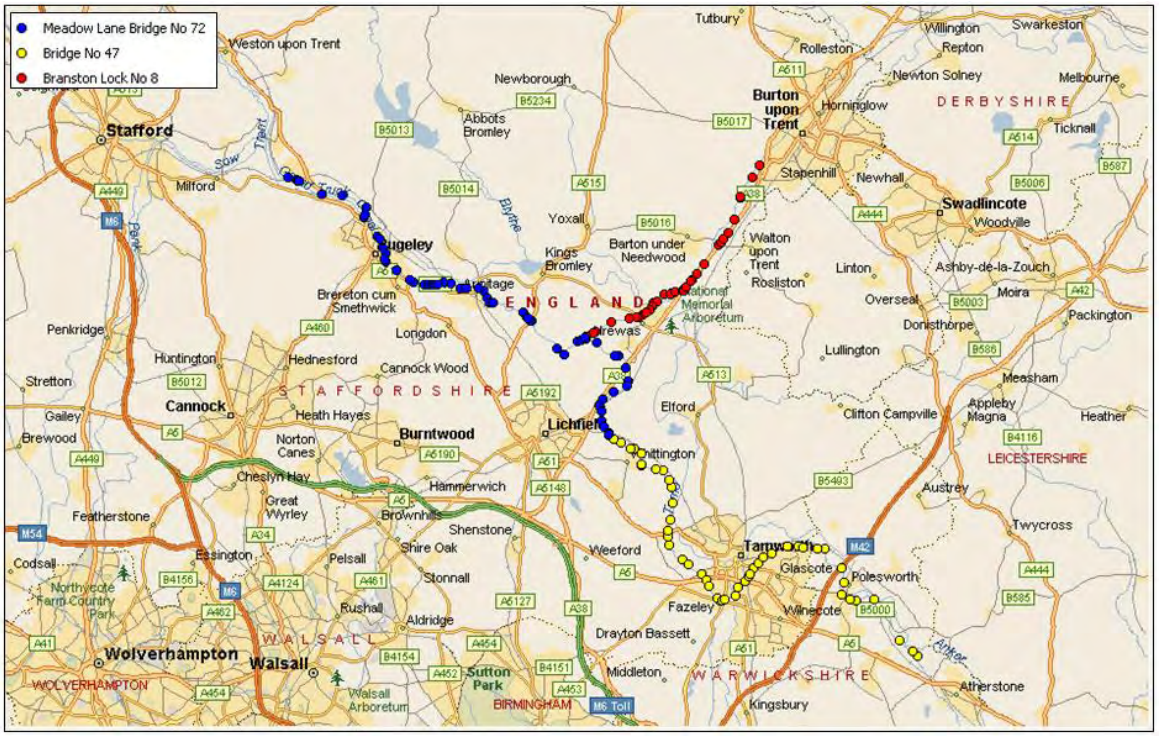


Figure 5.2 – One Day Cruising Options

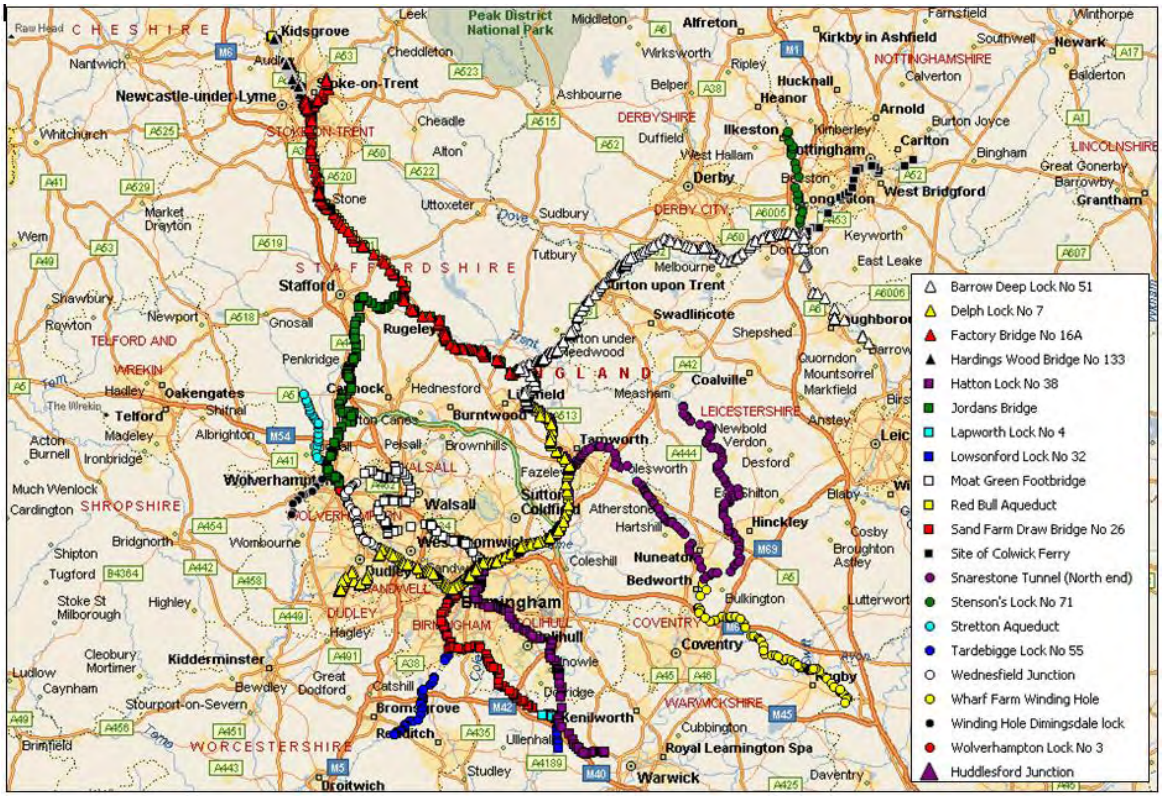


Figure 5.3 – Four Day Cruising Options

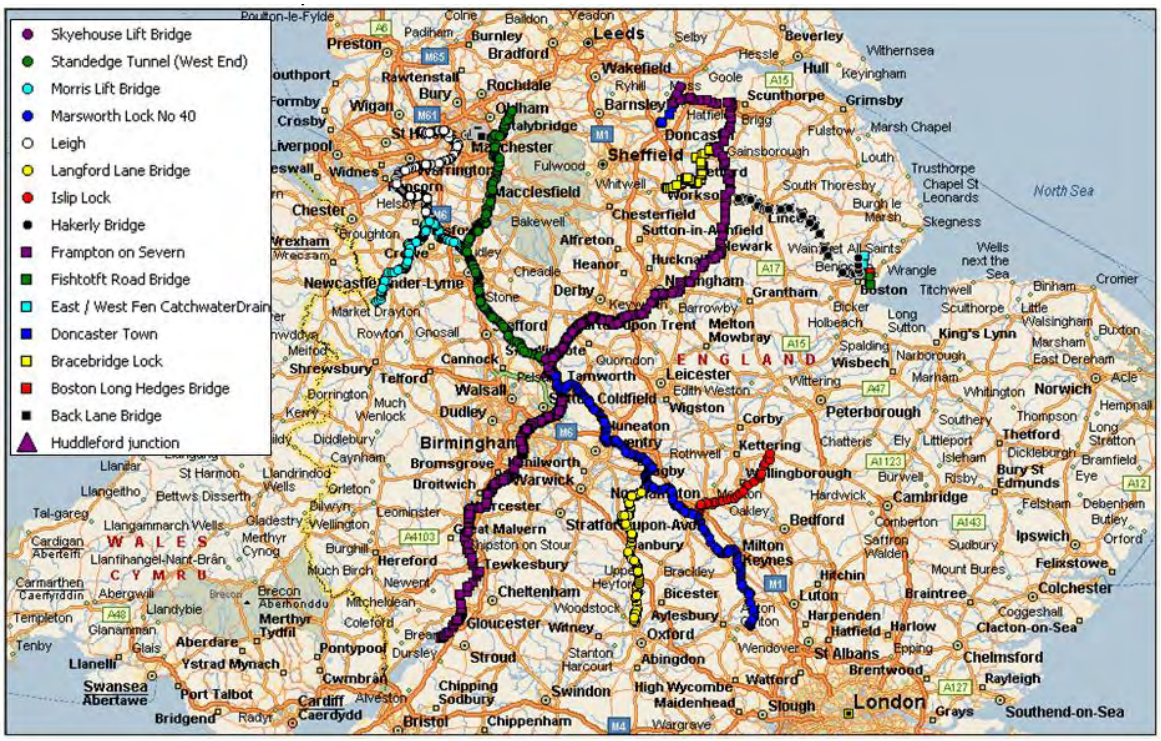


Figure 5.4 – Seven Day Cruising Options

5.2.3 Forecasting boat numbers

The figures for boat traffic in Table 5.2 give a strong guide as to the figures likely to be achieved for through passages of the whole Lichfield Canal. It is unlikely that use of the Lichfield Canal will exceed use of the other lock flights leading onto the Birmingham and Wolverhampton Levels, but it is also unlikely that use of the Lichfield Canal would be significantly lower than use of the other flights either. The Lapworth figures are significantly higher than any other flight recorded leading to and from the BCN, mainly because this flight, despite having nineteen locks, is comparatively gentle and attractive for out and back trips, and is some distance from the BCN, thus many of the boat trips are not related to BCN movements.

In our opinion the following rings which will be created by re-opening the Lichfield Canal will have the potential to attract traffic to undertake through passages of the restored canal.

- West Midlands North (Huddlesford, Fradley, Great Haywood, Wolverhampton);
- West Midlands South 1 (Huddlesford, Fazeley, Perry Barr, Rushall);
- West Midlands South 2 (Huddlesford, Fazeley, Farmers Bridge, Ryders Green, Walsall);
- South BCN (Huddlesford, Fazeley, Farmers Bridge, Stourbridge, Bratch, Wolverhampton);
- Warwick and Lichfield (Huddlesford, Rugby, Northern GU to Birmingham, BCN to Ogley);
- Knowle/Lichfield (Huddlesford, Fazeley, Garrison-Camphill, Kingswood, Lapworth, Kings Norton, Ryders Green, Walsall);
- Stourport and Lichfield 1(Huddlesford, Fazeley, Tardebigge, Severn, Stourport. Stourbridge, Ryders Green, Walsall);
- Stourport and Lichfield 2 (Huddlesford, Fazeley, Tardebigge, Severn, Stourport. Wolverhampton);
- Four Counties and Lichfield (Huddlesford, Fradley, Middlewich, Shropshire Union, Wolverhampton).

Many of the above are variants on rings that are already popular, and the presence of Lichfield on the variant should provide an additional attraction over and above the existing routes. The main constraint is that most of them will take longer than existing holiday routes. The cruise times are given below

Route	Miles	Locks	Approx time
WM North	64	68	38 hours/6 days
WM South 1	41	66	27 hours/4 days
WM South 2	52	84	33 hours/5 days
South BCN	81	136	53 hours/7 days
Warwick and Lichfield	117	132	62 hours/9 days
Knowle/Lichfield	84	97	48 hours/7 days
Stourport/Lichfield 1	122	189	76 hours/11 days
Stourport/Lichfield 2	123	183	76 hours/11 days
Four Counties and Lichfield	133	138	76 hours/11 days

Table 5.3 – Cruising rings created by restoring the Lichfield Canal

This gives nine routes that would make a one way passage through the Lichfield Canal as part of a circular cruise, with the routes varying from four to eleven days cruising at 7 hours per day. As holidays tend to be three, four, seven, eleven or fourteen days long there is plenty of scope for holidaymakers to enjoy a cruise through Lichfield. In addition, as the routes are generally not demanding for seven or fourteen day holidays there is the potential for many holiday makers to linger in Lichfield for half a day or more. This is important in terms of visitor spend as the longer visitors stay the more they will spend in Lichfield. If boaters can be persuaded to arrive by lunchtime and stay until the following morning then two benefits arise: they have more time in Lichfield to spend money, and are near Lichfield the preceding night thus having another opportunity to spend.

In addition, to the west of Ogley Junction as boats either approach or leave the Lichfield Canal, there are several miles of currently underused waterway. Boaters will require at least one more stop before leaving the BCN even if they stop at Ogley Top Lock. Within a typical day's cruising range are the top lock at Wolverhampton, Ryders Green Locks and Perry Barr Locks. Walsall Top Lock is around four hours cruise, and Walsall town wharf is around 5 hours. Thus there is further potential for visitor expenditure on the northern reaches of the BCN.

One thing that does run slightly counter to this is the lack of available opportunities for expenditure. Walsall town centre is the principal location (which is walking distance from Walsall top lock for those travelling to and from Wolverhampton). There are other locations where pubs at the canalside or close to the canal may take advantage of trade including:

- Brownhills – the Chase Inn, Royal Oak and Shoulder of Mutton;
- Pelsall – the Finger Post;
- Walsall – the Beacon Way, Horse and Jockey and White Horse;
- Walsall Wood – the Boatman's Rest and the Drunken Duck;
- Daw End – the Boat House and the Royal Oak.

Nevertheless there are clear economic benefits to be had on these underused waterways as well as in Lichfield.

Clearly there will also be visitor spend while on the Coventry Canal but the brief has not asked for this to be quantified. In our view this is a valid approach even though overnight stops on the Coventry Canal may well be in Staffordshire County and Lichfield Borough areas as this canal is very busy and increased spend here does not represent increased market penetration or the opportunity for new and enhanced businesses.

At this stage we are estimating that there will be of the region of 1,500 through movements in a year on the Lichfield Canal, which would place it towards the bottom end of the surveyed lock counts in Table 5.2. This is a deliberately conservative estimate in the absence of data from BW for movements on the Trent and Mersey Canal, Coventry Canal and Curdworth Locks.

Even with this data it will not be possible to be absolutely sure of the existing traffic flows on the Coventry Canal at Huddlesford or the northern reaches of the BCN, as these are long levels of canal and thus there are no lock counters to provide the information. Our best guess at present is that the Coventry Canal carries in the region of 6,000 to 7,000 boats per annum while the northern reaches of the BCN probably see as few as 300 to 400 boat movements. The latter is based on the experience of most boaters that we have spoken to who claim to see typically one other boat a day while cruising the Wyrley and Essington Canal even in summer.

It is fairly safe to assume that some of the 1,500 through trips would be diversions of the ones already on the Coventry Canal, but very few would be diversions of trips already on the northern BCN. We have assumed that 50% of the trips are new to the Coventry Canal and that only 100 of the trips are already on the Northern BCN.

Overall each through passage will result, on average, one night in Lichfield, one night near Lichfield, and a further night on the Northern BCN.

5.2.4 Out and Back Trips

We have assumed that out and back trips on the canal will be from the Huddlesford end. This is for the following reasons

- There is very little traffic at the Ogley end at present, and thus there is only a very low base market to be attracted to make return trips;
- The Coventry Canal is very busy indeed, with many boats on routes that can not readily be altered to take in the whole canal and a circuit of the BCN, such as the East Midlands Ring;
- Any approach from a greater distance to the Ogley Junction end would require either a large number of locks or a very circuitous route via the Wolverhampton level (or both);
- A boat arriving in Lichfield from Ogley will have travelled five miles and around twenty five locks of a seven-mile, thirty-lock canal, the incentive to carry on and return to base via another route is much stronger than when ascending the canal from Huddlesford.

We have no accurate information at present regarding the levels of use of the Coventry Canal at Huddlesford, but have made a rough estimate that there may be 6-7,000 boat movements a year on this. Elsewhere, BW's own estimates are that perhaps one quarter of passing boats will make a short attractive diversion (BW unpublished papers for the Daventry Canal proposals) in which case we would be looking at 1,500 boat movements each way from Huddlesford to Lichfield.

This may well be a good figure for a dead end, but we would suggest it is too high for a canal that is also a through route. Some of the boat movements on the Coventry are already being diverted to provide the through trips, and the number of these forecast (1,500) means that some of the capacity of the canal is already taken with through movements. If 1,500 boats per year attempt a return trip on top of 1,500 making a through trip then the entrance lock to the canal will see 4,500

boat movements a year. At this level the lock will become congested and this would choke back demand for out and back trips.

Combining these considerations we have estimated that 750 return trips (representing 1500 boat movements) will be made to Lichfield from Huddlesford.

5.2.5 Boat Moorings

The above section considers boat usage: however boats also need to be moored and BW have been encouraging a fairly rapid increase in marina berths, partly driven by shortages in mooring capacity in key parts of the system including the West Midlands. There is also increasingly a preparedness on the part of boaters in areas of the country less well served by the canal system or with mooring capacity restraints (e.g. parts of south east England) to travel further to their boat, and this has fuelled in part the rapid expansion of capacity close to the M1 and M40. The location of the Lichfield Canal close to the M6, M6 (Toll) and M42 motorways, Birmingham Airport, and the recently upgraded West Coast Main Line suggests that boaters from a wider catchment than just the surrounding area could be attracted to the right facilities.

Sites where large mooring basins can physically be built are limited and thus the nearest ones to Huddlesford Junction are not on the Coventry Canal but on the Birmingham and Fazeley Canal and the Trent and Mersey. The extended Marina at Barton Turns and the New Marina at Willington currently have capacity but others in the area generally don't. While the economic downturn has had some effect on marina developments the number of boats still needing moorings is significant and in any event, full reopening of the canal is sufficiently far off that the current recession is likely to be over even if it is long and deep as some fear.

The canal is expected to represent an opportunity for a 250 berth Marina either on it or on the Wyrley and Essington near the Ogley, which would become a much more attractive location for a marina with the opening of the Lichfield Route.

5.3 Other Recreational Use

The Kennet and Avon canal is 86 miles long and visited by an estimated 9.4 million walking or cycling visitors per year, plus day boat, trip boat, canoeing and angling activities of 405,000 visitors. Therefore, the land-based leisure use dominates and is approximately 106,378 visits per mile. In view of the influence of this figure on the overall benefits, great caution is required in assuming a number this high, as the Kennet and Avon Canal is surrounded by other tourist attractions, including the world heritage site of Bath City, and is internationally known. We have suggested on many occasions that a figure between 10 and 20% of this would be more appropriate for most canals. Due to the presence of Lichfield on the route, and the ability of the canal and Lichfield to mutually complement each other, we suggest heading for the upper end of that range with a visitor figure of approximately 18,000 per mile.

While the spend per head for cyclists within the BW model is higher than that for walkers, given the broad nature of the figures used, we have used a figure for daily expenditure of £4.86 per person for all visitors. Using these assumptions, 126,000 visitors could be expected to spend £613,824 in the local area per year.

There are also potential benefits in terms of health in encouraging visits by pedestrians and cyclists (and therefore presumably encouraging visitors to take more exercise). These have not been quantified.

We have not attempted in this report to attribute expenditure to different users of the towpath. The descriptions below, however, give more detail of principal user groups, possible non-financial benefits and an overview of how benefits might be enhanced.

5.3.1 "Gongoozlers"

Sightseeing and watching water-based activities is a major attraction to canal visitors. A survey of the Kennet and Avon Canal (Ref 6) indicated that 30% of leisure towpath users fell into this category. Levels of interest can be enhanced through the provision of interpretive facilities that inform visitors about the built and wildlife heritage of the canal. Special interest groups, such as canal historians, archaeologists and education groups can also benefit from such provision.

Economic benefits can be maximised by focusing commercial activities such as cafes, souvenirs, trip boats, cycle hire and pubs around 'honey pot' sites along the canal where good access from local populations exists.

5.3.2 Walkers

Walking is Britain's most popular outdoor recreation and the popularity of recreational walking is rising. Unlike most other physical activities, walking is popular with all age groups and both sexes. Information from the Ramblers Association notes that 77% of UK adults, or about 38 million people, say they walk for pleasure at least once a month. 62% of these walk more than 2 miles/3.2km and say that walking is their main form of exercise (ICM 2000). The most recent official national survey (National Statistics 1997) found 44.5% of adults went for a walk of over two miles for leisure at least once every four weeks. 891 million day trips for leisure in Great Britain in 1998 included a 'walk', up from 41% in 1993 and 38% in 1987 (National Statistics 1997). Ramblers' Association membership has risen from around 38,000 in 1980 to 111,500 in 1995 and over 140,000 today. Out of walking trips for all purposes in 2001, 16% were 'just to walk', including walking dogs. This figure has risen from 12% in 1986 (DfT 2003).

BW information indicates that around 40% of visitors walk to their canal visit. With the city of Lichfield actually on the route, and the canal to pass through the proposed new residential areas, there is huge potential to tap into this user group and provide a much valued local amenity. As part of any developments, there is an opportunity to highlight and interpret the canal line through creative landscape design and information provision, while allowing for the future incremental return of the line to water.

The Heart of England Way is a long distance recreational walk route linking Milford in Staffordshire and Bourton on the Water in the Cotswolds. The Way forms part of the European Walking Route E2. A section of the Way runs along Tamworth Road in Lichfield, and this section could be diverted onto the towpath, attracting more users to the canal and giving a safer and more peaceful route for walkers on the Way.

The Darwin Walk is a 10 mile long circuit of Lichfield, created to commemorate the association between Erasmus Darwin (grandfather of Charles Darwin and founder member of the progressive Birmingham Lunar Society in the mid 1700s) and Lichfield. Part of the walk runs parallel to the proposed canal restoration and the route could be diverted to make use of the towpath with similar benefits as for the Heart of England Way.

5.3.3 Cyclists

Almost one in ten of those questioned for the British Waterways survey above had cycled to the towpath. This can be compared with approximately 5% of visitors to the Kennet and Avon who are cycle-based. The Kennet & Avon report notes that the most recent National Cycle Network Route User Monitoring Report indicates a steady increase in usage of the national cycle network (by both cyclists and walkers) between 2000 and 2004; much of the increased use is associated with the expansion of the National Cycle network. There are several instances of cooperation between SUSTRANS and BW to fund and support the creation/upgrading of cycle networks along towpaths, for example the Bletchley-Leighton Buzzard route on the Grand Union opened in 2005. BW is also working with TfL in London to enhance and manage the use of the towpath network as part of off-road urban provision for cyclists.

The National Cycling Strategy, launched in July 1996, highlights the potential role of cycling in addressing issues of social inclusion, citing it as a possible means of widening the opportunities available to all sections of society. Regular cycling not only significantly improves fitness; it reduces obesity; decreases the risk of strokes, coronary heart disease and certain types of cancer and osteoporosis.

Lichfield is a key junction of routes on the National Cycle Network, and a centre for local cycling, with a thriving section of the Cycle Touring Club organising regular rides for families and children as well as more serious events. The family orientated events are held at Chasewater and on canal towpaths a few miles distant and the restored canal would offer a traffic free link to these venues, offering improved access to training and a more convenient venue for Lichfield's leisure cyclists.

5.3.4 Overnight visitors

The British Waterways Demand model assumes that 20% of visits to the canal are made by people staying overnight in the local area (i.e. 80% are day trippers). This is supported by the results of the Kennet and Avon Towpath Survey 2005 which indicated that 20.2% of respondents were in the area on a short-break or holiday (either staying with friends and relatives or in paid accommodation).

The regional tourism profile for the West Midlands identifies that there is a predominance of business visitors to the urban area. However, while Lichfield is technically in the West Midlands it is not typical of the area, offering a rather different experience to, say, Birmingham or Wolverhampton City Centres, and there are other tourist attractions near by such as Drayton Manor and Shugborough Hall (both beside canals). Given the local recreational appeal of the attractions along the canal route and the range of alternative attractions within and around the conurbation, we would estimate that the proportion of overnight visitors among land-based users of the canal would be lower than the Kennet and Avon at present but if Lichfield realise their ambitions to capture more of the overnight tourism market then 20% would be achievable.

We have assumed the following overnight stays for the canal:

Route	Nights per boat	Boats	No of nights	Hire / Private
Through-Lichfield	2	2,000	4,000	2,000 / 2,000
Through-BCN	1	2,000	2,000	1,000 / 1,000
Out and back	2	1,250	1,250	625 / 625
		Total	*7,250*	*3,625 / 3,625*

Table 5.4 – Estimated Number of Overnight Stays

From the figures in Table 5.1 this would give the following spend:

Route	No. of nights	Spend / person	Spend / boat	Total Spend	Hire Spend	Visiting Private Spend
Through-Lichfield (Private)	2,000	£10.06	£41.25	£82.5k		£82.5k
Through-Lichfield (Hire)	2,000	£14.19	£58.18	£116.4k	£116.4k	
Through BCN (Private)	1,000	£10.06	£41.25	£41.2k		£41.2k
Through BCN (Hire)	1,000	£14.19	£58.18	£58.2k	£58.2k	
Out and Back (Private)	625	£10.06	£41.25	£25.8k		£25.8k
Out and Back (Hire)	625	£14.19	£58.18	£36.4k	£36.4k	
			Totals	*£360.4k*	*£210.9k*	*£149.5k*

Table 5.5 – Estimated Overnight Visitor Spend

5.3.5 Daily Expenditure associated with Private Boats

There are also economic benefits which arise from casual visits to boats based on the Lichfield Canal or based on BCN near the Lichfield canal due to the presence of the restored Lichfield Canal. This is calculated by relating the spend per head given in Table 5.1 to the projected numbers of movements made by boats based on and close to the canal (250 boats making 2,500 total movements per annum):

	Movements	Nights in area	Spend per head	Spend / boat / day	Spend
To/from BCN	1500	2	£10.06	£41.25	£123.7k
To/from Lichfield	500	1	£10.06	£41.25	£20.6k
To/from Coventry Canal	500	1	£10.06	£41.25	£20.6k
				Total	*£165.0k*

Table 5.6 – Private Boat Daily Spend (In Use)

5.4 Summary of Economic Benefits

Table 5.7 shows a summary of the likely annual economic benefits of the restored Lichfield Canal which can be quantified at this stage. The assumptions made are set out at the start of this section of the report. Spend per day per hire boat/land-based visitor etc is as used by British Waterways in their report on Kennet and Avon Canal. The boat figures were based on an spreadsheet model using lockage figures provided by BW as raw data, which calculated which boats in the area were on which routes. Pedestrian figures were based on standard pedestrians-per-mile figures used in previous reports, adjusted using professional judgement to reflect local conditions (i.e. bearing in mind the attractions along the route and its role within Lichfield).

Source	Economic Benefit (£ pa)
Hire boat daily spend	£210,899
Private boat maintenance	£232,000
Private boat moorings	£375,000
Private boat daily spend (in use)	£164,984
Private boat daily spend (visiting)	£149,517
Trip boat income	£39,800
Trip boat spend	£36,500
Informal land-based visitors spend	£613,824
TOTAL	£1,822,525

Table 5.7 – Likely Annual Economic Benefits[61]

5.5 Cost Benefit Analysis

Using the costs derived in the engineering section, and the benefits derived in this section, a rudimentary cost benefit analysis has been undertaken to determine the value of the scheme. This is not intended to provide a justification or otherwise for the scheme, but to give an indication whether, in pure financial terms, the scheme is value for money. At this stage we have assumed that the whole of the cost is to be justified in terms of economic benefits and revenue streams into the local economy.

Cost Benefit analysis at its most basic level is intended to evaluate the value of an ongoing return into the economy (a revenue stream) against a one-off cost for achieving that return. The technique can be used in business planning but is more often used, as in this case, where the revenue stream will not go directly to the bodies financing the one-off cost. The technique is used for several public sector funded projects such as road schemes and flood alleviation.

To undertake a cost benefit analysis it is necessary to arrive at a net present value which differentiates between the value of costs and benefits in the future against the value of those same items at current prices: this reflects a perceived lowering of value for costs and revenues in the future compared to current values. At its simplest level, £1,000 in ten years time is worth less than £1,000 now, because £1,000 now could be invested to generate a higher value in future. The normal rate for use in public sector cost benefit analysis is 3.5%. Despite the current very low interest rates this is not altered as the cost benefit analysis covers a long period (in this case 30, 50 and 100 years) which irons out such fluctuations.

Certain assumptions have been made in deriving this cost benefit model for this study: they are as follows.

- Even spend over a ten year period to complete the project
- 30% of construction cost is spent in the local economy and thus is also an economic benefit
- Construction commences in year one
- There are no user benefits until year three when the canal opens to Lichfield

[61] These benefits are for both the Lichfield Canal and the Northern BCN. The Northern BCN element is entirely due to extra boat movements and amounts to £223,163. In addition further land based visitor spend may occur due the much greater level of activity on the canal. This has not, as yet been quantified.

- From year three user benefits increase from 10% of the annual benefit in table 5.4, in ten percent increments, with a ceiling of 50% until the canal opens in full.
- When the canal opens in full in year 11, benefits rise to 100% of those in table 5.4

Treasury Guidelines currently assume a 100 year project life, and any cost benefit analysis for a lesser period should give a residual value of the asset. In practice this is very difficult to calculate for an item such as a canal. There are two basic ways of doing this in the absence of a method of formulating an asset value, which a canal does not have as it can not be sold as a going concern. These methods are:

- Pro-rata the capital cost, such that after fifty years the residual value is half the cost of building the scheme: this should then be discounted for the future year
- Take the discounted value of benefits between the cut-off year and year 100 and state these as a residual vale. In effect this extends the analysis to year 100

Both techniques are intended to take account of the fact that the project will still have a “life” and still be generating benefits after the cut-off year.

For the purposes of this study we have taken the pro-rata cost and discounted to the future year.

The results of the Cost benefit Analysis are presented below:

Time Period	NPV	Residual Value	Adjusted NPV
30 years	£-5,216,611	£11,708,142	£6,491,531
50 years	£3,896,319	£7,787,796	£11,684,105
100 years	£11,188,889	£0	£11,188,889

Table 5.8 – Results of Cost-Benefit Analysis

The similar adjusted NPV after 50 and 100 years suggest that the residual valuation technique used is appropriate (the alternative approach guarantees the adjusted NPV will be the same, as it is simply a value of a future benefits yield). The first 30 years suffers due to high start up costs and low benefits for the first ten years of the time period.

For the unadjusted NPV, benefits break even against costs in year 40. Thus, if no residual value is assumed, the scheme will have generated benefits equal to the costs of construction forty years from commencement, or thirty years from opening as a through route.

6. Funding

6.1 Introduction

The total capital cost of the restoration is predicted to be £47.6 million. This has been broken down into five phases proceeding from east to west, climbing from the Coventry Canal up to the Wolverhampton Level

There are many funders who focus in particular 'themes.' Where large capital sums are not forthcoming, it is useful, in terms of identifying funding, to also examine the different elements of the restoration which could be funded by different organisations. These include:

- physical engineering works to channel/locks;
- highways alteration/improvement;
- historic structure repair;
- works to reduce flood risk;
- environmental enhancements or mitigation;
- community involvement;
- sports/health development;
- interpretation and education;
- visitor facility construction.

Funding will need to be assembled from a range of sources to ensure that the work can proceed. In view of the long timescale of the project there is little point in examining in great detail every single funding source. An excellent overview is given in the IWA's Funding for Waterway Restoration chapter of their Practical Restoration Handbook. Typical sources of funds for canal restoration projects include:

- Lottery Funds;
- The Waterways Trust;
- National Waterways Restoration and Development Fund;
- English Heritage;
- Local Authority Resources;
- Regional Development Agencies;
- Land Fill Tax Credit ;
- Private Sector;
- European Structural Funds;
- Sustrans;
- Sport England.

Of these, European structural funds are now extremely limited for English projects, as funds are being diverted to new European countries. As there appears to be little opportunity for securing any European funding, Lottery and RDA funding targeted at regeneration and community enhancement therefore tend to be the principal larger sources of capital funding. The Lichfield

Canal finds itself at a slight disadvantage in that the canal corridor is considered to be less or equally 'deprived' compared to the rest of the West Midlands and does not pass through any areas eligible for special assistance. In addition, the 'new build' aspects of the project (while generally following the original route) may limit the scheme's eligibility for Heritage Lottery funds.

Notwithstanding the above, the present funding regimes, through which schemes such as the Huddersfield Narrow Canal, Forth and Clyde Canals and Droitwich Canal restorations have been delivered, are drawing to a close. It is likely that the funding picture will be substantially different in two or three years (by the time the necessary pre-works have been undertaken to enable a start to be made in earnest with the restoration) and so a detailed funding proposal has not been prepared at this stage.

The remainder of this section outlines many of the current funding sources of funding available for canal restoration schemes.

6.2 Potential Sources of Funding

6.2.1 Government Sources

Local Authority Resources

It is recognised that the Local Authorities involved do not currently have the resources available or the will to fully fund a project of this scale. However, they may be able to part-fund certain aspects of the project and are likely to serve as the channel through which many alternative sources of funding may be secured. Local Authorities will be particularly useful where the restoration conforms with planning policy and other strategies; it is important therefore to make efforts to ensure policies favourable to the restoration or which the restoration could enhance are incorporated into emerging Local Development Frameworks (LDFs).

No funding initiatives local to the canal route, which could be linked with the restoration, have been identified during the course of this study. However new initiatives arise all the time; active monitoring of upcoming regeneration initiatives and ongoing communication with the local authority stakeholders identified can help the Trust 'piggyback' or even lead local-authority funded projects

Regional Development Agency (AWM)

Advantage West Midlands (AWM) is responsible for economic development (and tourism) within the region. There is little possibility of direct project funding from this source; however, the regional and sub-regional tourism boards can serve as excellent sources of funding information and can advise on how best to link project elements to regional or local tourism goals in order to create attractive 'fundable' packages.

6.2.2 Waterways-Related Sources

National Waterways Restoration and Development Fund

The Inland Waterways Association (IWA) supports the restoration of derelict waterways in a number of ways from lobbying to providing volunteer labour and financial aid. The IWA provides grants to assist with projects such as hands-on restoration schemes and helping to finance feasibility studies.

Grant awards tend to be up to £15,000 and are available to organisations that promote the restoration of inland waterways. Applications over £2,000 should demonstrate that the grant would apply to one of the following types of project:

- Construction – especially work relating to restoration of Navigation;
- Administration – for example, part funding a project officer;
- Professional services – such as funding or part funding a feasibility study;

- Land Purchase;
- Research on matters affecting waterway construction – including original research and literature reviews;
- Education – for example, providing promotional information to local authorities or agencies;
- Plant and equipment – the Trust has already received funding for a JCB excavator and a cement mixer.

An application over £2,000 should also demonstrate the extent to which it satisfies at least one of a number of conditions specified by the IWA. These conditions are:

- The grant would unlock a grant several times larger from another body;
- The grant would not replace grants available from other sources;
- The project does not qualify for grants from major funding agencies;
- The grant would enable a key project to be undertaken which would have a significant effect on the prospect of advancing the restoration and gaining funds from other sources for further restoration works;
- The result of the project would have a major influence over the progress of a number of other restoration projects; and
- The Restoration Committee would have a major influence on the management of the project, including the monitoring of expenditure.

The Waterways Trust Small Grants Scheme

Grants awarded are unlikely to exceed £5,000 and should represent a minimum of 20% of the total cost of the project. Grants may be considered for a phase of a larger project.

Eligibility for funding is based on a project fulfilling the following criteria:

- Waterway related;
- Provides lasting environmental enhancement;
- Encourages involvement in the waterways; and
- Involves and benefits the community.
- The Waterways Trust is especially keen to assist projects where the award is being used to attract further funding, i.e. from local sponsors or where the scheme involves volunteer effort or gifts in kind. Applications are considered only twice per year, (winter and summer) but can be received any time. One project supported by The Waterways Trusts Small Grant Scheme was the restoration of Bryndyrwyn Lock on the Montgomery Canal where a grant of £2,500 was made to the Shropshire Union Canal Society.

British Waterways (BW)

Navigation authorities, particularly BW, can be sources of match funding, expertise and have great influence with planning and other statutory bodies. These bodies can often access third party funds even if they have no core funding themselves to offer: BW are currently managing a number of restoration projects which are funded by others but BW's expertise has been fundamental in obtaining the funding; a local example is the Droitwich. These resources are only available, however, if the navigation authority would anticipate adopting the waterway following restoration. It must also be added that BW's withdrawal from the Cotswold Canals casts severe doubt over the integrity of any future involvement with such restoration schemes

The Lichfield Canal is not listed as a priority in BW's 'Waterways 2025' listing of restoration priorities. However, BW supports, in principle, restoration efforts. If the restoration proposals are

well worked through and seen to be viable, BW is likely to be more interested, although BW is not permitted to add any waterway to its portfolio that is not predicted to be self-sustaining in the future. If planning and remediation issues could be resolved, there is potential for marina development which is seen as a growth area for BW. In this respect the canal fulfils one of BW's key criteria in the 2025 strategy, in releasing pressure on the waterways network.

Factors likely to influence BW to look favourably on the restoration scheme are:

- An agreed technically feasible and fully costed solution to restoration that has the ability to be incorporated in Local Development Frameworks and which can ensure no additional long-term financial liability to BW;
- The opportunity for marina and other development to provide revenue streams to BW from which they can fund the maintenance and operation of the canal;
- Packaging of the restoration as "desirable" and "well supported" locally ;
- Presentation of a strategic argument for restoration and emphasis on the improved likelihood of restoration with BW involvement.

In the short term, however, it is unlikely that BW will become involved in restorations to which they are not already committed.

Community Arts Funding

Community Arts are funded through a plethora of different sources and may well be funded as a subsidiary to some other initiative. Grants may be available for public works of art such as sculptures, designed perhaps to reflect the heritage of the canal. The community could be involved in the design of interpretation boards, way markers, and seating, for example, so as to give them an element of ownership of the restoration scheme.

6.2.3 Heritage Preservation Sources

Heritage Lottery Fund

The Heritage Lottery Fund (HLF) uses money from the National Lottery to give grants to support a wide range of projects involving the local, regional and national heritage of the United Kingdom. The aim is to help groups and organisations of all sizes with projects that aim to:

- Care for and protect heritage;
- Increase understanding and enjoyment of our heritage;
- Give people a better opportunity to experience heritage by improving access; and
- Improve people's quality of life by benefiting the community and wider public.

These aims are grouped into four strategic priorities that guide Heritage Lottery Fund Policy and underpin its decision on funding. These priorities are: Heritage Conservation, National Heritage, Local Heritage and Heritage Education and Access. It is recognised that 'heritage' covers a range of things, places and people, from photographic collections to sites linked to industrial, transport and maritime history. Currently the Heritage Lottery Grants are divided by scale and theme, with the largest grants (over £5 million) being administered nationally. Given the excess demand for grants and the amount of new build in the canal project, it is more likely the Heritage Lottery fund would fund small-scale works at an earlier stage of the restoration than part fund the restoration of the entire canal.

English Heritage

English Heritage has indicated that it is only able to consider grant aid for canals in England if the canal itself lies within a designated conservation area. Grant aid may also be available for individual canal structures located outside of conservation areas if they are listed at Grade I or II*.

6.2.4 Lottery Fund & Associated Social/Environmental Funders

Lottery funding can cover many areas including Heritage, as above; however a principal focus is to address social issues in various guises. The lottery is often combined with other sources (e.g. Sport England or the Arts Council) to create specific funds; these change constantly. The key potential source at present is described below.

Big Lottery Fund (formerly the New Opportunities Fund)

The Big Lottery provides lottery funding for educational, health and environmental projects which help create lasting improvements to quality of life, particularly in disadvantaged communities. Quality of life projects that may be supported include those that improve elements of local value and projects that complement the work of the Heritage Lottery Fund. There is an increasing emphasis on health, sport, education and social inclusion, with some focus on environmental improvements. New schemes or 'funds' are constantly being introduced; certain funds may have limited timescales or budgets, so constant monitoring is critical, to ensure that the LHCT identifies likely sources.

6.2.5 Private Sector

Opportunities for private sector funding include business sponsorship and Section 106 contributions on private sector developments. It must be stated that in the short term this is unlikely to yield significant returns, but it is expected that the economy will not remain in the doldrums for a prolonged period, and the scope for canal restoration, with a longer term horizon, is undiminished.

Developer Contributions

Developer contributions are likely to be a significant funding source for the restoration and this is an area requiring much negotiation in the long term. The value of development to the canal will depend upon the will of Local Authorities to implement S106 contributions and the links that can be built with developers to demonstrate the value of the canal to development; planning support from local authorities is crucial to the success of private sector funding endeavours. Whilst it is recognised that some parts of the canal and associated development opportunities would class as development within green belt, the canal is seen as a strategic development which would be included in future local plans. The planning authorities would have to take a view as to facilitating limited supporting development in order to fund or part fund the wider objective of canal restoration.

There has recently been a frenzied discussion over the nature of both private and public sector funding with the proposals (enshrined in the 2008 planning act, but yet to be enforced) for a Community Infrastructure Levy. There is some doubt as to whether or not a future government will apply this legislation, but if they do, an opportunity presents itself to seek funding for the canal.

6.2.6 Benefits In Kind

The Trust benefits from the efforts and expertise of its volunteers and from the donations made by local firms. These benefits in kind can be used as match funding for other sources. Bodies such as HLF set out specific rates at which manual and professional services can be costed towards matching funding requirements.

Other possible sources of free (or cheap) labour are open prisons, the probation services, Duke of Edinburgh Awards scheme, British Trust for Conservation Volunteers (BTCV), the Waterway Recovery Group (WRG) and the range of constantly-changing government schemes for enabling those out of work to help in the community.

7. Conclusions and Recommendations

7.1 Conclusions of the study

The restoration of the Lichfield Canal is proven to be practicable, and could be achieved over a period of five to ten years at a total cost of £47.7 million. This is inclusive of a 20% optimism bias (£7.95 million), a 5% risk allowance on construction costs and fees (£1.89 million), construction costs and fees and disbursements. These figures exclude land acquisition costs.

The restoration will bring benefits to the surrounding area (including the area in the vicinity of the existing Wyrley and Essington Canal, where boat traffic and visitor numbers would increase by a factor of five to ten times following opening of the Lichfield Canal throughout) estimated to be worth around £1.8 million per year (this excludes many intangible / unquantifiable benefits such as quality of life and health improvements resulting from increased outdoor recreation opportunities).

Adopting an unadjusted Net Present Value analysis, costs break even against benefits in year 40, so the scheme will have generated benefits equal to the costs of construction forty years after commencement, or thirty years after projected opening of the canal as a through route.

Proposals for a phased approach have been developed which would see the canal restored in five stages. Each of the interim stages would have a temporary terminus with full length boat turning area and their own water supply, subject to consents. Two “early wins” are proposed which could be implemented for reasonable cost prior to commencement of the main restoration: the re-watering of a section of the canal at Borrowcop Locks Canal Park, and the creation of a “Lichfield Canal Walk”.

The estimate of costs assumes that no volunteer labour is available, although the Trust’s work on the scheme to date has amounted to several hundreds of thousands of pounds of equivalent construction costs being saved. With the exception of a section of piling at Darnford which requires remedial works and a trivial remedial to a wall at Borrowcop, British Waterways has confirmed that the work undertaken by the Trust to date is to a suitable standard.

Detailed alignment work has been undertaken which demonstrates that the route is viable and identifies a “red line” showing the likely land requirements to complete the restoration. There are no insurmountable engineering obstacles and there are solutions at reasonable cost to all of the perceived pinch points along the route.

The restoration can be achieved without demolition of any domestic property, although gardens and/or accesses to four houses (one of which is already in the Trust’s ownership) will have to be amended. The proposed alignment re-uses as much of the original canal infrastructure as possible – where existing structures will be demolished, significantly modified or buried, archaeological recording is recommended as part of the works package.

Restoration will bring benefits to the local economy which have been evaluated at £1.82 million per year. For an unadjusted Net Present Value, benefits break even against costs in year 40. Operation and maintenance costs are assumed to bring sufficient additional benefit locally to enable them to be offset.

Environmental issues, planning policy and funding sources have all been considered and are described in detail in the body of the report.

Details of the proposed works, including core restoration works, landscape / ecology mitigations and improvements, visitor and user facilities, built heritage and archaeology recommendations and operational recommendations are all shown on the Proposal Maps referenced by this report and produced as a separate volume.

7.2 Recommendations

It is recommended that the proposed route is adopted for the restoration, and that preliminary work such as land purchase and outline design should continue, based on the feasibility designs shown in the Proposals Maps.

7.2.1 Planning Protection

It is further recommended that the Trust should continue to liaise with planners and that the proposals made in this Feasibility Report should be put forward for inclusion in the Local Development Framework to ensure that the proposed alignment receives planning protection. Whilst there is much detail to address, there are no insurmountable objects to restoration within the timescales required by the Framework.

7.2.2 Further Investigations

Water Supply Study

A joint water supply study should be carried out by the Trust (or its consulting engineer) and British Waterways. This should establish whether there is sufficient excess capacity in the British Waterways system on and above the Wolverhampton pound (of which the Wyrley and Essington Canal is part) to feed both the restored Lichfield Canal and Hatherton Canal. If there is not adequate capacity then options for increasing capacity should be identified and the feasibility of each option assessed. The study should also expand the work already undertaken to refine the proposals for feeders along both canals, liasing with the Environment Agency to establish the means and costs of obtaining consent for abstractions from the various watercourse abstractions proposed for each canal and to develop a better understanding of the requirements in practical terms of water quality where surface water flows are to be balanced and used as feed water by the restored canals.

Environmental Impact Assessment

A screening opinion should be sought from the Local Authority to confirm the nature and scope of EIA required. A Strategic Environmental Assessment may be required due to the proposal for phased delivery of the scheme – this would have the benefit that EIA can follow on for each phase rather than being undertaken as one large task for the whole scheme, and it may be possible that smaller enabling work packages in advance of the main works in any Phase would not require EIA individually.

Flood Risk Assessment

Some work will be required to obtain approval from the Environment Agency for the changes to land drainage required to implement the scheme. This process should be commenced in early course, and a suitable format for this would be by means of undertaking a formal Level 2 Flood Risk Assessment for the entire scheme (refer section 3.3.1). Although most of the flood risk is within Phase 1, it would be most cost effective to undertake a single Level 2 Flood Risk Assessment for the entire scheme.

Lichfield Cruising Club Moorings – Options Study

As discussed in detail in section 2.4.1, a detailed study of the various options for providing moorings for Lichfield Cruising Club should be undertaken prior to commencement of outline design for Phase 1. This should present alternative layouts to the stakeholders, including Lichfield Cruising Club, the Trust, British Waterways, the Environment Agency and the Local Planning Authority, so that a single preferred option can be taken forward into outline design.

7.2.3 Implementation of the Restoration Scheme

Phased delivery

This feasibility study recommends delivery of the scheme in five discreet phases. Whilst for the purposes of cost estimates and simplicity all of the remaining works required are budgeted and describes as part of one of the five phases, the experience of the Trust so far is that it has had to be flexible in the order in which structures and sections of canal restoration are delivered. This flexibility has paid dividends, enabling the Trust to ensure that the proposed alignment does not become fragmented by delivering works such as the Birmingham Road Culvert and the M6 (Toll) Aqueduct. This flexibility should continue with opportunities to construct key pieces of the required infrastructure being weighed on their merits as time progresses. At present, the key opportunities which the Trust should target are:

- The possibility of constructing waterway walls and lining in the pinch point section west of London Road at the same time as the Southern Bypass construction (see section 2.6.3);
- The opportunity to construct the crossing under the Lichfield – Birmingham “Cross City Line” railway at the same time as the Southern Bypass construction (see section 2.6.4)

It is suggested that facilitating and funding the works required at these two locations are prioritised above any other physical works at present, even if this means deferring a start of Phase 1 of the restoration. The additional costs and difficulty if these two sections are not constructed as part of the Southern Bypass scheme are not insurmountable but should be avoided if possible.

The recommended process for delivering each phase is described below.

Land Acquisition / Licensing

This can take place in parallel along all sections of the canal, building on the Trust’s success in securing a good proportion of the land required already. The Trust are now well experienced in this process and will be further assisted by the “redline” drawings prepared as part of the study and issued to the Trust and the Local Planning Authority separately.

Main Site Investigation

A generalised geotechnical desk study and site investigation along the length of each phase should be undertaken at an early stage. This should be designed to characterise:

- The engineering qualities and waste management classifications of the materials likely to have to be excavated;
- The level of ground water and nature and competence of soil and rock strata underlying the proposed line of the canal;
- The likely design slope angles for each main area of cutting or embankment along the line of the route;
- The engineering qualities of the existing soil and rock strata in the vicinity of any proposed structures.

Outline Design and Preparation of Cost Plan

Once the results of the site investigation are known, an outline design should be prepared and costed. This should be worked up in sufficient detail that it can be used to support planning applications and funding submissions. Engineering solutions for the main structures would be selected at this stage, and the alignment of the canal finalised, particularly with regard to any pinch points either in terms of navigation or engineering. The outline design should be presented in an outline design report, including advice as to progressing the scheme to construction. It has been found to be advisable to include the production of artist’s impressions of key parts of the completed scheme at this stage to support the planning and funding submissions

Planning Application and Public Consultation

The next stage in the process is to optain planning permission. It has proved to be wise to engage with the public at this stage, with initial public consultation on the proposals being carried out in advance of the application being lodged to minimise the potential for objections. This can take the form of public meetings, leaflet drops (with return comment slips) and exhibitions in local public spaces or shopping areas. It is advisable to engage the support of local politicians and civic leaders if possible to assist in “getting the message over”. Formal consultation will be carried out by the Local Planning Authority as part of the consenting process.

Other consents required, such as Land Drainage Consents, Abstraction Licenses, any building consents, Network Rail Approval in Principle etc., should also be obtained at this point.

These applications will be supported by the studies discussed in section 7.2.2 above, and potentially by a specific EIA for the works which would have to be prepared once the outline design is clear.

Funding Applications and Fundraising

In parallel with the application for planning and other consents, the Trust will have to put funding in place to deliver the planned works at this stage. This will involve applications to potential funders (the current funding framework for canal restoration schemes is described in section 6 but is subject to change, and should be monitored continuously by the Trust for potential opportunities).

The Trust will also be engaged in its ongoing fundraising activities and co-ordinating volunteer labour on some elements of the scheme – these are both valuable contributions to the funding package in terms of match funding.

Detailed Design and Procurement of the Works

Once consents and funding are secured, detailed design of the scheme can be undertaken to produce the necessary Contract Documentation, which would typically comprise:

- An Invitation to Tender (if the works are to be procured by competitive tender);
- A Form of Contract or Agreement;
- Conditions of Contract;
- Site Information – a package of information which describes the site and the existing conditions pertaining to it;
- Works Information – the detailed designs and specifications for the work to be undertaken;
- A Pre-Tender Health and Safety Plan – which is provided to ensure that the works are managed in accordance with the Construction (Design and Management) Regulations 2007[62]

The scheme can then be tendered and a Contractor appointed.

[62] The Client for any works has a number of duties to fulfill in relation to the regulations: checking the competence and resources of all appointees; ensuring there are suitable management arrangements for the project welfare facilities; allowing sufficient time and resources for all stages of the work; providing pre-construction information to designers and contractors; appointing a CDM co-ordinator and a principal contractor; ensuring that the construction phase does not start unless there are suitable welfare facilities and a construction phase health and safety plan is in place; providing information relating to the health and safety file to the CDM co-ordinator and retaining and providing access to the health and safety file. The designer at outline stage is required by the Regulations to check the client is aware of their duties and to check that a CDM Co-ordinator has indeed been appointed.

Site Works

Arrangements should be made to ensure that the works are properly supervised and that the contract is administered correctly. Typically the designer is appointed to undertake these construction stage services.

The Client will then need to arrange entry onto any land required for the works in advance of the commencement date and to continue to liaise with the supervisor, contract administrator and Principal Contractor through the construction phase. Some funding agencies also have requirements with regard to monitoring progress and releasing funding, and these should be clearly understood prior to commencement.

Operation and Maintenance

The Principal Contractor should prepare detailed manuals for operation and maintence of any mechanical and electrical structures, and these should be passed to the navigation authority who will be responsible for operation of the completed canal.

7.3 Summary

A feasibility study into the restoration of the Lichfield Canal has been undertaken by Atkins Limited. The study finds that restoration is feasible, at a cost of £47.7 million. Annual benefits arising from the restored canal are estimated to be of the order of £1.8 million and the scheme will break even (benefits against costs) thirty years after opening as a through route.

There are no insurmountable physical or environmental objects to the restoration of the canal. Proposal Maps have been prepared which show workable solutions for each of the obstacles and give an idea of how the completed scheme could look and feel.

Recommendations are given as to the step the Trust should take in order to further progress the restoration of the Lichfield Canal.

Appendix A – Construction Costs

Lichfield Canal Restoration
Feasibility Study
Estimated Costs of Restoration (Huddlesford Junction to Ogley Junction)

SUMMARY	Length	Sub-total	Total
From itemised budget estimates, including fees and construction costs			
Phase 1: Huddlesford Junction to Darnford	1.62 km	£ 2,227,614	
Phase 2: Darnford to Cricket Lane	1.52 km	£ 6,100,901	
Phase 3: Cricket Lane to Lock 18	2.45 km	£ 10,146,055	
Phase 4: Lock 18 to Coppice Lane	2.09 km (*)	£ 6,746,915	
Phase 5: Coppice Lane to Ogley Junction	4.00 km	£ 12,615,070	
(Phase 4 includes much of the bulk earthwork for Phase 5)*			
Sub-total			£ 37,836,554
Risk allowances	5%	£ 1,891,828	
Construction Total			£ 39,728,382
Optimism bias	20%	£ 7,945,676	
Grand Total for Phase			**£ 47,674,058**

Item	Work Required	Quantity	Unit	Approx Rate	Allowance
Phase 1: Huddlesford Junction to Darnford					
Earthworks (excl cruising club basins)					
Canal Channel	Excavation	6,210	m³	£ 1.50	£ 9,315
	Dredging	2,775	m³	£ 1.80	£ 4,995
	Deposition on site in landscape areas	85	m³	£ 2.00	£ 170
	Disposal (5km haul + landfill tax)	8,900	m³	£ 9.00	£ 80,100
	Disposal unacceptable matl. To tip	694	m³	£ 95.00	£ 65,930
	Bio-engineered banks	900	m	£ 35.00	£ 31,500
	Piling (repair / re-drive and anchor ex.)	300	m	£ 150.00	£ 45,000
	Piling (new)	800	m	£ 450.00	£ 360,000
	Bentonite mat liner and sand cover	6,000	m²	£ 20.00	£ 120,000
	Towpath surfacing	3,600	m²	£ 10.00	£ 36,000
	Biodiverse hedge planting + protection	690	m	£ 32.00	£ 22,080
	Tree planting	5	nr	£ 200.00	£ 1,000
	Other environmental mitigations	1	item	£ 5,000.00	£ 5,000
					£ 776,090
Structures					
Huddlesford Junction Bridge	Remove lift bridge	1	item	£ 20,000.00	£ 20,000
	New pedestrian bridge	1	item	£ 75,000.00	£ 75,000
Watery Lane Bridge	Modifications to make turnover bridge	1	item	£ 30,000.00	£ 30,000
Cappers Lane Bridge	Excavate channel and form towpath	1	item	£ 15,000.00	£ 15,000
Lock 30	Excavate and restore chamber	1	item	£ 30,000.00	£ 30,000
	New gates and contol gear incl fitting	1	item	£ 50,000.00	£ 50,000
Darnford Lift Bridge	Principal Inspection and Assessment	1	item	£ 5,000.00	£ 5,000
	Minor repairs and commissioning	1	item	£ 10,000.00	£ 10,000
Darnford Culvert	CCTV and Principal Inspection	1	item	£ 5,000.00	£ 5,000
					£ 240,000
Cruising Club Basins					
Earthworks	Excavation	8,730	m³	£ 1.50	£ 13,095
	Dredging	1,260	m³	£ 1.80	£ 2,268
	Deposition on site in landscape areas	500	m³	£ 2.00	£ 1,000
	Disposal (5km haul + landfill tax)	8,990	m³	£ 9.00	£ 80,910
	Disposal unacceptable matl. To tip	500	m³	£ 95.00	£ 47,500
	Bio-engineered banks	300	m	£ 35.00	£ 10,500
	Piling	20	m	£ 427.50	£ 8,550
	Bentonite mat liner and sand cover	6,000	m²	£ 20.00	£ 120,000
	2m wide Pontoons	145	m	£ 800.00	£ 116,000
	Finger Pontoons	234	m	£ 500.00	£ 117,000
	Slipway & relocation of cover, winch	1	item	£ 10,000.00	£ 10,000
	Footpaths, accesses and car parking	1,700	m²	£ 15.00	£ 25,500
	Security Fencing	300	m	£ 20.00	£ 6,000
	Biodiverse hedge planting + protection	400	m	£ 32.00	£ 12,800
	Tree planting around basins	15	nr	£ 200.00	£ 3,000
	Other environmental mitigations	12,000	m²	£ 2.00	£ 24,000
					£ 598,123
Sub-total					£ 1,614,213
Preliminaries at 20% of structures costs		20%		£ 322,843	
Construction Total					£ 1,937,056
Fees and disbursements		15%		£ 290,558	
Grand Total for Phase					**£ 2,227,614**

Item	Work Required	Quantity	Unit	Approx Rate	Allowance
Phase 2: Darnford to Cricket Lane					
Earthworks					
Canal Channel	Excavation	66,777	m^3	£ 1.50	£ 100,166
	Dredging	0	m^3	£ 1.80	£ -
	Deposition on site	1,411	m^3	£ 2.00	£ 2,822
	Disposal (5km haul + landfill tax)	60,410	m^3	£ 9.00	£ 543,690
	Disposal unacceptable matl. To tip	411	m^3	£ 95.00	£ 39,045
	Bio-engineered banks	520	m	£ 35.00	£ 18,200
	Piling (repair / re-drive and anchor ex.)	0	m	£ 150.00	£ -
	Piling (new)	1,370	m	£ 450.00	£ 616,500
	Bentonite mat liner and sand cover	13,238	m^2	£ 20.00	£ 264,760
	Towpath surfacing	3,030	m^2	£ 10.00	£ 30,300
	Biodiverse hedge planting + protection	640	m	£ 39.00	£ 24,960
	Tree planting	50	nr	£ 200.00	£ 10,000
	Other environmental mitigations	1	item	£ 25,000.00	£ 25,000
					£ 1,675,443
Structures					
Darnford Bridge	New road bridge	1	item	£ 250,000.00	£ 250,000
	Localised highway raising	1	item	£ 30,000.00	£ 30,000
Lock 29	New lock	1	item	£ 200,000.00	£ 200,000
Darnford Brook	Divert brook	30	m	£ 500.00	£ 15,000
	New culvert	28	m	£ 1,000.00	£ 28,000
A38(T)	New jacked box culvert	1	item	£ 750,000.00	£ 750,000
Lock 28	New lock	1	item	£ 200,000.00	£ 200,000
A51 Tamworth Road	New jacked box culvert	1	item	£ 830,000.00	£ 830,000
Lock 27	New lock	1	item	£ 200,000.00	£ 200,000
	Footbridge/turnover at lock tail	1	item	£ 7,500.00	£ 7,500
Storm Weir	New weir to route storm water to brook	1	item	£ 50,000.00	£ 50,000
Lock 26 (Jubilee Lock) (note 1)	Finish restoration of chamber	1	item	£ 5,000.00	£ 5,000
	New gates and contol gear incl fitting	1	item	£ 50,000.00	£ 50,000
Lock 25 (Millenium Lock) (note 1)	Finish restoration of chamber	1	item	£ 5,000.00	£ 5,000
	New gates and contol gear incl fitting	1	item	£ 50,000.00	£ 50,000
Old lock 24 (Garrick Lock)	Remove top sill; make good chamber	1	item	£ 75,000.00	£ 75,000
					£ 2,745,500
Sub-total					£ 4,420,943
Preliminaries at 20% of structures costs		20%		£ 884,189	
Construction Total					£ 5,305,131
Fees and disbursements		15%		£ 795,770	
Grand Total for Phase					**£ 6,100,901**

Item	Work Required	Quantity	Unit	Approx Rate	Allowance
Phase 3: Cricket Lane to Lock 18					
Earthworks					
Canal Channel	Excavation	97,547	m³	£ 1.50	£ 146,321
	Dredging	0	m³	£ 1.80	£ -
	Deposition on site	6,160	m³	£ 2.00	£ 12,320
	Disposal (5km haul + landfill tax)	88,637	m³	£ 9.00	£ 797,733
	Disposal unacceptable matl. To tip	2,750	m³	£ 95.00	£ 261,250
	Bio-engineered banks	1,070	m	£ 35.00	£ 37,450
	Piling (repair / re-drive and anchor ex.)	0	m	£ 150.00	£ -
	Piling (new)	3,260	m	£ 450.00	£ 1,467,000
	Bentonite mat liner and sand cover	24,937	m²	£ 20.00	£ 498,740
	Towpath surfacing	5,382	m²	£ 10.00	£ 53,820
	Biodiverse hedge planting + protection	1,220	m	£ 39.00	£ 47,580
	Tree planting	50	nr	£ 200.00	£ 10,000
	Other environmental mitigations		item	£ 25,000.00	£ -
					£ 3,332,214
Structures					
Cricket Lane	New road bridge	1	item	£ 210,000.00	£ 210,000
	Localised highway raising	1	item	£ 30,000.00	£ 30,000
Lock 24	New lock	1	item	£ 200,000.00	£ 200,000
Tamworth Road	Retaining wall north of canal (197x1.6)	315	m²	£ 450.00	£ 141,840
	Retaining wall south of canal (161x1.2)	193	m²	£ 470.00	£ 90,710
xxx Crossing	New footbridge	24	m²	£ 1,150.00	£ 27,600
	Approach ramps etc.	1	item	£ 20,000.00	£ 20,000
rear of shops	Retaining wall north of canal (35x1.0)	35	m²	£ 480.00	£ 16,800
	Retaining wall south of canal (70x1.0)	70	m²	£ 480.00	£ 33,600
London Road Bridge	Retaining wall on bridge app (70x2.0)	140	m²	£ 430.00	£ 60,200
	Refurbish existing bridge	1	item	£ 50,000.00	£ 50,000
Lock 23	New lock	1	item	£ 200,000.00	£ 200,000
	Footbridge/turnover at lock tail	1	item	£ 7,500.00	£ 7,500
Lock 22	New lock	1	item	£ 200,000.00	£ 200,000
Lock 21	New lock	1	item	£ 200,000.00	£ 200,000
	Footbridge/turnover at lock tail	1	item	£ 7,500.00	£ 7,500
Lichfield - B'ham Railway	New jacked box culvert	50	m	£ 30,000.00	£ 1,500,000
Birmingham Road	Connect existing box culvert and fit out	45	m	£ 5,000.00	£ 225,000
Locks 20 and 19	New locks	2	nr	£ 200,000.00	£ 400,000
Claypit Lane Bridge	New bridge	1	item	£ 210,000.00	£ 210,000
	Approach retaining walls (2x35Lx1.5H)	105	m²	£ 450.00	£ 47,250
Railway corner	Provision for ret. wall offside (50Lx2H)	100	m²	£ 420.00	£ 42,000
Water supply	Provision for supply (SWS / pumping)	1	item	£ 100,000.00	£ 100,000
					£ 4,020,000
Sub-total					£ 7,352,214
Preliminaries at 20% of structures costs		20%		£ 1,470,443	
Construction Total					£ 8,822,656
Fees and disbursements		15%		£ 1,323,398	
Grand Total for Phase					**£ 10,146,055**

Item	Work Required	Quantity	Unit	Approx Rate	Allowance
Phase 4: Lock 18 to Coppice Lane					
Earthworks					
Canal Channel	Excavation	97,432	m^3	£ 1.50	£ 146,148
	Dredging	1050	m^3	£ 1.80	£ 1,890
	Deposition on site	1,318	m^3	£ 2.00	£ 2,636
	Selected material deposit over liner	6,237	m^3	£ 3.50	£ 21,830
	Haulage to phase 5 earthworks	81,079	m^3	£ 7.50	£ 608,093
	Deposition on site (in phase 5 e/work)	81,079	m^3	£ 2.00	£ 162,158
	Disposal (5km haul + landfill tax)	0	m^3	£ 9.00	£ -
	Disposal unacceptable matl. To tip	9,848	m^3	£ 95.00	£ 935,560
	Bio-engineered banks	1,405	m	£ 35.00	£ 49,175
	Piling (repair / re-drive and anchor ex.)	0	m	£ 150.00	£ -
	Piling (new)	2,405	m	£ 450.00	£ 1,082,250
	Bentonite mat liner and sand cover	20,790	m^2	£ 20.00	£ 415,800
	Towpath surfacing	5,120	m^2	£ 10.00	£ 51,200
	Biodiverse hedge planting + protection	1,470	m	£ 39.00	£ 57,330
	Tree planting	200	nr	£ 200.00	£ 40,000
	Other environmental mitigations	1	item	£ 17,750.00	£ 17,750
					£ 3,574,069
Structures					
Lock 18	Finish restoration of chamber	1	item	£ 5,000.00	£ 5,000
	New gates and contol gear incl fitting	1	item	£ 50,000.00	£ 50,000
Fosseway Lane	New bridge	1	item	£ 210,000.00	£ 210,000
	Retaining walls and groundworks	1	item	£ 100,000.00	£ 100,000
Locks 17 to 13	Excavate and restore chamber	5	nr	£ 60,000.00	£ 300,000
	New gates and contol gear incl fitting	5	nr	£ 50,000.00	£ 250,000
Wall Lane	New bridge	1	item	£ 210,000.00	£ 210,000
Pipehill Lane	Restore and line ex bridge opening	1	item	£ 50,000.00	£ 50,000
Pipehill Brook	Rehabilitate existing culvert	1	item	£ 100,000.00	£ 100,000
	Install pump to abstract feedwater	1	item	£ 40,000.00	£ 40,000
					£ 1,315,000
Sub-total					£ 4,889,069
Preliminaries at 20% of structures costs		20%		£ 977,814	
Construction Total					£ 5,866,883
Fees and disbursements		15%		£ 880,032	
Grand Total for Phase					**£ 6,746,915**

Hatherton Canal Restoration
Supplementary Feasibility Study
Estimated Costs of Restoration for Alternative Route Connecting to Wyrley and Essington Canal at Fishley Junction

Item		Work Required	Quantity	Unit		Approx Rate		Allowance
Phase 5: Coppice Lane to Ogley Junction								
Earthworks								
Canal Channel		Excavation	59,876	m^3	£	1.50	£	89,814
		Dredging	0	m^3	£	1.80	£	-
		Deposition on site	34,106	m^3	£	2.00	£	68,212
		Selected material deposit over liner	10,808	m^3	£	3.50	£	37,828
		Disposal (5km haul + landfill tax)	8,974	m^3	£	9.00	£	80,766
		Disposal unacceptable matl. To tip	5,988	m^3	£	95.00	£	568,860
		Bio-engineered banks	2,455	m	£	35.00	£	85,925
		Piling (repair / re-drive and anchor ex.)	0	m	£	150.00	£	-
		Piling (new)	4,365	m	£	450.00	£	1,964,250
		Bentonite mat liner and sand cover	36,025	m^2	£	20.00	£	720,500
		Towpath surfacing	14,590	m^2	£	10.00	£	145,900
		Biodiverse hedge planting + protection	2,575	m	£	39.00	£	100,425
		Tree planting	250	nr	£	200.00	£	50,000
		Other environmental mitigations	1	item	£	50,000.00	£	50,000
							£	3,912,480
Structures								
Coppice Lane		New road bridge	1	item	£	300,000.00	£	300,000
Lock 12		Excavate and restore chamber	1	nr	£	60,000.00	£	60,000
		New gates and contol gear incl fitting	1	nr	£	50,000.00	£	50,000
Muckley Corner Bridge		Re-excavate bridge and fit-out	1	item	£	50,000.00	£	50,000
Locks 11 and 10		Excavate and restore chamber	2	nr	£	60,000.00	£	120,000
		New gates and contol gear incl fitting	2	nr	£	50,000.00	£	100,000
Watling Street		New jacked box culvert	1	item	£	650,000.00	£	650,000
Lock 9B - Wall Butts		New lock	1	item	£	200,000.00	£	200,000
Boat Lane		New lift bridge to access house backs	1	item	£	200,000.00	£	200,000
Boat Bridge		New cut and cover box culvert	1	item	£	700,000.00	£	700,000
Lock 9A - Boat Inn		New lock	1	nr	£	200,000.00	£	200,000
Locks 7 and 8		New lock	2	nr	£	200,000.00	£	400,000
Crane Brook		New culvert	50	m	£	2,500.00	£	125,000
M6 Toll		Wing walls / interface with ex aqueduct	1	item	£	50,000.00	£	50,000
Old Locks 7 and 8		Archaeological recording	2	nr	£	5,000.00	£	10,000
		Remove top sill; make good chamber	1	nr	£	75,000.00	£	75,000
Barrack Lane	(Note 1)	New bridge	1	nr	£	360,000.00	£	360,000
		Approach road surface and drainage	425	m	£	1,475.00	£	626,875
		Junctions and side roads	110	m	£	1,200.00	£	132,000
Locks 5 to 1		Excavate and restore chamber	5	nr	£	60,000.00	£	300,000
		New gates and contol gear incl fitting	5	nr	£	50,000.00	£	250,000
		Water feed culverts and control gear	5	nr	£	30,000.00	£	150,000
		Vehicle accessible tail bridges	2	nr	£	60,000.00	£	120,000
							£	5,228,875
Sub-total							£	9,141,355
Preliminaries at 20% of structures costs			20%		£	1,828,271		
Construction Total							£	10,969,626
Fees and disbursements			15%		£	1,645,444		
Grand Total for Phase							**£**	**12,615,070**

(Note 1) Construction of approach embankments included in phase 4 and 5 earthworks

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Plan Design Enable

Lichfield Canal

Restoration Feasibility Study

Final Report - July 2009

ATKINS

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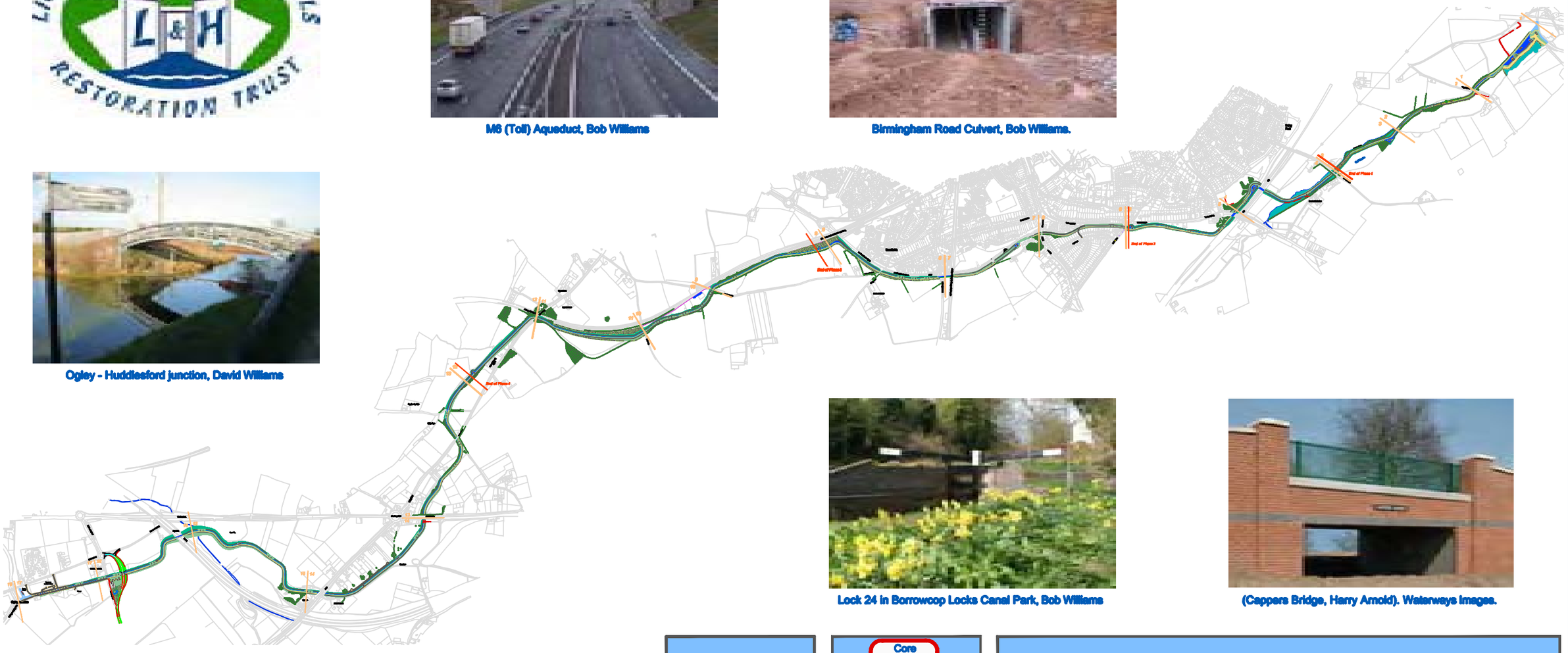
Restoration of Lichfield Canal

M6 (Toll) Aqueduct, Bob Williams

Birmingham Road Culvert, Bob Williams.

Ogley - Huddlesford junction, David Williams



Lock 24 in Borrowcop Locks Canal Park, Bob Williams

(Cappers Bridge, Harry Arnold). Waterways Images.

Proposal Maps

These proposal maps show indicative feasibility layouts which are intended to demonstrate that robust solutions are available facilitating restoration of the canal. Details and final layouts may change as the project develops.

- Core Restoration Works
- Landscape /Ecology
- Visitor / user issues
- Built Heritage Archaeology
- Operational issues

- Existing trees
- Existing hedge
- Proposed trees
- Proposed hedge
- Towpath fringe 0.5 - 1.0m wide
- Offside fringe 1.0 - 2.0m wide
- Grass surface (managed longer)
- Grass surface / verge (Maintained Short)
- Rolled stone towpath (width varies)
- Grass towpath surface
- Original /historic towpath route
- Public footpath
- Lock gates & brick heelgrips
- LS Lock landing stage
- VM Visitor mooring

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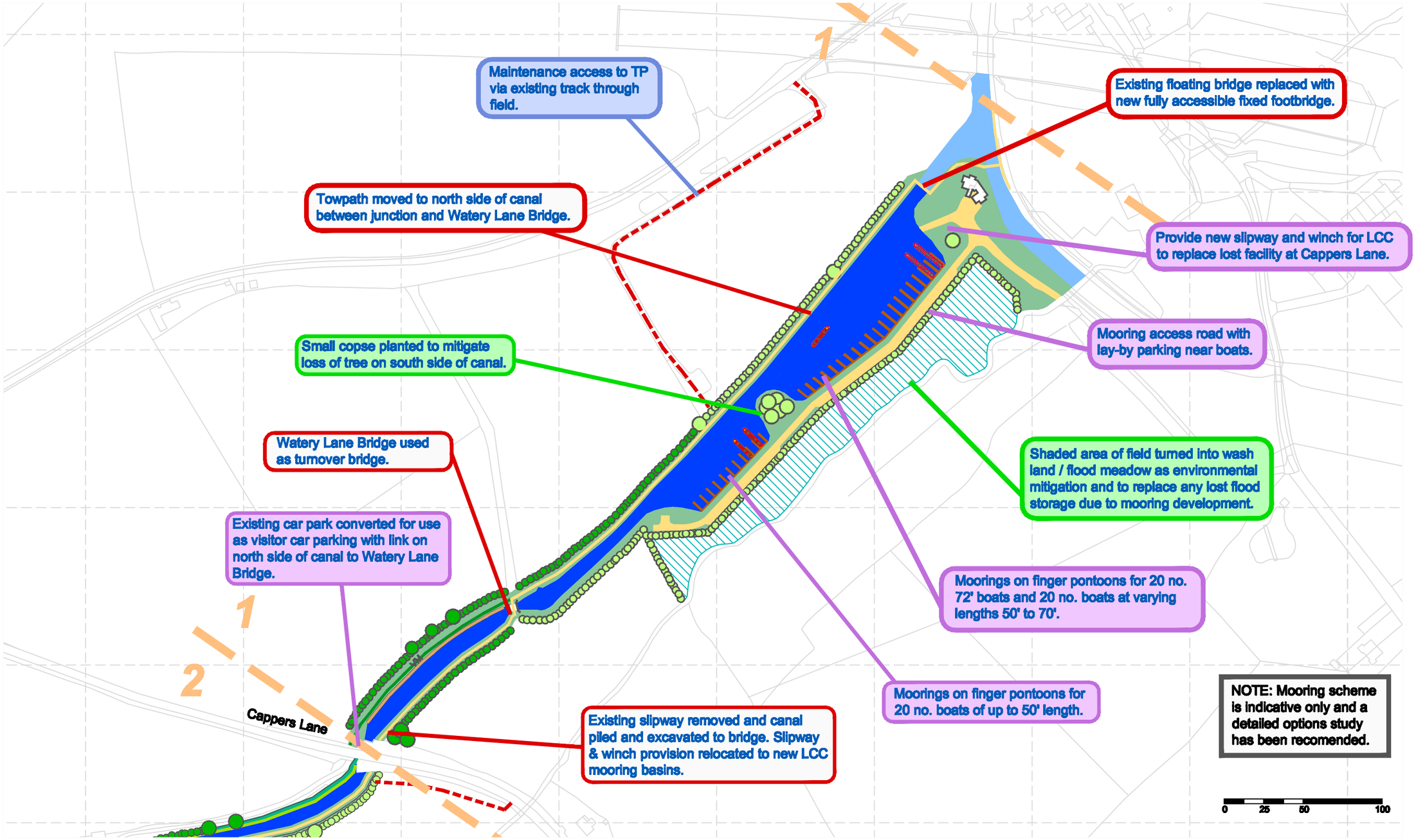
Restoration of Lichfield Canal



Proposal Map 1 - *Huddlesford Junction to Cappers Lane*

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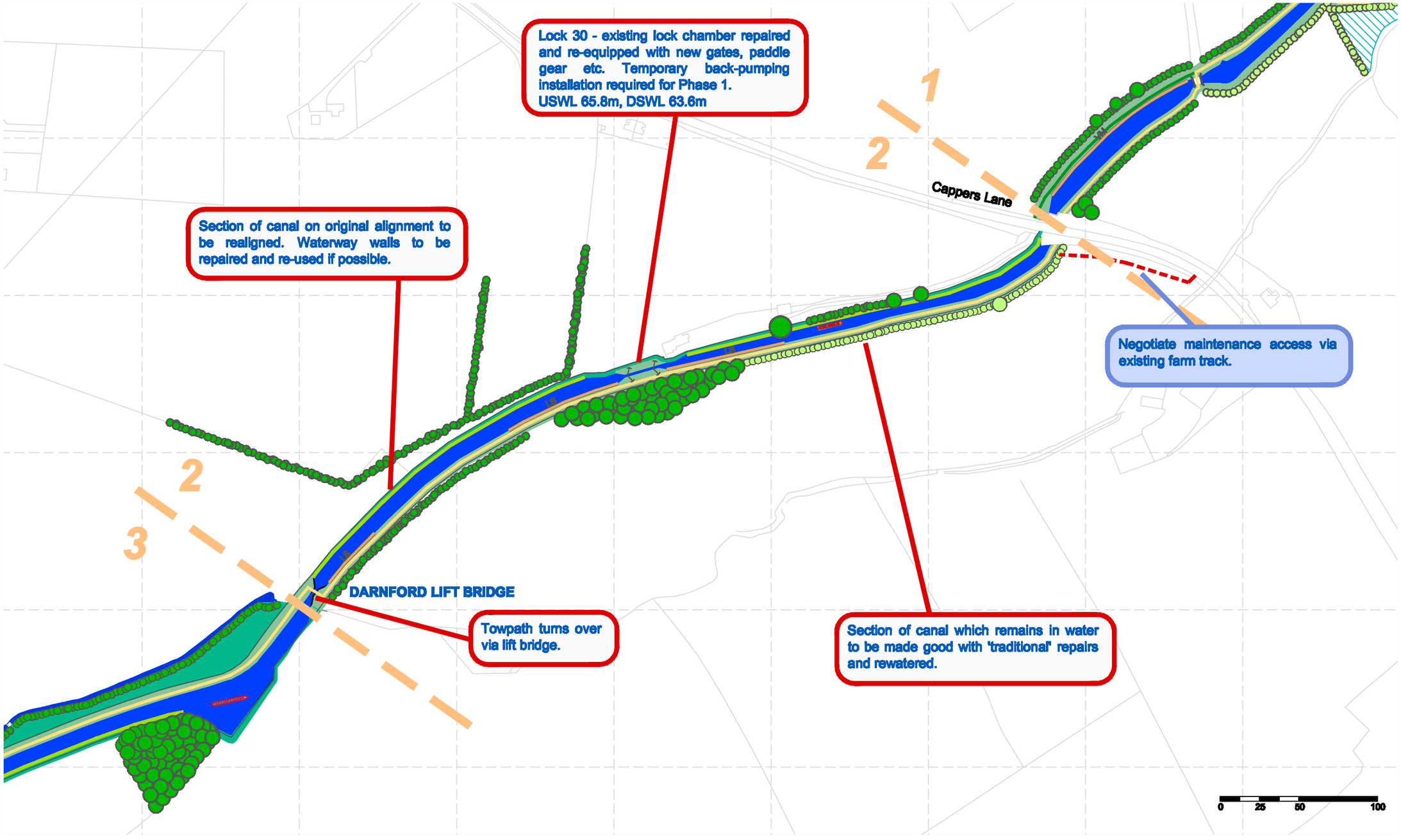
Restoration of Lichfield Canal



Proposal Map 2 - *Cappers Lane to Darnford Lift Bridge*

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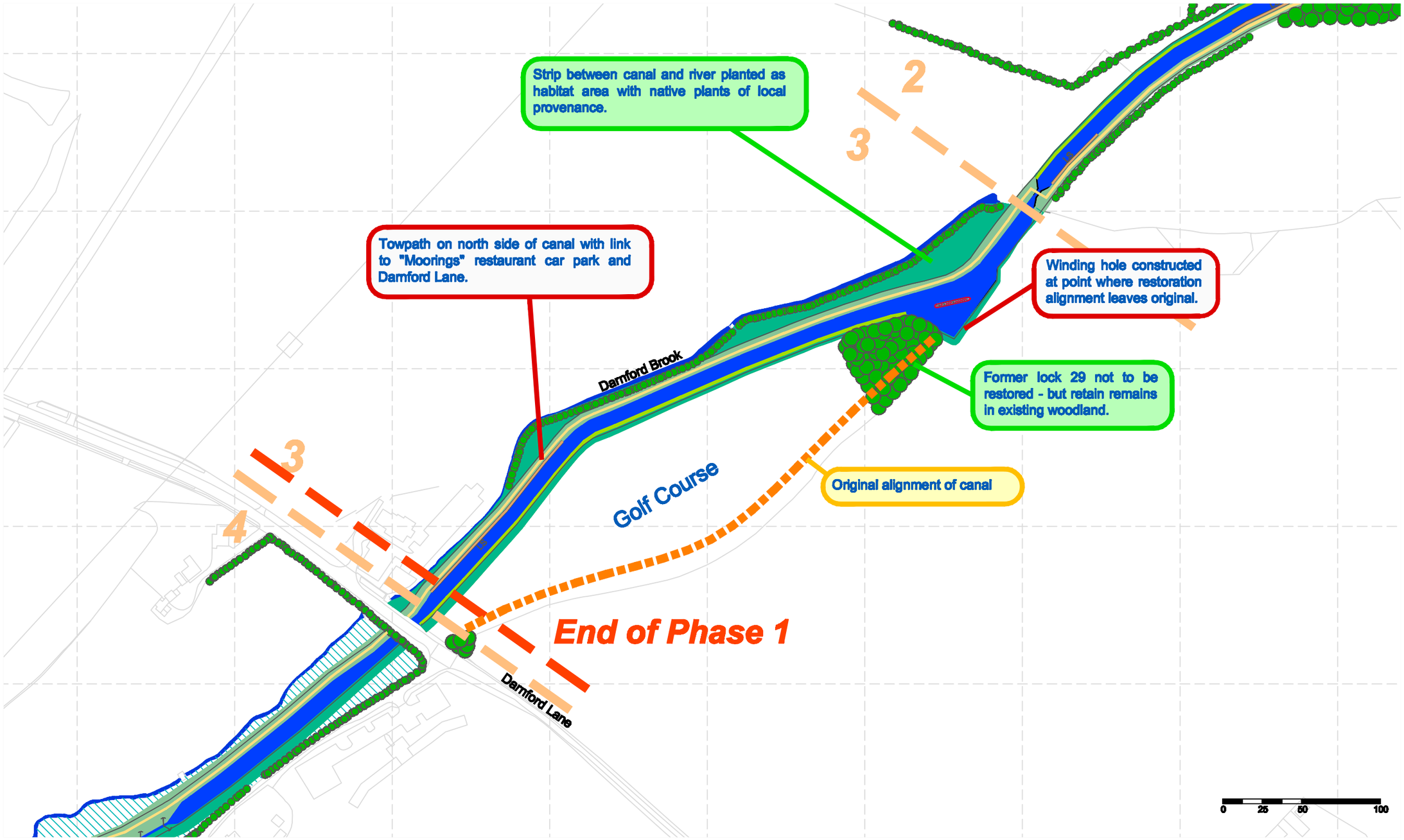
Restoration of Lichfield Canal



Proposal Map 3 - *Darnford Lift Bridge to Darnford Lane*

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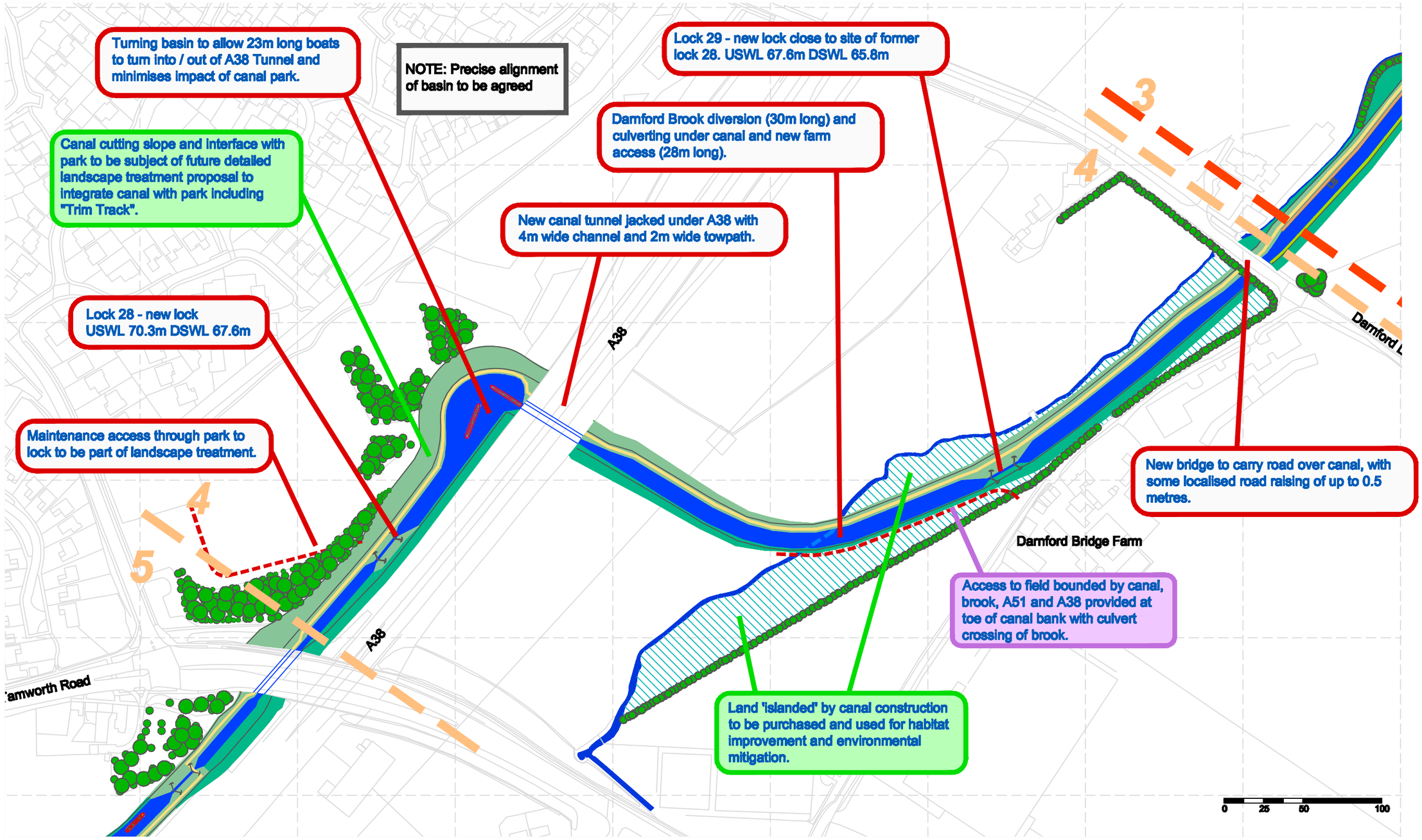
Restoration of Lichfield Canal



Proposal Map 4 - *Darnford Lane to Tamworth Road Crossing*

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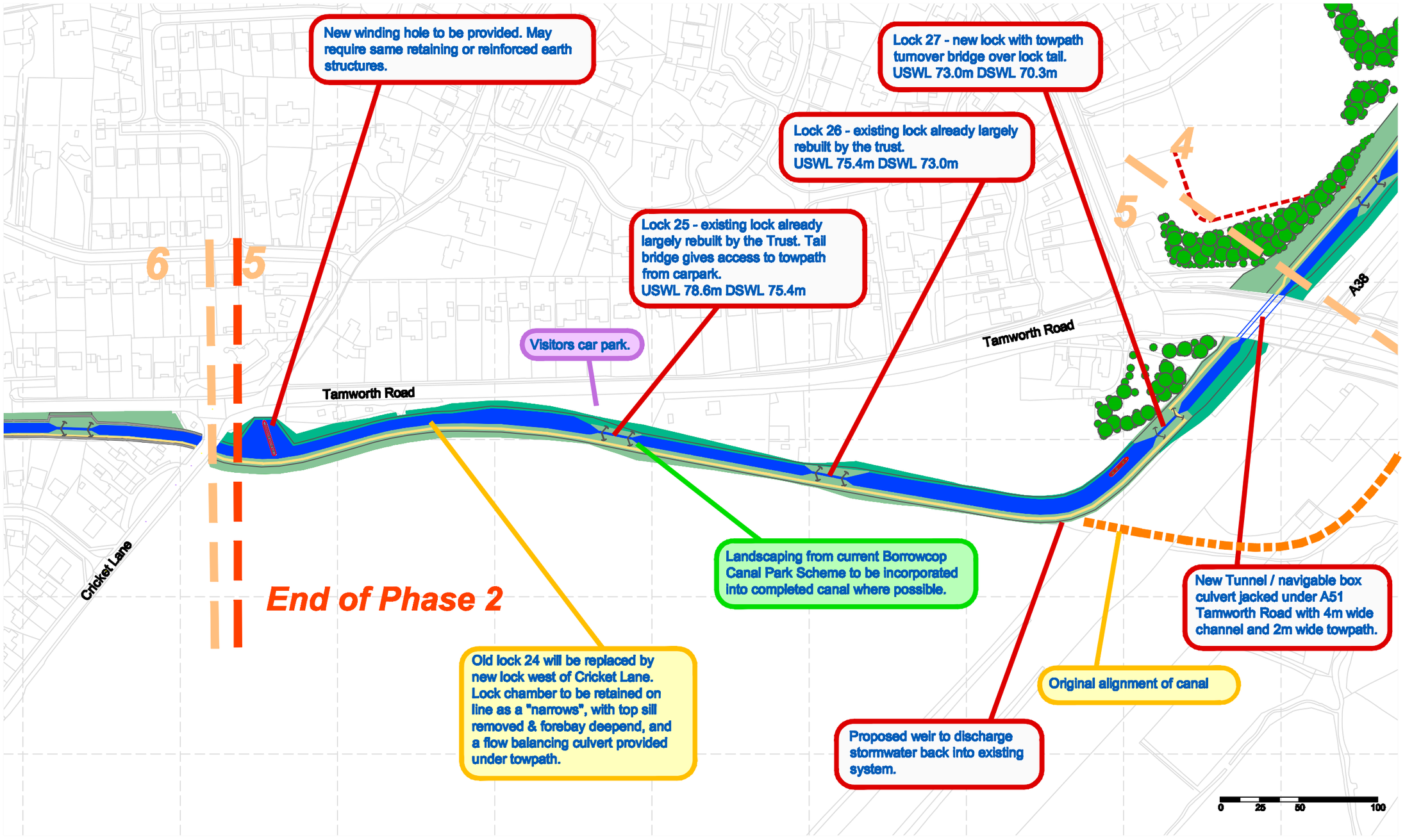
Restoration of Lichfield Canal



Proposal Map 5 - *Tamworth Road Crossing to Cricket Lane*

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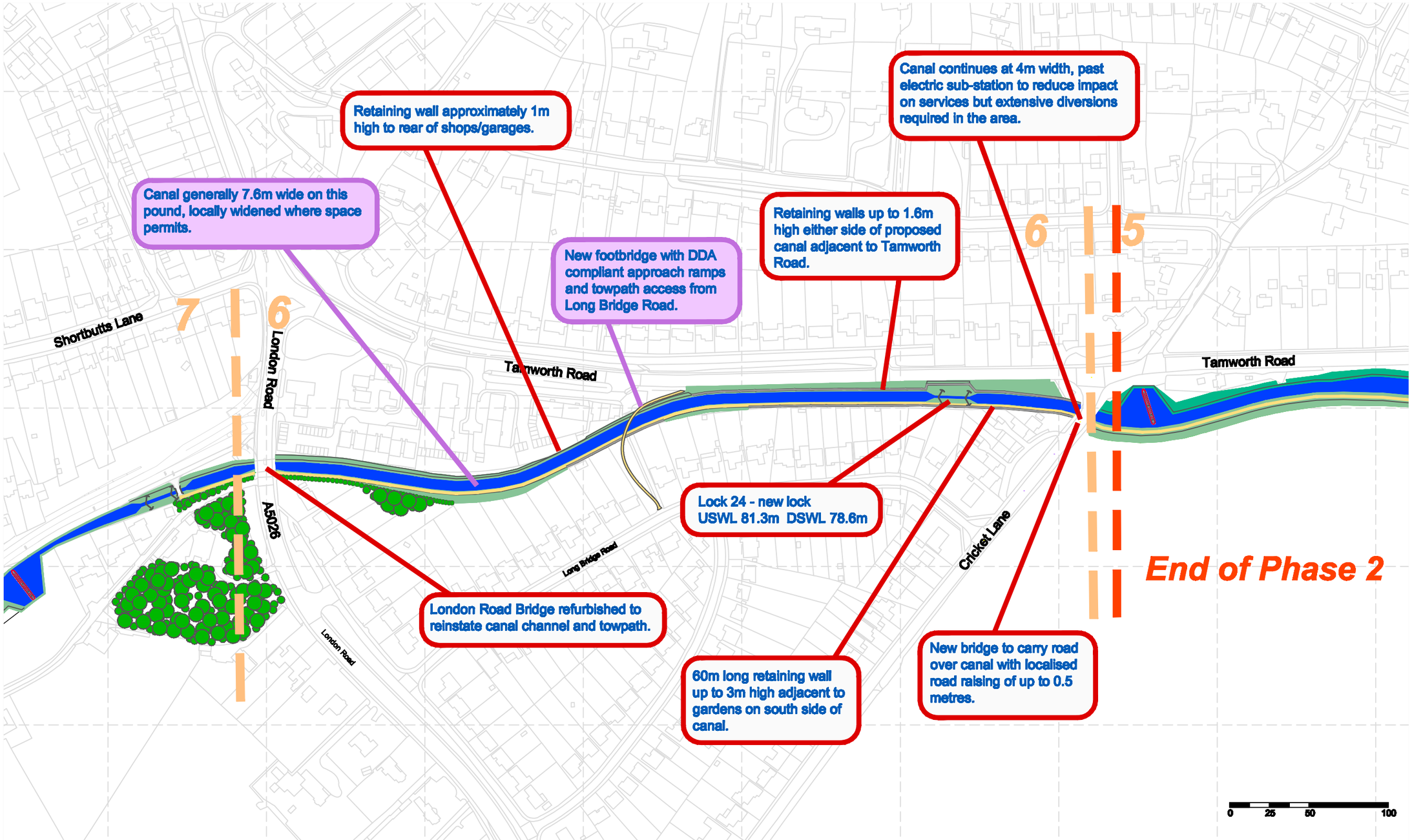
Restoration of Lichfield Canal



Proposal Map 6 - *Cricket Lane to London Road*

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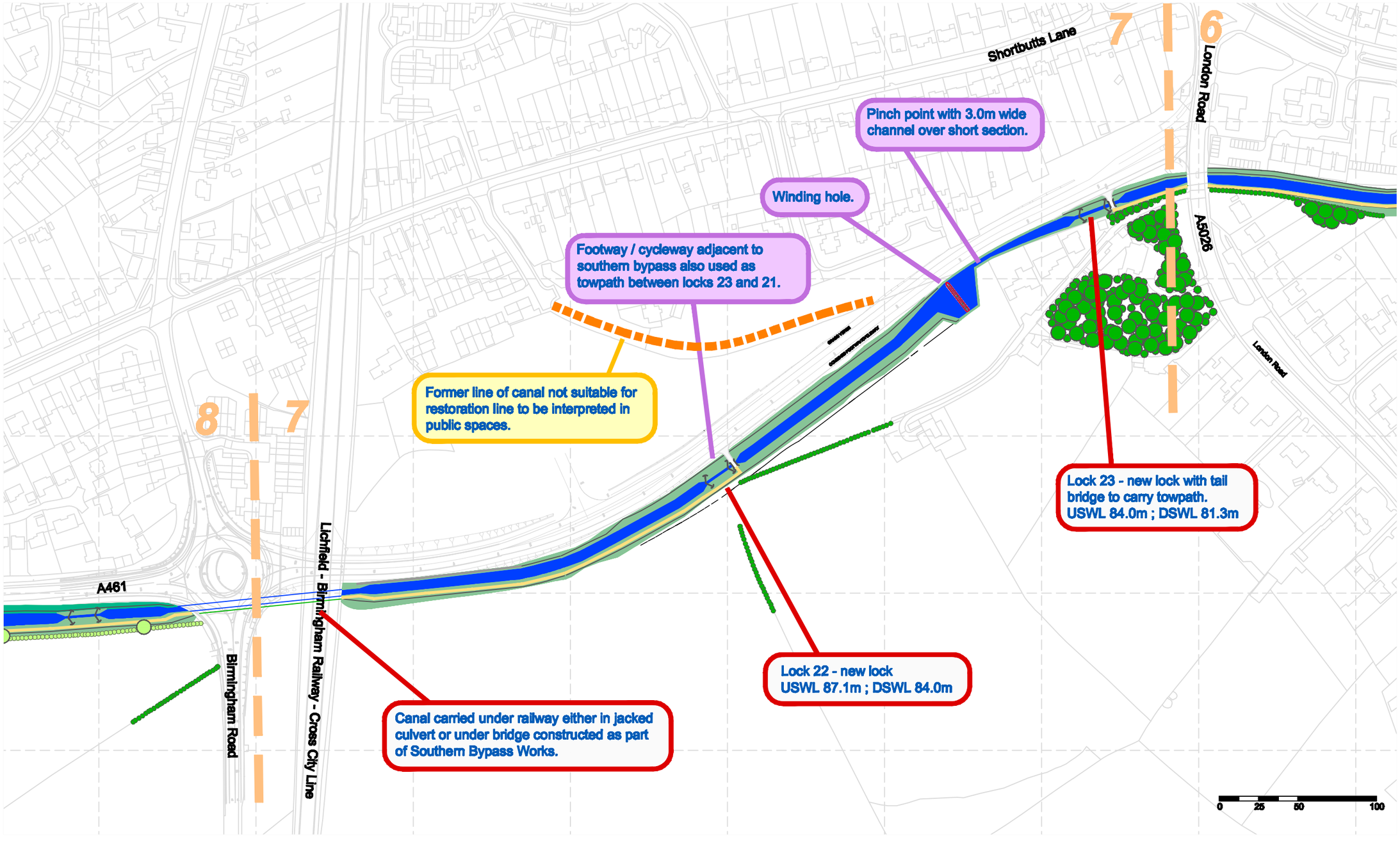
Restoration of Lichfield Canal



Proposal Map 7 - *London Road to Birmingham Road*

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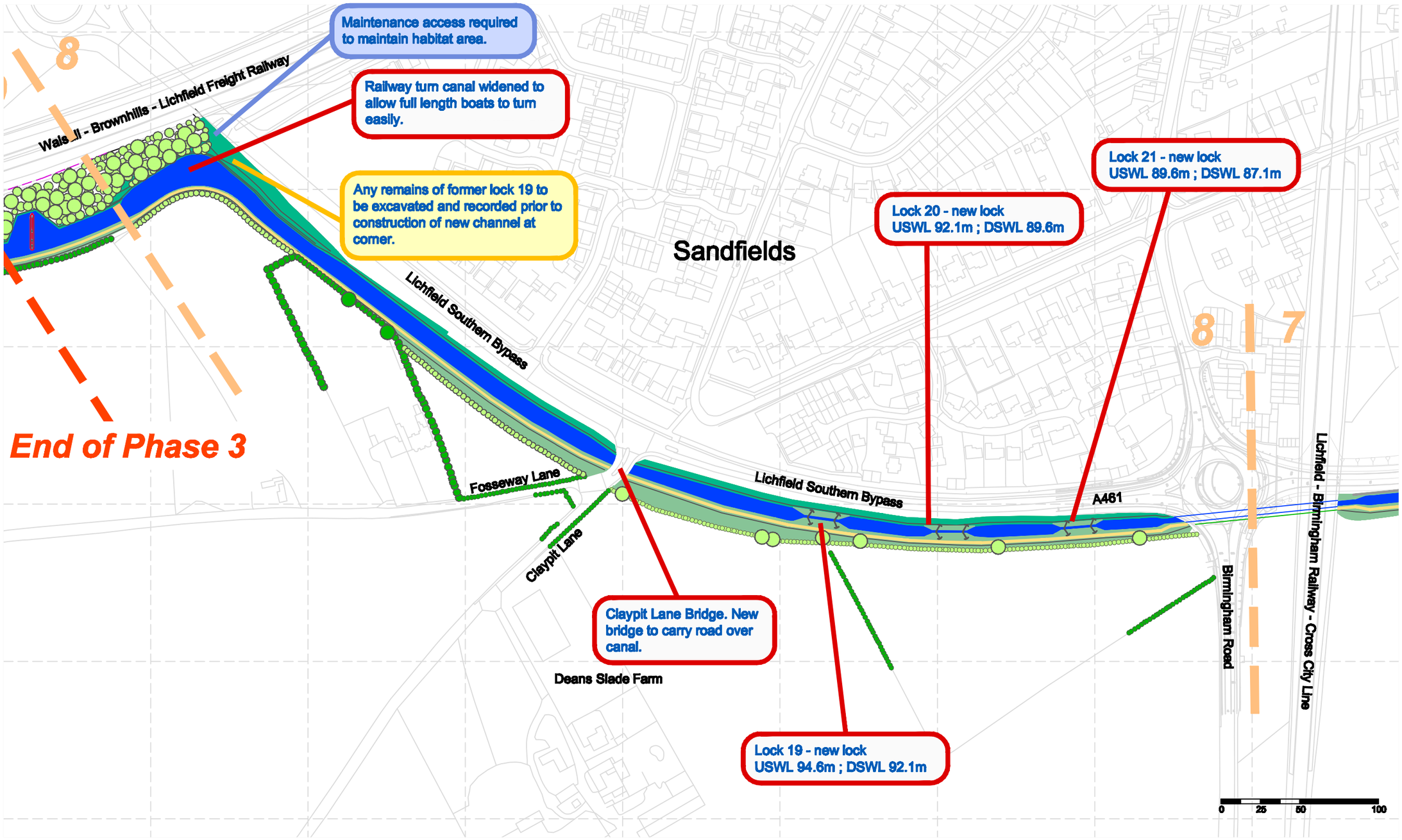
Restoration of Lichfield Canal



Proposal Map 8 - *Birmingham Road to Former Lock 19*

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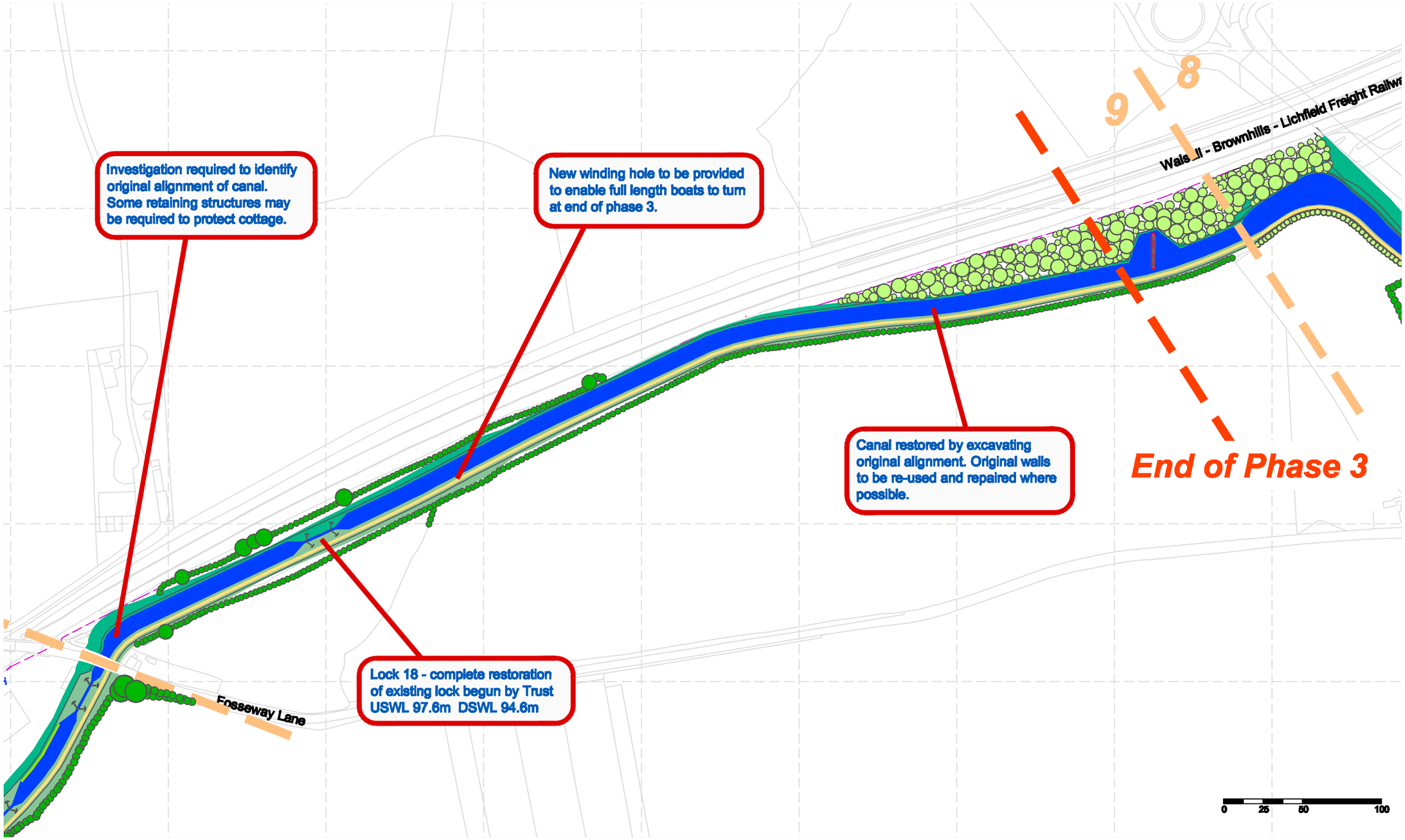
Restoration of Lichfield Canal



Proposal Map 9 - *Former Lock 19 to Fosseway Lane*

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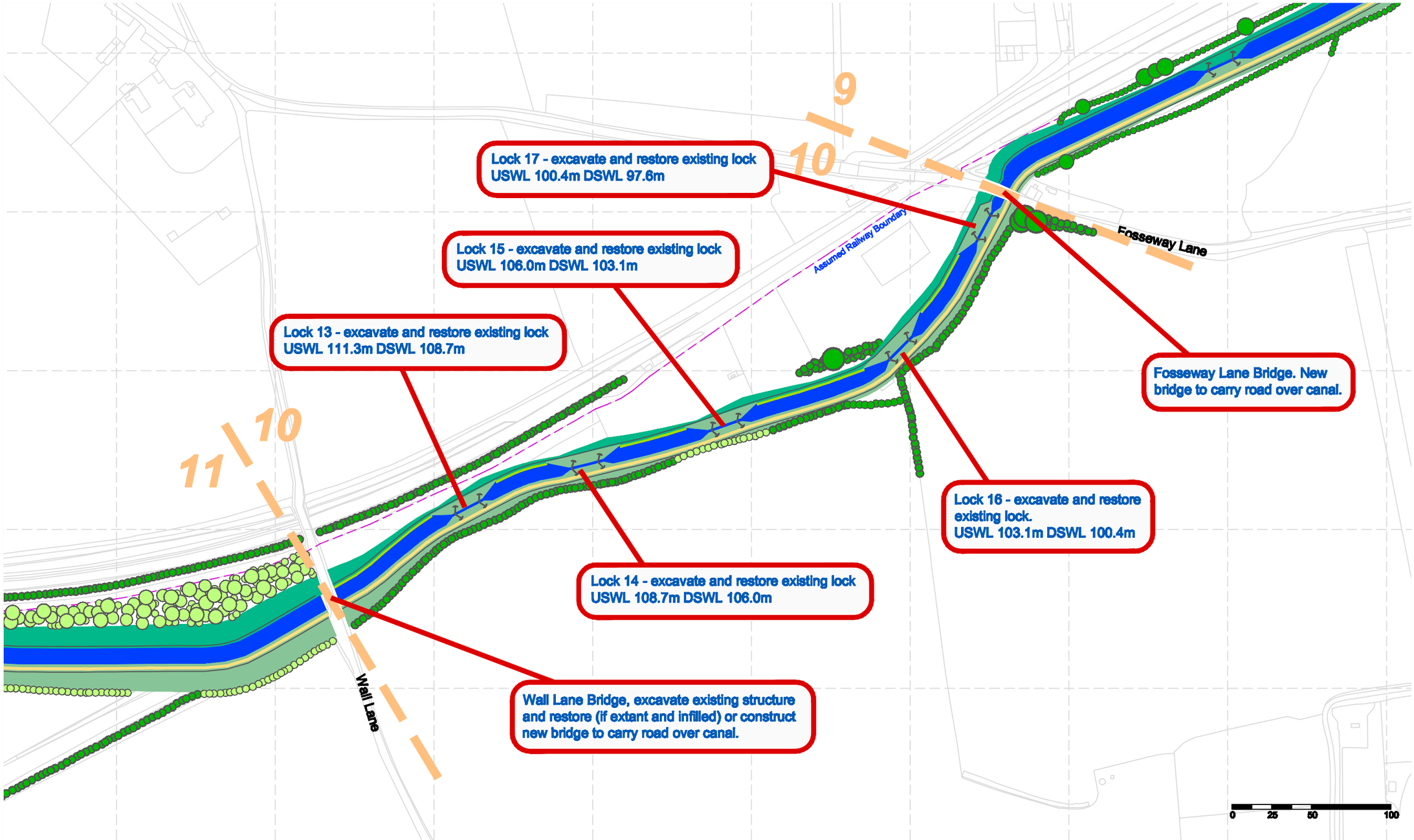
Restoration of Lichfield Canal



Proposal Map 10 - *Fosseway Lane to Wall Lane*

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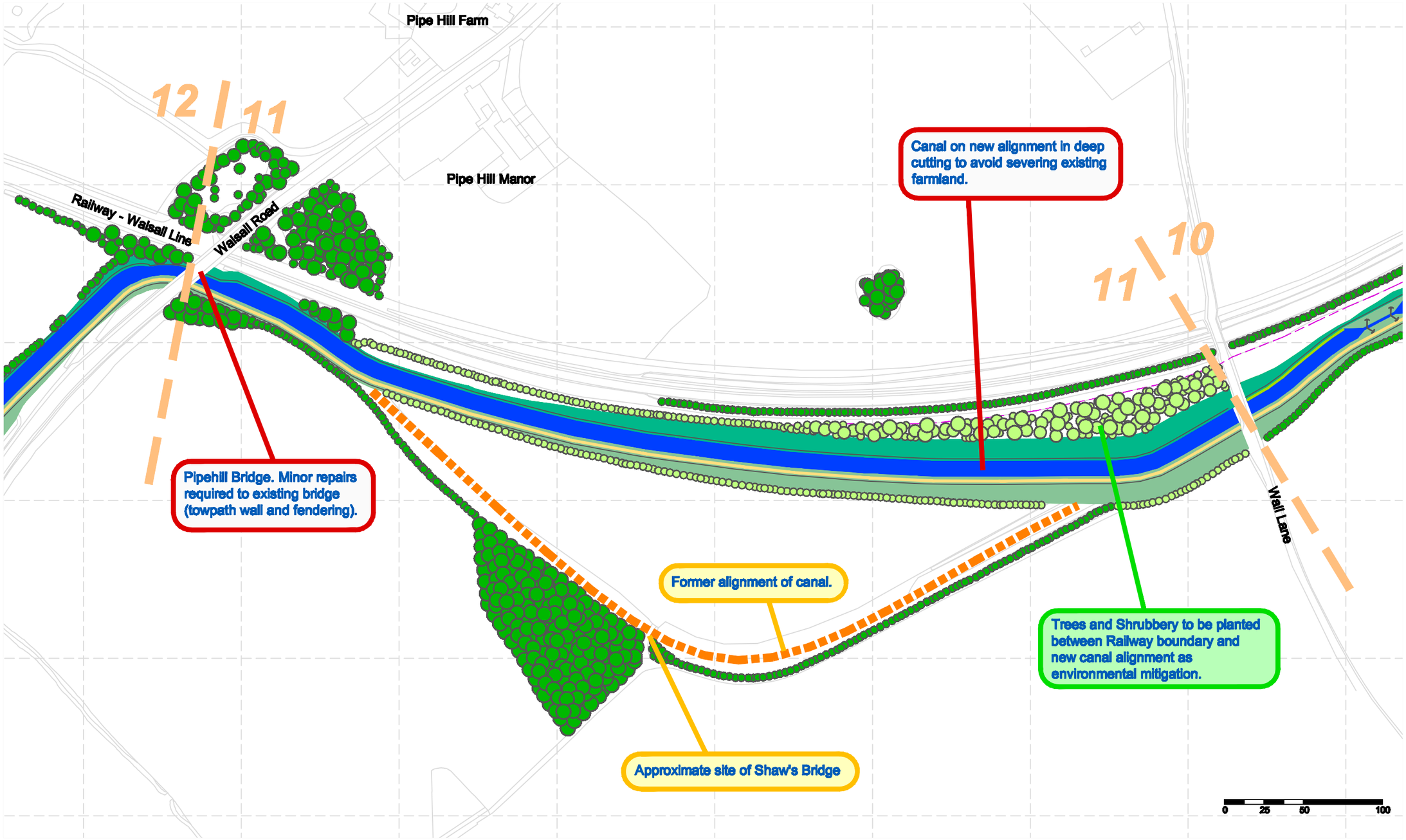
Restoration of Lichfield Canal



Proposal Map 11 - *Wall Lane to Pipehill Bridge*

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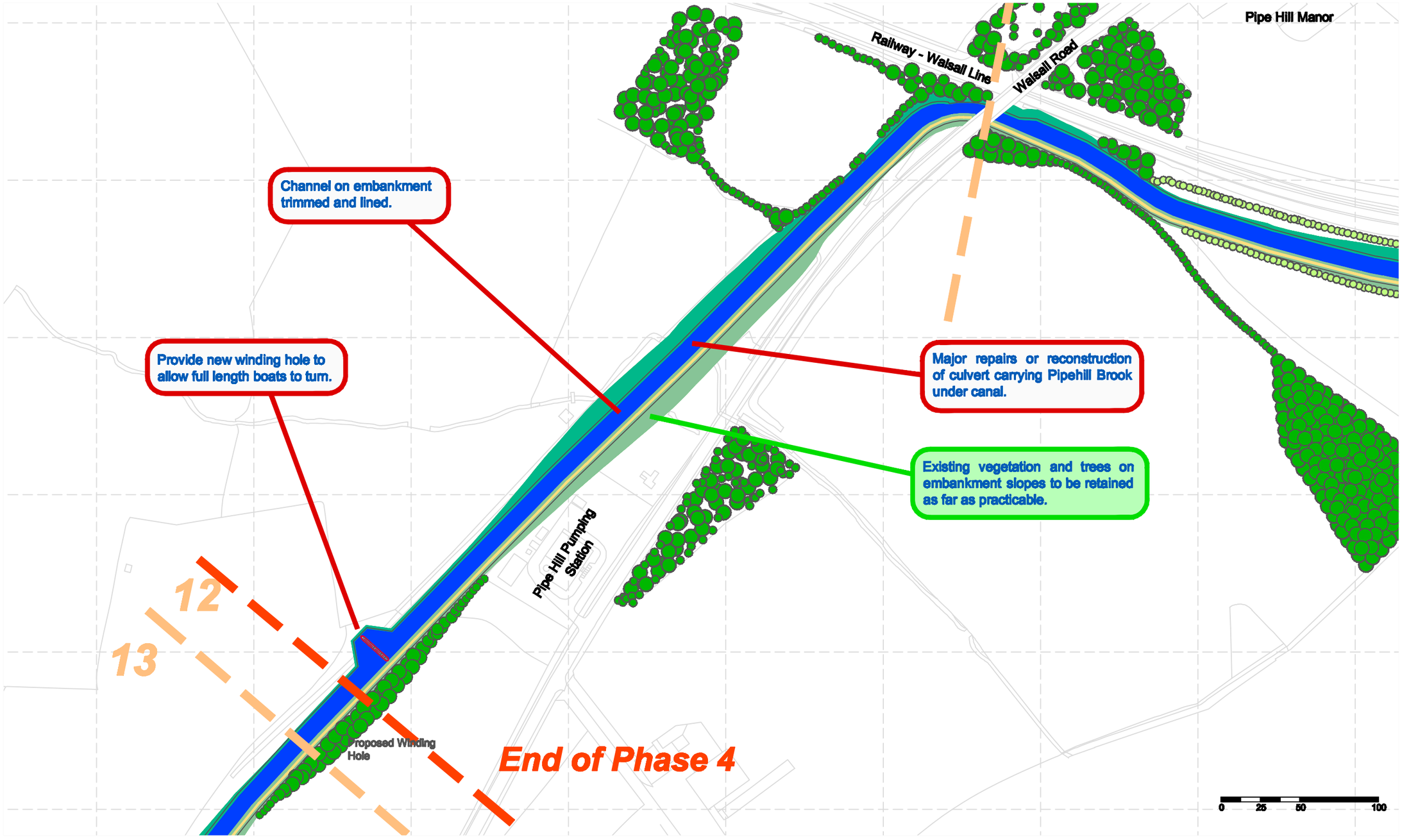
Restoration of Lichfield Canal



Proposal Map 12 - *Pipehill Bridge to Temporary Winding Hole*

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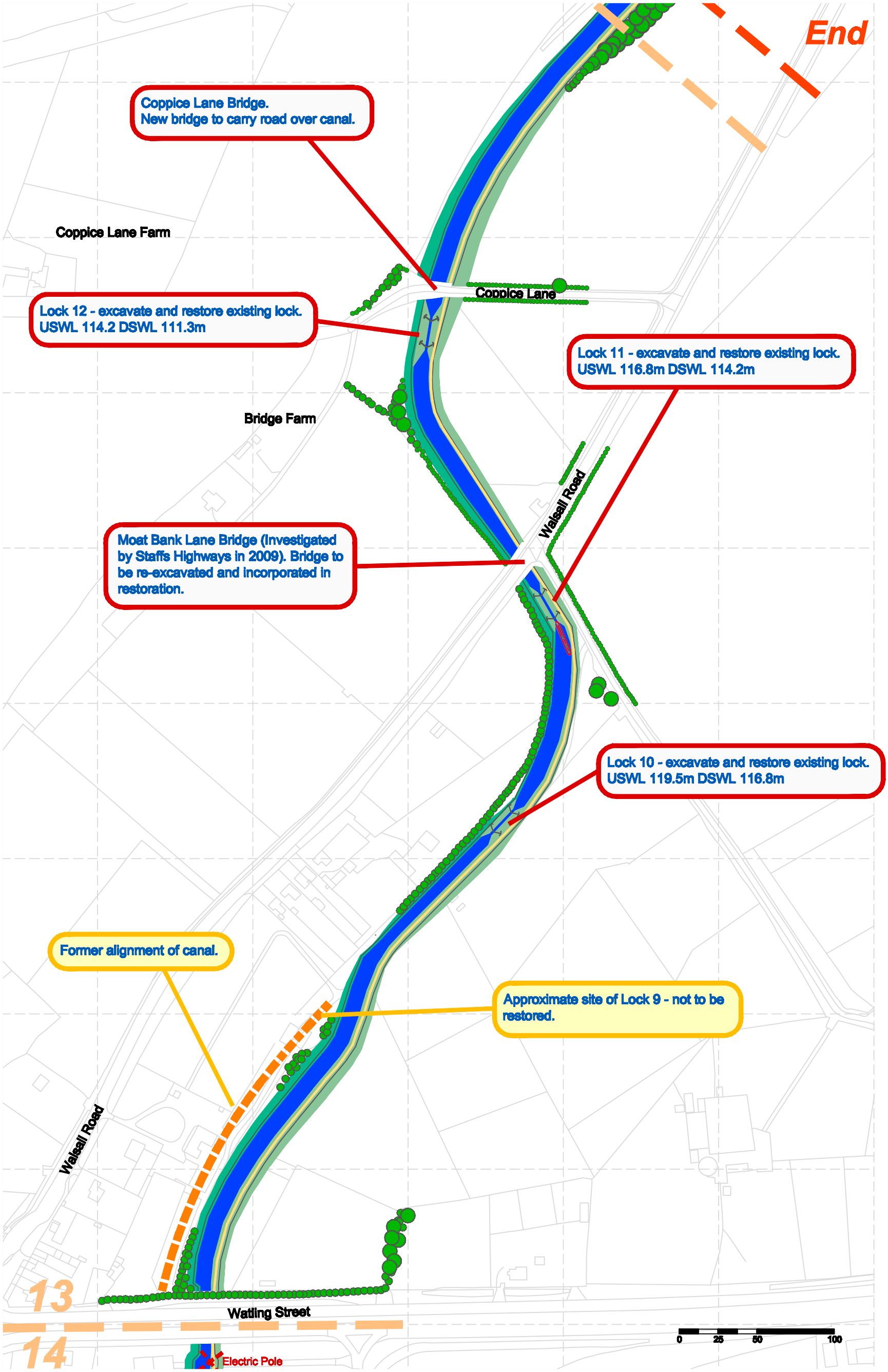
Restoration of Lichfield Canal



Proposal Map 13 - *Temporary Winding Hole to Watling Street*

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Proposal Map 14 - *Watling Street to Boat Inn*

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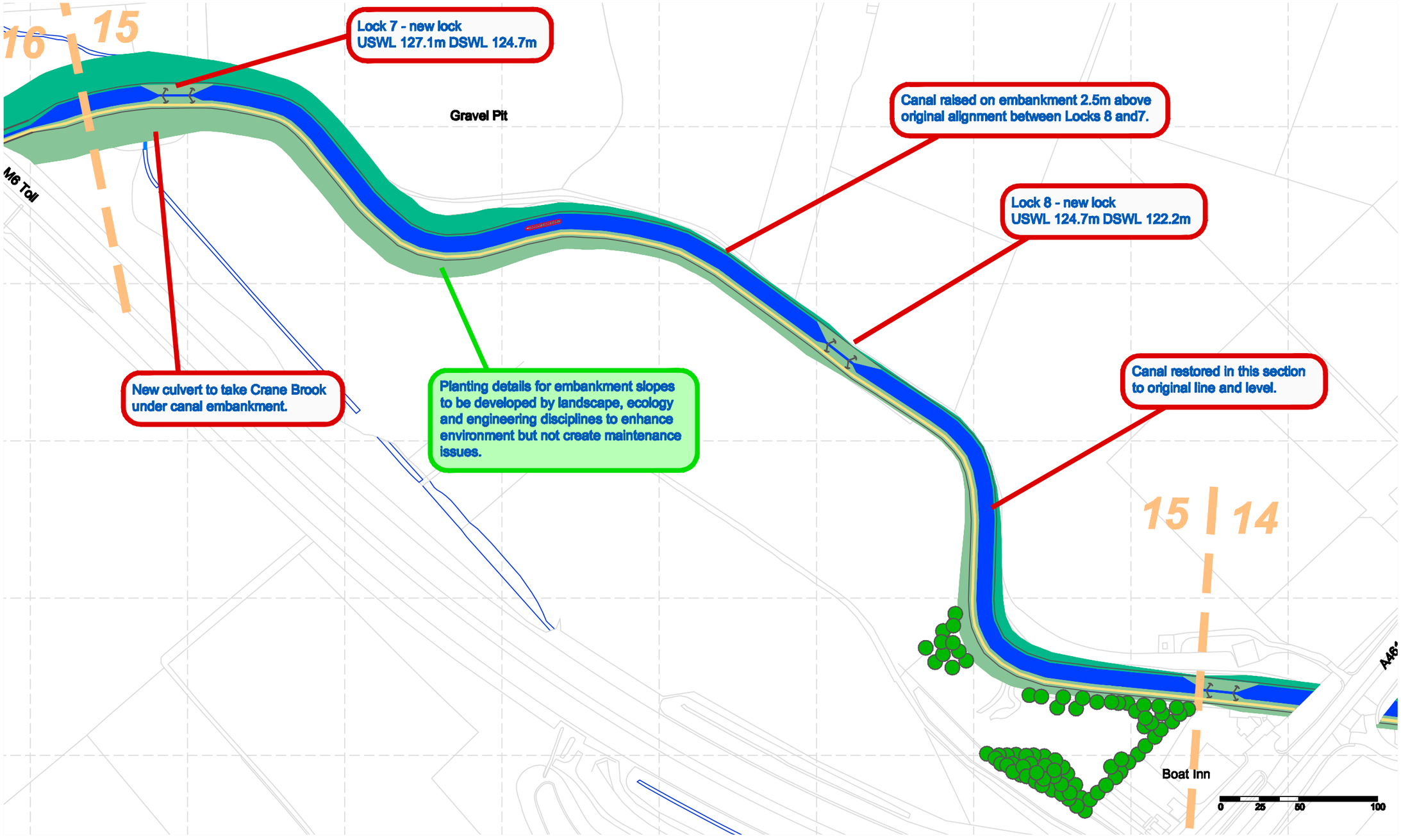
Restoration of Lichfield Canal



Proposal Map 15 - *Boat Inn to Crane Brook*

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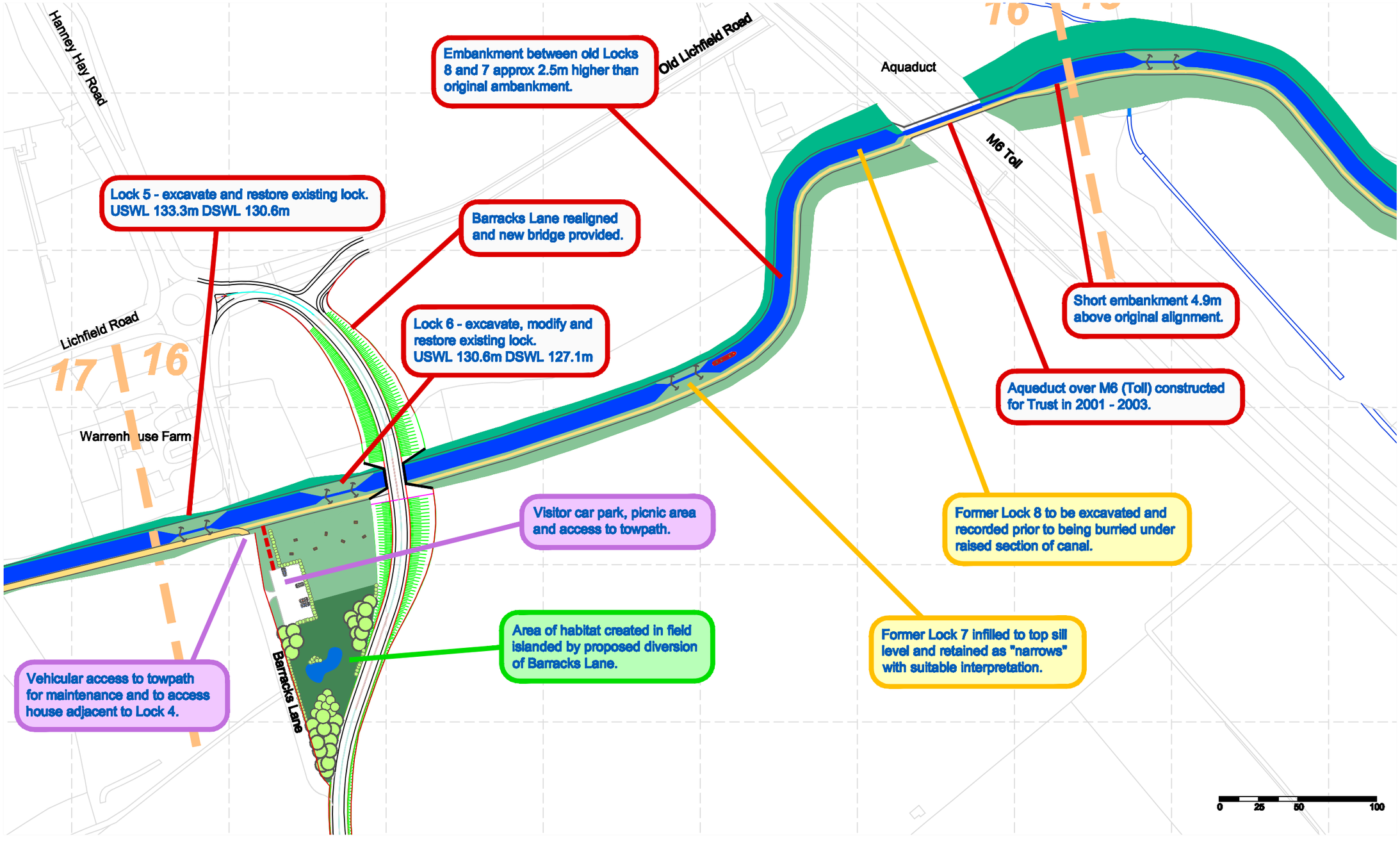
Restoration of Lichfield Canal



Proposal Map 16 - *Crane Brook to Barracks Lane*

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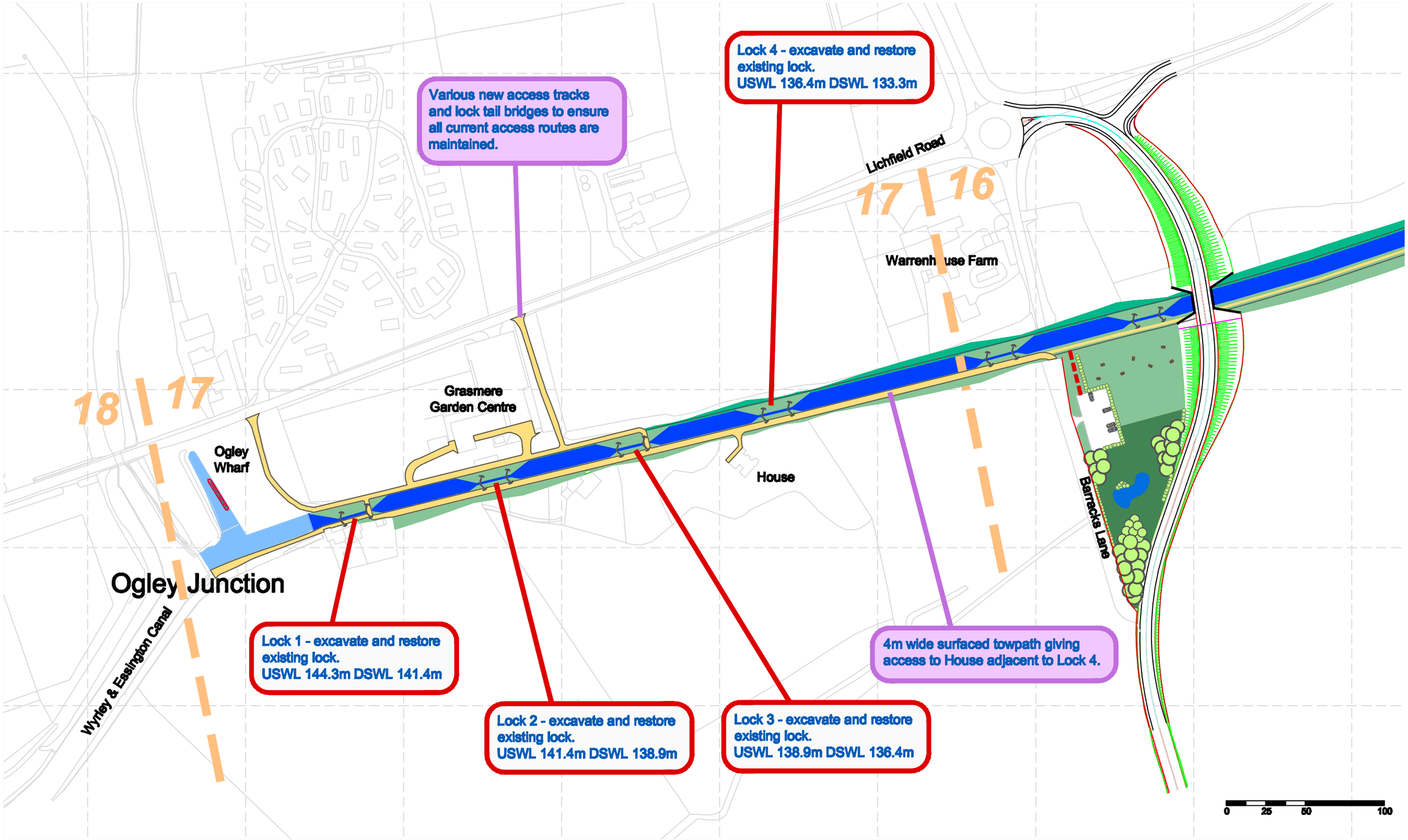
Restoration of Lichfield Canal



Proposal Map 17 - *Barracks Lane to Ogley Junction*

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Plan Design Enable