4.0 CONSTRAINTS ON RESTORATION

4.1 Changed Alignment

It is possible to restore much of the canal along its original route and at its original level. However, at the following two locations the horizontal and vertical alignments must be modified from those of the original canal:-

Park Road to Old Double Lock

From the Rainford Brook alignment, the original canal route turned sharp left beyond the overflow to Sankey Brook, ran parallel to Park Road A58 then sharp right at the road junction, where Blackbrook Road A58 crossed the canal on a swing bridge. From there the canal ran parallel to Boardmans Lane and thence to Old Double Lock.

St Augustines School, its grounds and its playing fields now occupy the original canal route and restoration of the canal on its original alignment would be unacceptable being so close to school buildings and involving the loss of a significant part of the school playing fields.

The Education Authority indicated that the school is one to which pupils are transferred from closed schools in the area and there are no closure plans. In addition, the Authority objected to the construction of the canal adjacent to the school on safety grounds. This decision also eliminated any new alignment that passed north of the school. Therefore, alternative alignments south of Boardmans Lane were investigated.

The alternative routes considered would both follow the western boundary of St Helens Wastewater Treatment Works (WwTW) from Old Double Lock, passing south of the Rugby Club, to Boardmans Lane. There are then two horizontal alignment options to return the canal to its original route beyond Park Road.

These two options and the original route are illustrated on drawing number AY2311/120/850/025 and the key factors affecting the vertical alignment are shown on drawing number AY2311/120/850/024.

Option One

The first option would take the canal between the Princess Royal public house and the houses on Park Road. This has less severe bends than the alternative but would

require a long culvert or tunnel to cross Park Road and the public house car park and it would require the IMO car wash to be relocated. The culvert length could be reduced by amending the car parking provision for the Princess Royal and nearby houses. If the canal were to retain its original vertical alignment, both Park Road and Boardmans Lane would need to be raised by approximately 1.6m to achieve the minimum air draft of 2.0m for the canal within the culvert. Such a change is not considered practicable at either location because of the close proximity of the road junction and the existing Parr Bridge respectively. The only feasible solution would be movable bridges at both locations.

Option Two

The second horizontal alignment option would run parallel and close to the Sankey Brook from Parr Bridge at Boardmans Lane to its confluence with Rainford Brook. It would then follow the line of Rainford Brook across Park Road, rejoining the original canal route near the existing overflow weir. This latter section would probably require the relocation of the scout huts and would have to take into account the Environment Agency's requirements for a "main river."

If the canal were to retain its original vertical alignment, Park Road would need to be raised at the canal crossing by approximately 1.0m to accommodate a moveable bridge or by approximately 2.8m to accommodate a canal culvert with the minimum 2.0 m air draft. At Boardmans Lane a moveable bridge would be required, as for the first option.

Discussion of Options

The Highway Authority, St Helens MBC, which was approached regarding the possible provision of either a lift or a swing bridge at both Park Road and Boardmans Lane indicated that, particularly in the case of Park Road, traffic volumes were such that any moveable structure be unacceptable. Therefore, alternative vertical alignments for this section were considered which lowered canal water levels sufficiently to pass under both Park Road and Boardmans Lane.

The most practicable way this could be achieved would be to reduce the lift at Old Double Lock creating a new pound level from there to beyond Park Road, where a new lock would be constructed. Unfortunately, this would mean that the historic Old Double Lock could not be used in its original form as part of a restored canal. It would be retained but bypassed, and a new lock constructed on a parallel alignment. This change in pound level also has implications for the Blackbrook Branch.

Retention of the original pound level above Old Double Lock would have allowed the lock to be restored and put back in use and would have minimised the depth of the new cutting around the playing field perimeter. However, it would have required new locks downstream of Boardmans Lane and upstream of Park Road. This would have created a sump level of canal which could not be recommended, particularly downstream of the Rainford Brook section of canal.

The preferred solution is to use the Option One horizontal alignment with the pound level lower than the original between Park Road and Old Double Lock, with the new Park Road Lock constructed off-line from Rainford Brook and with fixed crossings under Park Road and Boardmans Lane. This solution also preserves options for the future restoration of the Black Brook Branch.

Hulme Lock to Bewsey Lock

The Sankey Brook has been diverted into the original canal channel downstream of Hulme Lock and the channel bed has been lowered as part of a flood alleviation scheme. The dry canal channel from the Sankey Brook to Bewsey Lock is also part of this flood alleviation scheme and has been regraded to control flood flows to the canal from Sankey Brook. The flood defences constructed downstream on Sankey Brook rely on the correct operation of this overflow channel and the balance between flows in the Sankey Brook and the canal thus generated.

Any solution in this area will be subject to some navigation restrictions due to the flood levels which can occur in this section of Sankey Brook.

The reinstatement of the canal in its original channel and at its original level could not be achieved without affecting the flood regime and compromising the Environmental Agency's existing flood defence strategy. It would require extensive revisions to the flood defence works throughout the Dallam area and upstream of Cromwell Avenue. As an alternative, alleviation measures involving greater utilisation of the flood plain system upstream could be considered but these would involve compensation to landowners and works removed from the canal corridor.

The two restoration options considered for this section were the use of Sankey Brook over the section through Dallam and the construction of a new canal channel parallel to Sankey Brook.

Option One

The use of the Sankey Brook would appear to be by far the cheaper option. It would require the channel of the Sankey Brook to be deepened through Dallam to allow navigation and a weir downstream of the navigation reach to maintain navigable depth. Boats would lock down to the Sankey Brook via a new, deeper Hulme Lock and they would have to lock up to the canal near Bewsey via a new lock. This option has the major advantages that it would not require any service diversions and that it would provide sufficient air draft under all the existing fixed obstructions. Deepening of the canal would have an impact on the stability of the adjacent flood defences and may require shallowing of the existing bank slopes. Also, in order to obtain a navigable width, the existing river channel would need to be widened. As a result, significant earthworks would be required and some rebuilding of structures necessary.

The two locks into Sankey Brook would form a break in the hydraulic continuity of the canal and result in serious loss of water from the canal system. Water would be lost at each use of a lock unless backpumping were to be installed. To maintain water supplies to the lower pound from Bewsey to Widnes it would be essential to install back pumping at the downstream lock near Bewsey, preferably supplemented by a pipeline linking the two sections of canal to transfer by-wash water to the lower pound by gravity.

The abstraction would be drawn from Sankey Brook near Bewsey and would only be acceptable if the water quality in the Brook were to improve to Class 1/2. In addition, the abstraction would require a licence from the EA and would be subject to a number of conditions to ensure that the flow and quality within the Sankey Book was maintained at an acceptable level. The improvement formed behind the weir could have a detrimental affect on water quality, with dissolved oxygen levels likely to drop in this slow moving, deeper section of brook.

It is likely, therefore, that abstraction from Sankey Brook would be restricted during periods of low flows and this would impose limitations on the use of the locks. During periods of high fluvial flows, navigation on the Sankey Brook section would be restricted by high velocities. Furthermore, sediment carried downstream by Sankey Brook would be deposited in the navigable section, with a consequent demand for dredging.

Because of the serious implications for water supply to the lower pound, the additional dredging requirements and the likely restrictions to boat movements, which

could occur over significant periods during the boating season, it is considered that this option would not be acceptable. Its impact on water quality and the existing flood defences would required detailed investigation and substantial mitigation measures.

Option Two

The construction of a new canal channel parallel to the Sankey Brook would not be subject to such severe restrictions in boat movements, as the canal would only receive flood waters during extreme storm events. This option would involve modification to the canal vertical alignment to prevent restriction of the Sankey Brook flow by a new canal crossing. The highest practicable level that can be achieved for crossing the Sankey Brook would be by abandoning the original Hulme Lock and constructing a new lock downstream of the Sankey Brook crossing. This would allow the canal to cross the Sankey at a higher level, reducing the obstruction caused.

This option would incur additional costs due to the need to construct a new channel, divert services and overcome structural obstructions. However, it has the benefits of maintaining hydraulic continuity and of limiting restrictions to navigation due to high velocities during flood flows in Sankey Brook. It is, therefore, the preferred option.

4.2 Contaminated Silt and Fill

Investigative Work

The ground investigation, including sampling and testing of silt, natural soil and fill materials, is described in Volume 3 Technical Appendix - Geotechnics.

Contamination, mainly due to excessive concentrations of heavy metals, was detected in both canal silt and fill material. Although some samples with very high concentrations indicated unusually heavy contamination, it is considered that the handling and disposal of these materials would not constitute an insurmountable impediment to the dredging and excavation needed to restore the canal to navigable use. In any event, it could be considered to be highly desirable to remove such contaminated materials as part of a programme for the clearance of contaminated land.

The general principles set out in the Health and Safety Executive publication entitled "Protection of Works and the General Public During the Development of Contaminated Land" should be adopted for the dredging and excavation work.

The contamination testing programme, covering both canal silt and fill materials, was only intended to be a scoping exercise and it was not considered appropriate at feasibility study stage to classify sections of the canal in terms of their disposal requirements. However, the information gained should provide the basis for discussions with the Environment Agency and waste disposal site operators, regarding the acceptability of materials for disposal, the options for re-use, the need for further sampling and for any conditioning or pretreatment prior to disposal or re-use.

An additional, limited, programme of silt testing was undertaken to investigate if the addition of lime and/or other materials would improve the handling characteristics of the silt and, even, if it could be made suitable for re-use in earthworks. Initial results appeared promising but field trials would be needed to establish the economics of this process and further tests to determine the long term effects on lime stabilised silt of prolonged immersion under water and to demonstrate that this material would be environmentally acceptable.

If it could then be demonstrated that the silt, after stabilisation, could be re-used in earthworks construction or even better as a canal lining material, savings could be made in the canal restoration costs.

Water quality testing did not form part of this study but a previous investigation within the St Helens MBC area concluded in 1983 that water quality in the canal was adequate to good, apart from the "St Helens Industry" section, which needed improvement. The canal is used by local anglers which indicates that water quality is adequate to support coarse fish.

In-Water Sections

A legacy of the canals industrial heritage is the contaminants within the canal silt. The results of a sampling and testing regime has established that the silt in the in-water sections of the canal is highly contaminated as indicated by following;

- 10% of samples with Class C contamination
- 66% of samples with Class D contamination
- 24% of samples Class E contamination

In accordance with the Chemical Industry's classification system, where:-

Class A	-	Typical values for uncontaminated soils
Class B	-	Slight contamination
Class C	-	Contaminated
Class D	-	Heavy Contamination
Class E	-	Unusually Heavy Contamination

This classification would put all the silt into the most expensive price band for disposal to landfill (£40-£50/m^3), and its high moisture content would necessitate that the silt be dried prior to its acceptance by a landfill operator.

This therefore represents a major cost item in the canal restoration, however, it may also attract funds for cleaning up of contaminated land.

In the future, changes in legislation may require the canal authority or canal operating company to acquire a waste disposal licence for the disposal of dredgings.

Leachability tests were carried out on a small number of silt samples, which were specifically chosen as worst case examples, and these tests showed that the majority of contaminants are not readily leachable. This suggests that the silt in the canal bed has little direct effect on the water quality and currently does not adversely affect aquatic life, as witnessed by the marginal vegetation and fish present in the canal.

Dredging, even with low disturbance methods, will release bed sediments into suspension. It would be preferable, therefore, that fish be removed from each section of canal before dredging commences and that water in the completed sections be tested before their reintroduction.

From consideration of other canals with contaminated bed sediments, it is unlikely that, with full navigable depths in the canal, any disturbance of silt by boat propellers would cause problems for fish. Where problems do arise on inland waterways from silt plumes raised by passing boats, they usually result from highly organic silts causing a rapid reduction in dissolved oxygen, particularly in hot weather. Nevertheless, it would be prudent to conduct tests to confirm this before mixing boats and fish on newly dredged sections.

Infilled Sections

When sections of the canal were infilled, it appears that, generally, the silt was left in the bed of the canal and covered with the fill material. So, even if inert fill was used, the possibility of contamination must still be addressed when restoring the canal. The thickness of silt is likely to vary and more detailed ground investigations would be needed prior to the design of each section of the restoration works.

In the infilled sections of canal, from Hulme Lock to Winwick Quay and from Winwick Lock to Newton Brook, domestic refuse was used as the fill material. The only solution that can be recommended on these sections is the total removal from site of all refuse and refuse contaminated materials for proper disposal at a licensed landfill site. This would prevent the possibilities of landfill gas being produced under the bed of the restored canal and of the potential pollution of groundwater by leachate from the refuse.

4.3 Major Structural Obstacles

The canal was designed to accommodate sailing barges and, therefore, all the original canal crossings were on swing bridges to allow the passage of masted vessels. The present fixed structures, which replaced these swing bridges after the canal was abandoned, were at the level of the original crossing, generally leaving very little clearance above water level. Therefore, nearly every crossing not only prevents navigation but many also have little scope for regrading the road or railway to provide the required air draft for a new fixed crossing. This leaves very few options available for overcoming the obstacles caused at these traditional crossing points, other than replacement with swing or lift bridges.

The general approach adopted to the provision of new highway or railway crossings is to assume the use of concrete box culverts to convey the canal under the obstruction. Descriptions of all the proposed new structures is contained in Volume 2 but the problems presented by a number of major obstacles and their proposed solutions are also described below.

4.3.1 M62 Motorway Crossing (H15) - Chainage 12795

The M62 motorway crosses the canal on a high embankment at Winwick Quay, north of Dallam. This was built in the early 1970's immediately prior to the infilling of the canal in this area. However, the motorway construction drawings show 2 No 32" pipes beneath the canal to maintain its hydraulic continuity.

To re-open the canal it would be necessary to provide a new waterway crossing of the motorway.

The towpath would be diverted onto an existing public right of way which passes under the motorway through a span of the nearby viaduct. This diversion would accommodate the footpath, cycleway and bridleway in preference to routing them through a long tunnel.

However, the close proximity of existing houses and business properties, including the listed buildings on Old Winwick Quay, and their access roads would appear to prevent the possible diversion of the canal along this alignment.

The only practicable alternative at present would be to form a new canal crossing through the embankment. This would be approximately 70m long and the most economical method of construction would be to use a precast concrete box culvert, jacked through the embankment. With internal dimensions of 5.5m by 3.9m, this would provide a waterway 4.8m wide, with 2.4m air draft and an emergency escape route 0.7m wide.

It is understood that the existing embankment comprises compacted PFA fill material over a drainage layer approximately 1m thick. The level of this drainage layer is not known and can only be established through detailed site investigation work, which would be essential prior to the detailed design and costing of the crossing.

The height of the embankment is such that the depth of cover above the tunnel would be sufficient to allow proper control of surface settlement, which would be a major constraint on the design of the crossing and on the construction method adopted. Surface settlement increases with reducing depth of cover between the surface and the top of a tunnel. However, tunnel construction and the containment of settlements is easier when homogeneous material and dry conditions are encountered throughout the drive.

There could be advantages, therefore, in raising the level of the tunnel so that it lay totally within the PFA fill and above the drainage layer. This would require the level of the canal to be raised and Winwick Lock to be relocated to the south of the motorway. The desirability of this option would be determined through detailed ground investigation, discussions with specialist contractors and with Cheshire County Council, acting on behalf of the Department of Transport. There would be only marginal differences in the total cost of the crossing.

There are proposals, currently programmed for 1998, for widening this section of motorway, by adding one lane in each direction, which would increase the length and hence the cost of this crossing. The Highways Agency have been advised of the proposed restoration of the St Helens Canal and the need to construct a new crossing of the motorway. It would be beneficial if the Department of Transport could be persuaded to include, within the motorway widening contracts, measures designed to facilitate future canal crossing and the ground investigation necessary for its design.

4.3.2 Sankey Way Culvert (K13) - Chainage 8,855

The canal currently passes under Sankey Way dual carriageway in a concrete box culvert which has an air draft of 0.68m. To allow navigation it is proposed that this culvert be demolished and replaced with a new reinforced concrete twin box culvert. One section, with internal dimensions of 4.8m wide and 3.9m deep, would carry the canal. The other section would have internal dimensions of 3.0m by 2.4m and would accommodate the towpath.

Construction would be carried out in two phases. At any one time one carriageway would be closed to allow installation of the new box culverts. The other carriageway would remain open to maintain traffic flows. Suitable traffic management procedures would be adopted.

Either side of the culvert, sections of the central reserve would be surfaced to allow installation of the traffic management. With the increase in height of the new structure the carriageways above would be regraded accordingly. Services which pass over the structure would be diverted prior to construction. Petrol interceptors would be installed as the existing highway drainage would be severed by the new structure.

Channel air draft would be 2.4m and minimum headroom to the towpath 2.3m.

4.3.3 Liverpool Road Bridge (L1) - Chainage 8,155

The bridge which now carries Liverpool Road over the canal replaced an earlier bascule bridge which itself had replaced the original swing bridge. With an air draft of only 0.5m it impedes navigation and would have to be demolished and replaced with an alternative form of construction.

A reinforced concrete box culvert was considered but discounted because it would require the carriageway to be raised by approximately 1.3m. The existing vertical alignment of the carriageway is poor and there are numerous junctions near the canal.

Regrading this road would create a potential high risk accident area and would disturb several nearby properties.

To maintain the existing vertical road alignment, a moveable bridge would be required. Both lift and swing bridges were considered. Due to the overall size of the structure, with a 7.3m wide carriageway and two 1.8m wide footways, a swing bridge was selected for the purposes of this feasibility study. The final form of the bridge would be the subject of a design study. The bridge would be power operated and designed to carry full highway loading (HA and HB load). The design of the new bridge would be subject to the approval of Cheshire County Council, as the Technical Approval Authority.

To minimise delays to road traffic through opening of the bridge it is suggested that it should not be operated during peak hours ie. 07.00 to 9.00 and 16.00 to 18.00 Monday to Friday.

During construction, road traffic and pedestrians would be diverted over a temporary earth bund constructed in the canal. The existing, presently disused, swing bridge nearby could also be used as a diversionary route. The existing utilities in this area would be diverted prior to construction.

The towpath would cross Liverpool Road via a pedestrian crossing at this location.

4.4 Blackbrook Branch

The chemical pipelines laid along the bed of the Blackbrook Branch do not inhibit water flow but their removal or engineering works to permit navigation with the pipes remaining would be very expensive and strictly controlled by the Health and Safety Executive.

The bridge carrying Blackbrook Road over the Blackbrook Branch is now a fixed bridge with insufficient air draft. A swing bridge is unlikely to be acceptable at this location and, so, unless the bridge were to be replaced with increased air draft as part of the proposed improvements to the A58, which links the town centre with the East Lancashire Road, a revised vertical alignment of the canal would be needed if navigation to the head of the branch is required.

The restoration of the Blackbrook Branch to navigable standards is not proposed at this stage, since the cost of overcoming the problems presented by the multiple pipeline and the fixed road bridge is considered to be disproportionate to the benefits

gained. However, nothing should be done that would prevent restoration in the future. Water would be retained at its present level and if, in the future, full restoration of navigation was required, the vertical alignment could be determined on the basis of the obstructions then present.

It is understood that a diversion of the A58 planned by St Helens MBC is likely to proceed in 1997. This diversion will commence at the bridge over the canal and, thus, further consolidate a low level fixed bridge at this location.