Coles Baxter Associates LLP

Heritage Management, Heritage Led Regeneration & Cultural Tourism

Final Report

Manchester & Salford Junction Canal: Restoration Scoping Study

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Manchester & Salford Junction Canal: Restoration Scoping Study

Summary

This study has identified four options for the restatement - in memory, in part or in whole – of the Manchester & Salford Junction Canal.

Option A: Remembered Water / A Memory Space – create a walking and cycling corridor along the line of the waterway. May be linked (Option A Plus) with the development of the canal tunnel as a tourist destination in its own right.

Option B: New Brunswick Basin – Reinstate the canal from the River Irwell to the centre of the St. Johns site. May be linked (Option B Plus) with the development of the canal tunnel as a tourist destination in its own right.

Option C: Irwell to Great Northern Warehouse (or 'The 1904 Canal') – Reinstate the canal as far as the underground wharf below the Great Northern Warehouse.

Option D: Irwell to Rochdale Canal (or 'The 1839 Canal') – Reinstate the entire waterway and recreate a through navigation to the Rochdale Canal.

Options A and B are compatible with the development of the historically significant Tunnel Air-Raid Shelters as a visitor destination and / or museum (Options A Plus and B Plus, respectively).

Options C & D require the removal of these significant historic monuments and this is considered to be a major stumbling block in their short term development.

Headline Costs and Benefits

It was concluded that Option B is the most likely to produce a reasonable return on investment in the medium term (five years) and is capable of covering its own annual operational and maintenance costs.

Only Option B can contribute effectively and cost effectively to the sustainability of the St. Johns site as a whole through providing cooling and heating, flood relief and sustainable urban drainage.

Recommendation

This report recommends the adoption of Option B Plus.

This would provide the optimum balance between the needs of the historic environment and the commercial needs of development. It would enable the development of the tunnel air-raid shelters as a museum which would partner and, by providing a very human story, complement the adjacent Museum of Science and Industry.

Option B Plus would not preclude the development of options C or D at some point in the future when the funding climate, financial circumstance and development pressures may have changed considerably.

Next Steps

The report identifies the next actions to be taken to develop New Brunswick Basin and the Air-Raid Shelter visitor destination.

1 Introduction

1.1 Introduction

1.1.1 The Manchester and Salford Junction Canal was a product of the intrigue and politics of the canal age and is an important part of the rich waterway heritage of Manchester – a city that owes much of its growth and early success to water transport.

1.1.2 The Friends of Manchester's Underground Canal (The society for the Manchester & Salford Junction Canal) seek the preservation, conservation and eventual restoration to navigation of the Manchester & Salford Junction Canal (M&SJC).

1.1.3 This initial study was commissioned by them to explore the feasibility of, and options for, the future development of the Manchester and Salford Junction Canal.

1.1.4 The study sets out the history of the canal and its corridor. It assesses the current condition of the route and the surviving canal structures as far as is known without undertaking invasive exploration. It then explores and appraises potential options for the development and restoration, in whole or in part, of the M&SJC, in the context of current regeneration proposals in central Manchester. To do this it makes an initial (outline) cost / benefit assessment of each development and restoration option.

1.2 The Manchester & Salford Junction Canal

1.2.1 The Manchester and Salford Junction Canal is Manchester's Lost Waterway – opened at the end of the canal era in 1839 the waterway offered a direct route from the Rochdale Canal to the River Irwell and thence to the Manchester, Bolton and Bury Canal thus avoiding transhipment and the cartage of goods across Manchester.

1.2.2 The canal originally ran for 5 furlongs (1 km) between the River Irwell southwest of Quay Street, to a branch of the Rochdale Canal southeast of Lower Mosley Street. From the Irwell the route climbed by two locks to reach the western warehouses and side arm (Brunswick Basin or Potato Market Wharf) and then passed through a 499-yard (456 m) tunnel before ascending by two further paired locks to reach the Rochdale Canal. For about half the route it was in a tunnel.

1.2.3 The hoped for through trade never lived up to expectations and the waterway was quickly sold to the Mersey and Irwell Navigation Company. The through route was lost in 1875 when the eastern end was abandoned and infilled during the construction of Manchester Central Station. Although the tunnel was disused trade on the western end continued. In 1899 the tunnel reopened when the Great Northern Warehouse was built over the canal tunnel with hoists to the waterway below to enable direct loading. In spite of these improvements trade continued to decline and the last regular use of the western end was around 1922. The entire waterway was formally abandoned under a Manchester Ship Canal Act of 1936 (Hadfield 1970).

1.2.4 This was not the end of activity on the route as during the Second World War the canal was drained and the canal tunnels converted to air raid shelters. The rest of the open air route was infilled during and immediately after the Second World War. In the late 1950's the land was used for the development of Granada Studios. Little is now visible although at the

western end the original entrance from the River Irwell and Lock No.1 is still visible. The Rochdale Canal arm which led to the eastern entrance to the M&SJC has been redeveloped into a small canal basin behind the Bridgewater Hall.

1.3 Opportunity and Context

1.3.1 The formal abandonment of the canal in 1936 was followed by a long period of development and re-development. Until recently the presence of the Granada TV Studios over much of the western end of the route prohibited any thought of restoration. Recently, however, Granada Studios have re-located to Media City in Salford and there are proposals to redevelop the site within the strategic regeneration plan for Manchester City Centre.

1.3.2 As a result there have been several masterplan proposal for the area, to be known as the St. Johns Quarter, most notably the 'St. Johns, Manchester: Strategic Regeneration Framework' (Deloitte in 2014). This made broad brush proposals but it is clear that if the canal is to feature in more detailed plans such proposals must be made at this preliminary stage.

1.3.3 Much work has already been done on understanding the heritage of the site, including the canal line (Levrant 2014). This has also highlighted the importance of some of the post-canal buildings and structures. The need is therefore for proposals which balance and integrate these different heritages in an economically sustainable manner.

1.3.4 The Granada Studios regeneration site is immediately north of the Manchester Museum of Science and Industry (MOSI). Now part of the National Museums network MOSI is undergoing a major redevelopment programme to broaden the appeal of its exhibitions and displays and to more completely tell the story of Manchester as "the world first industrial city". Waterways played a key role in this development (Maw 2013) but are currently under represented in the MOSI galleries. There may therefore be opportunities to link waterway developments on the M&SJC route to the re-development of MOSI. Plans for the MOSI redevelopment are ongoing.

1.3.5 Further, the on-going development of the Irwell River Park along the western boundary is opening up a new green space for the cities of Manchester and Salford. That, together with the restoration of the Manchester Bolton and Bury Canal on the west bank of the Irwell, provides a potential destination and rational for reinstatement of the M&SJC as part of a wider development strategy for the waterways and waterside of Manchester, Salford and surrounding towns.

1.3.6 In order to seize this once in a generation opportunity it is necessary to explore the feasibility of restoration and evaluate the impact this could have on existing economic regeneration plans.

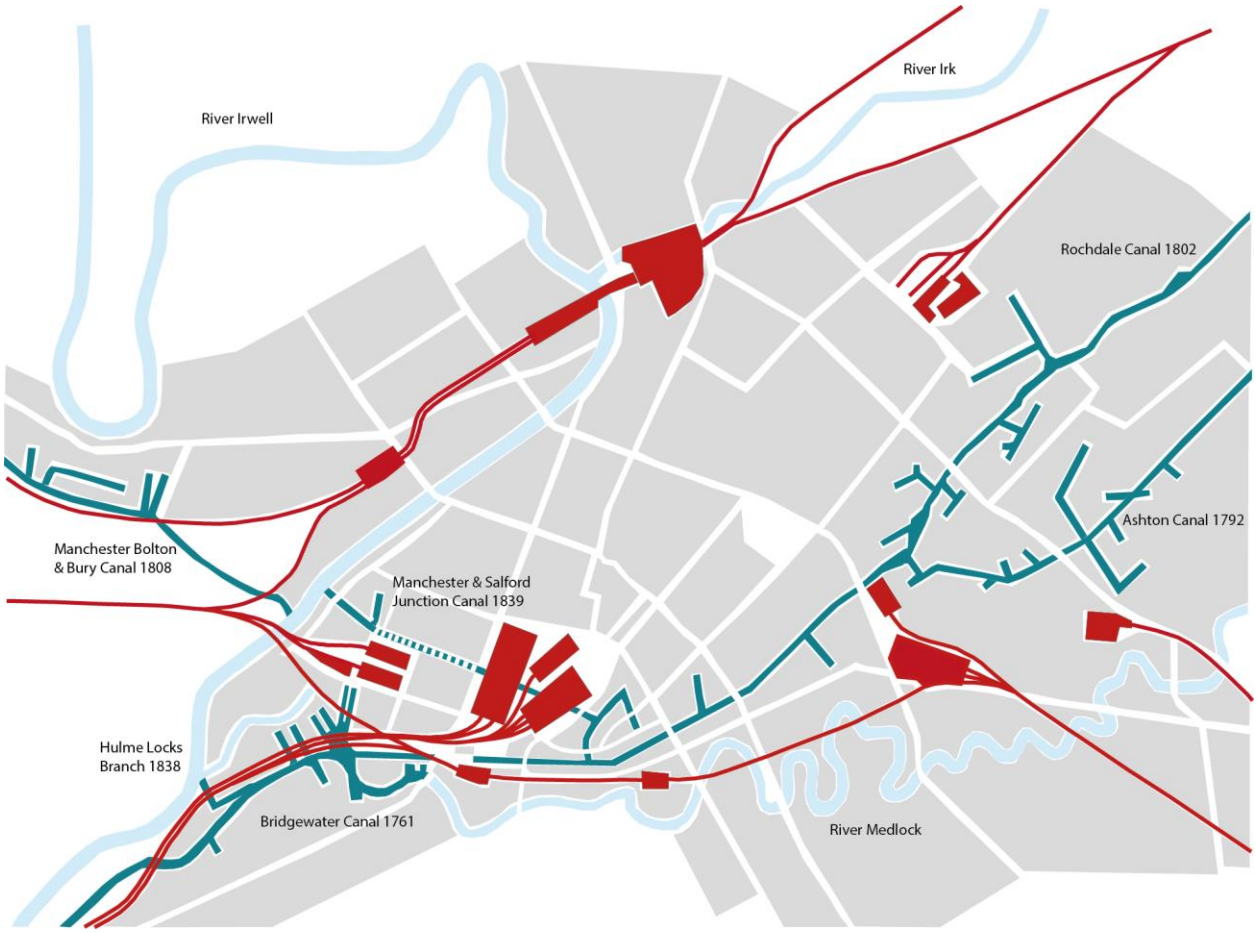

Figure 1.1 Location of the Manchester & Salford Junction Canal within the canals of Manchester. Canals are dark blue, rivers light blue. Main railways and principal stations are shown in dark red.

2 Heritage

2.1 Location and Route

2.1.1 The Manchester & Salford Junction Canal was located on what was the south-western side of the rapidly expanding industrial city of Manchester.

2.1.2 When opened the M&SJC ran for 5 furlongs (1 km) between the River Irwell southwest of Quay Street, to a branch of the Rochdale Canal southeast of Lower Mosley Street, largely through a 499-yard (456 m) tunnel. It can be considered in three parts from west to east:

- West: An open section from the River Irwell and the Irwell Bridge (also known as Water Street Bridge) to the Junction of Charles Street, Camp Street and Atherton Street.
- Central: A tunnel from Atherton Street under Camp Street and Deansgate which emerged immediately east of Watson Street.
- East: An open section from Watson Street to Lower Mosley Street Bridge where it joined an arm of the Rochdale Canal.

2.1.3 The arm of the Rochdale Canal which linked the end of the M&SJC to the Rochdale Canal mainline can be considered to be the fourth section of any through route and is, of course, relevant to any potential restoration.

2.1.4 Between 1839 and 1936 the canal underwent significant changes which are outlined below. Following abandonment the route continued to be used and reused - even once drained it continued to play an important part in the Manchester story. Today the route is hard to trace and this has an obvious impact on the visibility and interpretability of the heritage as well as the feasibility of restoration proposals.

2.2 Outline History of the Manchester & Salford Junction Canal

Origins

2.2.1 Manchester owed a considerable measure of its early growth and prosperity to its burgeoning canal network and position at the head of navigation and the Mersey and Irwell Rivers (Williams 1992, Maw 2013). The Manchester and Salford Junction Canal was a late addition to the network, created in response to the lack of any direct canal link between the Mersey and Irwell Navigation (and the Manchester, Bolton and Bury Canal) and the Rochdale Canal. The lack of a link meant that goods being transported between destinations on these waterways had to be offloaded onto carts and carried across the city, before being loaded back onto boats to continue their journey. This was costly and time-consuming. It was also widely seen as contributing to congestion on the streets of Manchester (Maw 2013).

2.2.2 Several proposals were made to overcome this problem, the first was in 1799 when the Manchester, Bolton & Bury Canal Company proposed to extend their canal from its then terminus in Oldfield Road in Salford across the River Irwell on an aqueduct to join the Rochdale Canal. Strong objections were made by the Mersey and Irwell Navigation who feared a loss of trade and the link was not made (Hadfield 1970). Although the MB&B

would later link to the River Irwell and the Mersey & Irwell Navigation it would continue to support a direct link to the Rochdale Canal and in 1801 considered making proposals to the Mersey & Irwell Navigation for "a navigable tunnel from the Old River Navigation towards the Rochdale Canal" (Hadfield 1970, 126).

2.2.3 The transhipment issue certainly did not go away. In 1805 it was the turn of the Mersey & Irwell Navigation Company to propose a link. They asked the engineer, John Nightingale (who, along with Charles Roberts, was the engineer of the 1796 Clifton Aqueduct on the Manchester, Bolton & Bury Canal), to estimate the costs of a canal link between Manchester and Salford. The cost was estimated at £12,100, however, again no action was taken (Hadfield 1970, 127).

2.2.4 In spite of buoyant trade in Manchester and the rising cost of transhipment it was not until July 1836 that an act was passed for the construction of a link and John Gilbert was appointed as engineer (Lead 1990).

Building the Canal

2.2.5 John Gilbert's 1836 plan for the waterway differs in many details from the waterway as built (see Canalmaps Archive B043). What did remain, however, was the gauge – the M&SJC as built was a broad canal with locks capable of taking Mersey Flats and Rochdale Boats.

2.2.6 At the west end the 1836 plan shows three locks climbing to the tunnel entrance. As built there were only two locks, the second of which was positioned much closer to the river. At the east end there are three locks which are spaced apart and on a different alignment to the two linked, paired, locks as built. It is probable that all the locks were built deeper than originally planned enabling two of them to be eliminated from the design.

2.2.7 As built there were four locks; two to the west and two to the east of the tunnel:

2.2.8 Lock No.1 Irwell River Lock. This was the entrance to the canal from the River Irwell. It was a brick built single chamber lock with stone copings and with double mitred gates. The primary function of the lock appears to have been to permit entry to the river under different heights of flow.

2.2.9 Locks No.2. This was immediately east of the Irwell (Water Street) Bridge. As built it consisted of two parallel chambers each with double mitre gates hence the M&SJC description of "Locks No.2" plural.

2.2.10 Locks No.3 and Locks No.4 (not named). These were to the east of Watson Street (and the eastern entrance of the Canal Tunnel). Like Locks No.2 both Locks No.3 and Locks No.4 consisted of two parallel chambers but here both sets of chambers were linked to form two parallel staircase locks (where the top gates of the lower chamber, No.3, are the bottom gates of the upper chamber, No.4).

2.2.11 The tunnel appears to have been built on the intended alignment of 1836.

2.2.12 To maintain water in the M&SJC required pumping from the River Irwell. The 1836 plan addressed the canal's water supply by a single small diameter tunnel – described as "The head or driftway for supplying the engine with water" - which was to be driven from the River Irwell to an "Engine Shaft" above the top lock. An "engine house" is marked on the

east side of Watson Street but this does not correlate with the position of the shaft as shown on the cross section. Clearly the plan was a 'work in progress'.

2.2.13 As built, the single pump house was replaced by two – one to the west drawing water from the Irwell to above Lock No.2 (the tunnel pound) and the second to the east drawing water from the tunnel pound below Lock No.3 to above Lock No.4. The pump houses and boiler houses were sited on the north bank of the waterway.

2.2.14 The need to store pumped water to cope with periods of high demand most likely led to the abandonment of two planned canal arms on the summit level and their replacement by a small off-line reservoir.

2.2.15 The short M&SJC terminated at a stop gate (unnumbered) immediately to the west of Lower Mosley Street Bridge.

2.2.16 Construction must have not been without its technical challenges as the route passed through and under a crowded part of Manchester (Fletcher et al 1990). In spite of its exceedingly short length it was not until Monday 28th October 1839 that the Manchester & Salford Junction Canal opened to traffic.

Operation as a Through Route

2.2.17 From the outset the canal was hamstrung by legal restrictions on water supply as its Act of Parliament prohibited the drawing of water from the Rochdale Canal. To prevent abstraction the act stipulated a stop gate at the junction of the two waterways and required that the water level in the top pound of the M&SJC would be (when the stop gate was not open) 3" higher than that of the Rochdale Canal. In consequence all the water in the canal had to be pumped upwards from the River Irwell by two steam pumps. The operation and maintenance of these pumps was to prove a great liability.

2.2.18 The stop gate delayed through traffic as the opening of the stop lock (required to keep the M&SJC top pound 3 inches higher than the adjacent Rochdale Canal) would have required dropping the entire pound or forcing the gate – both time consuming.

2.2.19 A further operating cost came from the provision of gas lighting in the tunnel – this was supplied from a gasometer at the west end of the tunnel. Lighting was present along the towpath side of the canal. The towpath itself was on the north side and was intended for man haulage through the tunnel. It is not known if the gas lighting was abandoned before the tunnel itself become disused.

2.2.20 The M&SJC also faced competition from the Bridgewater Canal Company who on 20th September 1838 opened their Hulme Locks Branch. This provided an alternative route from the Rochdale Canal to the River Irwell which, as it did not require pumping, was considerably cheaper to operate. This effectively undermined the potential trade on the M&SJC even before it opened.

2.2.21 Unsurprisingly the initial returns were poor and the waterway was plagued by technical and legal problems. While the technical problems were resolved and the addition of the Brunswick Basin arm in 1841 (Dean 2001) provided some additional traffic to and from the Irwell, through trade did not increase.

2.2.22 As trade languished the costs of operation were rising and by April 1841 the board were to offer the waterway to the Mersey & Irwell Navigation for the sum of £30,750 and

accumulated debts of c.£20,000. Although this was £10,000 less than the M&SJC was built for, the M&IN had already invested heavily in the canal and held nearly half the shares. Predictably this offer was refused. The financial situation continued to deteriorate and in June 1841 the Manchester & Salford Junction was again offered but this time "for nothing if it were freed from all debts and liabilities at the date of transfer" (Hadfield 1970, 129). This time the Mersey & Irwell Navigation company reluctantly accepted as it was obvious that if they did not the canal would almost certainly close. In early 1842 the M&SJC officially became part of the M&IN.

2.2.23 The Mersey and Irwell Navigation Company offered extensive discounts on the use of the route by some traffics but this did little to encourage trade. By 1869 the M&SJC section was barely breaking even and it was clear that while its western (Irwell River) end and its associated canal arm served several important depots and warehouses its value as a through route was practically nothing.

2.2.24 By 1870 the Mersey and Irwell Navigation itself was facing problems with railway competition and a lack of investment and in 1872 was bought out by the Bridgewater Canal Company (Hadfield 1970). The latter company owned the Hulme Locks Branch which provided an alternative, and cheaper to operate, route from the Rochdale to the M&IN and the MB&B Canal. The writing was on the wall for the M&SJC as a through route.

Truncation and Operation as a Branch Canal

2.2.25 The end for the eastern end of the M&SJC and its link to the Rochdale Canal came about on the 13th April 1872 when the Cheshire Lines Committee (formed of the Midland Railway, the Great Northern Railway and the Manchester, Sheffield & Lincolnshire Railway) agreed with the Bridgewater Navigation to carry their tracks over the canal to give access to their new Manchester Central station. A later act in 1875 empowered the Cheshire Lines Committee to "close and fill in the canal between Lower Mosley Street and Watson Street, on paying compensation to the Bridgewater Company" (Hadfield 1970, 365).

2.2.26 The new station works lay to the east of the Watson Street entrance to the Canal Tunnel and removed Locks 3 & 4 together with the upper pumping station and the small canal reservoir between the canal and Great Mount Street. The Eastern Portal of the Canal Tunnel was walled up at Watson Street. The rest of the tunnel itself was left open but saw no further traffic.

2.2.27 The canal east of Watson Street was closed by late 1875 and railway construction proceeded quickly - a temporary Manchester Central station was opened on 1st July 1878 on the site of what became the good yard; the permanent station (the building still visible today) opened on 1st July 1880 (Dow 1985, 137-139).

2.2.28 Notwithstanding the loss of the infrequently used through route, the western end of the waterway and the Brunswick Basin remained active. Trade from 1875 to the 1890's was reasonably steady if not spectacular.

Reinvention: The Manchester Ship Canal and the Great Northern Railway

2.2.29 To enable the construction of the Manchester Ship Canal the new company purchased the Bridgewater Canal in 1887 (Hadfield 1970, 371). The new ship canal opened in 1894 and was largely built upon the lower part of the Mersey and Irwell Navigation but terminated to the east of central Manchester. The upper Irwell Navigation would be unaffected but

would now connect directly with the Manchester and Salford Docks and would benefit from a slightly raised and more stable pound level.

2.2.30 It was this opportunity to tap trade transhipped by barge directly from the new docks which persuaded the Great Northern Railway to incorporate a Canal interchange into their new Deansgate Goods Station. A massive good warehouse was opened in 1899 – still known as the Great Northern Warehouse – was built over the line of the waterway. Below the warehouse the tunnel was enlarged; two canal arms at 90 degrees to the main tunnel ran northwards under the warehouse - a pair of goods hoists gave access to the canal arms from the warehouse (Grinling et al 1966, 438). These changes created an integrated exchange between railway, road and water transport (Hadfield 1970, 365-366). Thus reinvented the canal tunnel saw a new lease of life after some 20 years of disuse.

2.2.31 The warehouse is listed grade II* as a unique survival of a three-way road-railway-canal interchange (list entry number 1268529).

2.2.32 This was the situation recorded by Henry de Salis in Bradshaw's guide to canals and navigable rivers published in 1904 (Bradshaw 1904). This describes only the two western locks and a canal of only three furlongs terminating underground at the Great Northern Warehouse.

Decline, Closure and Abandonment

2.2.33 The opening of the Great Northern Warehouse provided a modern canal, railway & road interchange in the heart of Manchester. Such improvements, however, failed to make a significant impact on the overall decline in waterways traffic. This decline accelerated after the First World War when reliable surplus motor vehicles became available, along with trained drivers, leading to the rapid rise of the independent road haulier. Distribution became more and more focused on major freight centres such as the Manchester and Salford Docks, Trafford Park and key railheads.

2.2.34 By 1922 canal traffic to the GN Warehouse had ceased although it continued to be an important railway freight depot until 1954. It is not known when the final cargo was carried to Brunswick Basin by canal but is believed to be at around the same time. With no traffic the pumping of water ceased and the canal was allowed to drain. The entire M&SJC was formally abandoned under a Manchester Ship Canal Act of 1936 (Hadfield 1970).

2.2.35 There was no redevelopment of the canal before the start of the Second World War as it was depicted in 1943 in a derelict condition, complete with abandoned barges, in several evocative watercolour sketches by Albert Pile (Manchester Archives).

2.3 Reuse of the M&SJC Tunnel as an Air Raid Shelter

2.3.1 The M&SJC Tunnel was abandoned in 1922 with the end of freight traffic to the Great Northern Warehouse. The Western Tunnel Entrance was sealed following the Act of Abandonment in 1936. The Tunnel however remained intact.

2.3.2 With threat of war, increasing attention started to be given to the protection of the civilian population during air raids. It quickly became obvious that the pre-war policy of population dispersal was, with the exception of child evacuees, unworkable. Attention therefore turned to the development of both family (Anderson shelters) and mass air raid shelters

(Community Surface Shelters). Initially this did not include large deep shelters but faced with public agitation the Government started to permit the conversion of existing underground locations such as railway tunnels.

2.3.3 In Manchester the former Manchester & Salford Junction Canal tunnel was one of several sites converted to, or built as, shelters by Manchester Corporation. Other sites include the Cathedral Steps Tunnels, the concrete surface shelters in Piccadilly Gardens (now removed) and Victoria Arches air-raid shelter. Air raids on Manchester began in August 1940, but it was not until December 1940 that serious attacks began. During the Manchester ('Christmas') Blitz nearly 500 tons of high explosive and nearly 2000 incendiaries were dropped on Manchester, resulting in the deaths of nearly 700 people and destroying, or severely damaging, many buildings, including the Free Trade Hall, Town Hall, Royal Exchange and Manchester Cathedral. Further raids took place throughout the war with nearby centres, such as Salford and Stretford also suffering heavily

2.3.4 The conversion of the M&SJC Tunnel started in 1939/40 although Manchester Corporation did not formally take ownership until 1941. The majority of the tunnel (between Brunswick Basin and Watson Street) was employed. Conversion involved drainage and, to combat damp, raising the floor level using poured concrete rafts and, in places, inserting a brick skin lining wall. The tunnel was sub-divided into 16 bays separated by reinforced-brick, blast walls. In addition five new external entrances and stair cases were inserted. These entrances were at Grape Street, Lower Byrom Street, Byrom Street, Deansgate and Watson Street. The shelter was designed to accommodate up to 1350 people, although it was generally used by 300-700 people; benches were provided and people brought their own bedding.

2.3.5 In November 2012 the tunnel was listed Grade II (No.1405199) for its value as a largely intact example of a Second World War municipal air-raid shelter. The reasons for designation given in the listing documentation notes include the following principal reasons:

- “WWII air-raid shelter use: it is a good surviving example of a deep tunnel air-raid shelter, having been converted in 1939/40 from an 1839 canal tunnel, and it survives as an evocative monument to civil defence during WWII”
- “Interior survival: it retains clear and tangible evidence of its wartime use as an air-raid shelter, including its internal 16-bay configuration formed by the use of reinforced-brick blast walls and brick bulkhead wall passageways with reinforced-concrete roofs, as well as key features relating to its adaptation, including reinforced stairs, painted signage, some lights, a gas-proof screen, brick skin walls inserted to prevent damp, and a series of underground buildings/structures comprising first-aid posts, chemical toilet blocks, and ARP warden's posts/look-outs”
- “Evidence of defence policy: it reflects the government's shift away from the pre-war policy of protecting the public through dispersal, which avoided concentrations of people in one place, to authorising a few local authorities to exploit and adapt existing features, such as tunnels and culverts into deep shelters”
- “Historic interest: it has significant historic interest in representing an important period in Manchester's history: the Manchester Blitz of December 1940, and in illustrating the threat posed throughout the war not only to the city's, but the nation's civilians as a result of aerial bombing, and the steps taken to protect them”

2.3.6 At the end of WW2 the air raid shelters were closed and have not been used since. Over time the surface entrances have been sealed and infilled. The Tunnel can now only be entered from below the Great Northern Warehouse at the eastern end and from the basement of Granada House at the western end. The inaccessibly of the site has preserved the evidence of its use as an air raid shelter and it is this which is the reason for listing rather than its status as an historic canal tunnel (English Heritage 2012, Levrant 2014).

2.3.7 The surviving structures from the air raid shelter are described in detail in Section 4: Engineering (below).

2.4 Post War Redevelopment

2.4.1 The abandoned western end of the canal had a series of poorly recorded ad hoc uses during and immediately after the war. By 1948-49 the Lower Pump House and the Brunswick Wharf buildings were described as an "engineering works". The derelict canal, locks No.2 and Brunswick or Potato Market Arm basin had by that time been infilled with demolition debris from war damaged buildings in the area (Fletcher et al 1990). In 1955 the entire area around the canal was acquired in stages by the Granada Television Company for the development of a TV Studio.

2.4.2 The development of the Granada TV Studios took place in several stages. The first stage was completed by 1957. The development of the landmark Granada House offices took during the 1960's and was followed by a succession of new studios and ancillary buildings during the 1970's and 1980's. Studio 12 and the props warehouses were constructed over the canal line. Several of these buildings are now themselves of architectural and heritage interest (Levrant 2014) and are proposed for retention in the emergent master plan.

2.4.3 Post war an only slightly bomb damaged Manchester Central Station continued to occupy the eastern end of the canal corridor. The station was repaired and in 1963 its architectural importance was recognised when it was Listed Grade II*. As railway traffic patterns changed during the late 1960's the station gradually lost its services and was closed to all traffic on 5th May 1969. The building remained derelict for some time and was used for a period as a car park. In 1982 it was acquired by the Greater Manchester Council and converted to an exhibition and concert venue as "GMEX". Following a further refurbishment and upgrade it has recently reverted to "Manchester Central".

2.4.4 During the conversion to an exhibition venue the station undercroft was converted to a car park through the addition of a mezzanine floor, access ramps and entry roads. It continues in that use.

2.5 Historic development of the Canal Corridor (Historic Environment Assessment)

2.5.1 The land on which the canal was to be built has a long history of previous use and in many respects encapsulates the story of Manchester's origins and growth.

2.5.2 In the Roman period the St. Johns area lay to the north of the Roman Fort at Castlefield and west of the Roman Road which would become Deansgate. It is likely that the area probably contained elements of Roman vicus and Roman-British settlement. Evidence is sparse.

2.5.3 Following the end of Roman rule there is a long silence in the archaeological record. There is some suggestions for Anglo Saxon activity in the area such as the "Angel Stone" memorial of around AD700 which is today incorporated in the later cathedral.

2.5.4 By Mediaeval times the settlement focus was to the north of the site on land extending south from the confluence of the River Irk with the River Irwell. A simple ringwork castle may have stood at the rivers confluence and the town appears to have been bounded by a ditch on the east and south sides. Early growth is slow but by the 1650's and the arrival of Flemish weavers the town begins a period of rapid textile-industry based growth. The town expends southwards beyond the cathedral and we start to see activity in the St. Johns area.

2.5.5 By the late 1700's the eastern end of the canal corridor and the area above the tunnel was already largely built up but the western end (the Granada Studios site) is less developed. The banks of the Irwell are lined with warehouses and wharfs; part is already described as the "Old Quay". Leading to the Irwell waterfront Quay Street and Charles Street form a box to the north and south of the area. A plan of 1770 shows Great St John Street laid out but not yet built up. Curiously a plan of 1800 suggests that by that time no further major developments had taken place in and around the site and the areas south of the site also remained undeveloped.

2.5.6 In the early 1800's the surrounding area became progressively infilled, culminating in the opening in 1830 of the Liverpool & Manchester Railway Terminus on Liverpool Street just to the south of the canal corridor. The new railway crossed the Irwell on a high viaduct and then ran on raised arches to reach the higher ground at Lower Byrom Street. The new station included the first purpose built railway warehouse.

2.5.7 The railway was a well-established feature by the time construction of the M&SJC started in late 1836. The Canal cut across and effectively removed what had been the riverward continuation of Great John Street. The western tunnel entrance was placed at the junction of Atherton Street and Charles Street (now named Grape Street). The Eastern tunnel entrance on the east side of Watson Street.

2.5.8 The eastern end of the canal cut through and demolished two substantial blocks of housing and formed a new corridor linking with the pre-existing Rochdale arm – the route may have been laid out to minimise land purchase and house demolitions as it runs parallel to the existing street grid not across it.

2.5.9 By the time of the 1848-1850 large scale OS maps there has been further change. The cramped Station at Liverpool Road has outgrown increasing passenger traffic and in May 1844 all passenger services moved to Exchange Station (and Later Victoria Station). In consequence the station is now a goods depot and has been re-organised with the addition of new sidings and a range of increasingly specialised warehouses.

2.5.10 On the M&SJC a new side arm – the Brunswick Basin - opened in 1840. This is shown extending from the main line near the tunnel mouth northwards toward Quay Street. A covered potato market is located on the west (left) side of the basin and new housing is appearing on the right (east side – "Little Atherton Street"). On the west side of the site some of the previously vacant land has been taken by a timber yard and a slate wharf. Four or five grand town houses are shown extending from the junction with Quay Street southwards along Water Street; behind them is a short dead end street "Little Edward Street" which is occupied by mews houses and stables.

2.5.11 During the 1860's, 70' and 80's the area continues to infill and by the OS 1891 survey the Bonded Warehouse is in place as are the stable block and accumulator tower for the Liverpool road good depot. Further housing has been built together with a range of buildings including a blacksmiths which is sited over the canal tunnel opening. Charles Street is renamed Grape Street.

2.5.12 At the same time the eastern length of the canal is truncated by the construction of Manchester Central Station (above). This involved wholesale demolition of several street blocks and the removal of the waterway. The 1891 map shows the Central Station and its adjacent Cheshire Lines Committee Good Station lying between Lower Mosley Street and Watson Street. The new Great Northern Railway Goods Station occupies the land between Watson Street and Deansgate. The Rochdale Canal arm is shown truncated at Lower Mosley Street but appears to be still in use to serve local mills.

2.5.13 The pattern of land-use and holding established by the 1900's persists until the 1930's when with the closure of the canal the route becomes available for re-use. Wartime damage is sporadic; the Manchester Blitz destroyed the Free Trade Hall and many civic buildings and dwellings in the city centre. By the 1948 -49 survey some rebuilding has taken place, the basin and canal are infilled and the pump house and wharf buildings now form part of a small 'engineering works'.

2.5.14 By the OS 1957 survey the western end of the canal corridor had been acquired by Sidney Bernstein and Phase 1 of Granada Studios has been completed. The line of the canal can still be traced and some of the canal-side industrial buildings on the site have been re-used as offices, workshops and canteens. The new Phase 1 administration building and Studio 2 can be seen to the north-east of the site with a petrol garage located to the right of this.

2.5.15 The 1961 Survey shows that the garage has been replaced with Phases 2 and 3; the link block and Granada House. Some of the older industrial structures still occupy the centre of the site and now have further buildings adjoining them.

2.5.16 By 1963 to 1965 the last main phases of the Granada Studios development were completed. The new Studio 8 and 12 buildings have been constructed to the south of the existing studios, resulting in any remaining structures located around and above the Salford Junction Canal tunnel opening being removed. A large part of the western end of Great John Street's southern aspect has been removed and some industrial buildings to the centre of the site still remain in situ.

2.5.17 The 1970's and 1980's saw the removal of the last older industrial buildings and their replacement with new structures with the Granada site. Outside the site several street blocks of slum housing were cleared and replaced with new medium density housing, most notably along Camp Street.

2.6 What remains of the M&SJC Today

2.6.1 Of the original structures of the M&SJC only four survive and of these only two are visible as the surface. These are:

- Lock No.1 (entry from the River Irwell).
- Irwell Bridge (the second 1920's bridge, infilled but still extant).

- Locks No.2 (infilled and under the studios car park, not visible but proven by archaeological excavation).
- The Canal Tunnel (entrances blocked and not visible but still standing and accessible via new buildings).

2.6.2 The historical design and current condition of each structure is reviewed in depth in the Engineering section, below.

2.7 Heritage Protection

2.7.1 The canal corridor is not protected as a canal corridor. Some landscape elements and several buildings along the route are listed and there is a local conservation area around St John Street, but none of these are intended to preserve the canal heritage.

2.7.2 The only canal structure to be listed is the Canal Tunnel - although it is listed Grade II* for its later role as an air raid shelter and as an example of civil defence during the Second World War not because of its waterway origins. List entry Number: 1405199.

Figure 2.1 1839-1875: The Manchester & Salford Junction Canal in 1842 after the Brunswick Basin opened. This is the canal at its maximum extent. Ordnance Survey 6" Series Map 1842.

Figure 2.2 1875-1899: The Manchester & Salford Junction Canal after the through route was severed in 1875. Locks No.3 & 4, the reservoir and upper pump house have been replaced by Manchester Central Station. OS 6" Series Map 1894 (published 1896).

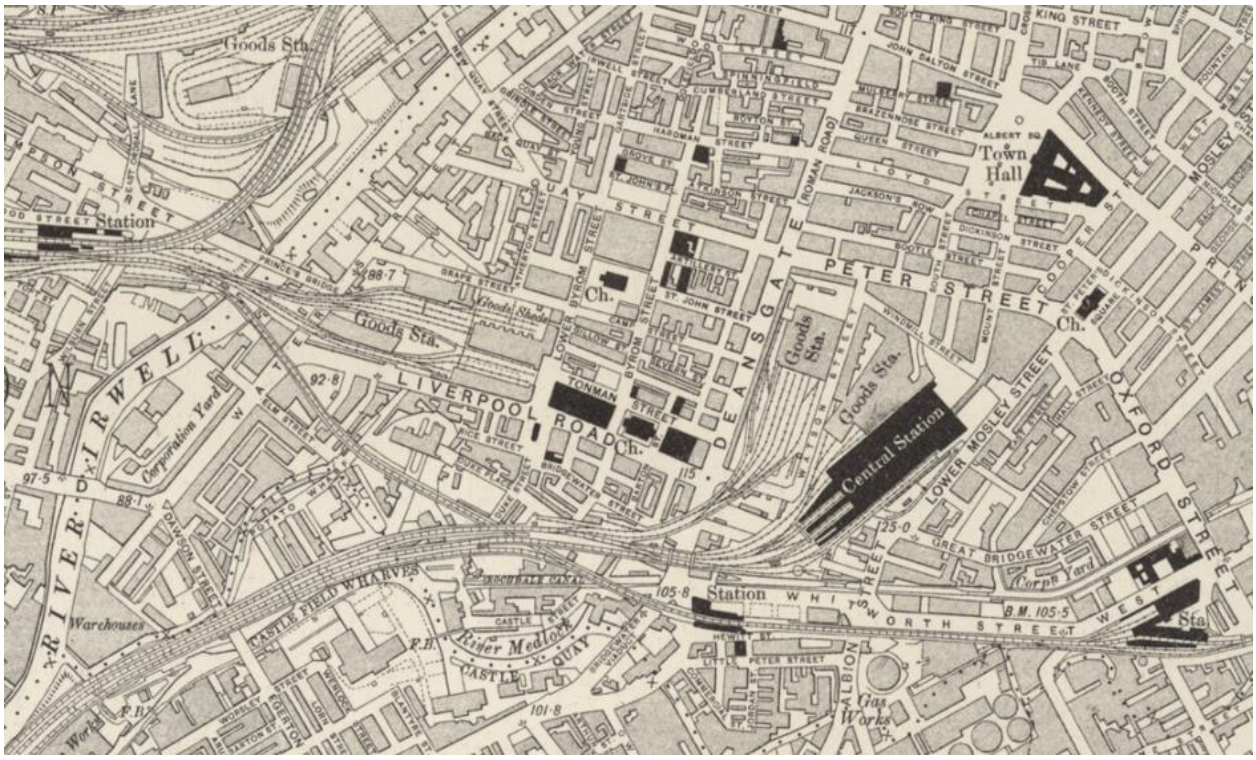

Figure 2.3 1899-1922 (to abandonment in 1936): The M&SJC after the Great Northern Warehouse, and its underground canal wharf, was built over the tunnel in 1899. Traffic ceased around 1922. The canal was formally abandoned in 1936. OS 6" Series Map 1905 (published 1909).

3 Environment & Ecology

3.1 Geology & Soils

3.1.1 The centre of Manchester is underlain by the red coloured sandstones of the Chester Pebble Beds Formation which is part of the Sherwood Sandstone Group (SSG). They are of Early Triassic Epoch (TE) Age.

3.1.2 The Chester Pebble Beds Formation in Manchester consists of between 90 and 220 m depth of sandstones, red-brown and pinkish-red, fine- to coarse-grained, commonly pebbly, with conglomerates and sporadic siltstones; they are cross-stratified and moderately cemented. Towards the base bands of non-local quartzite pebbles are common. (see Warrington *et al* 1980). The beds are exposed at surface in the Castlefield Wharf area. The canal tunnel is dug entirely through this formation.

3.1.3 Below the Sherwood Sandstone group, and exposed by faulting and folding, there is a small band of Late Permian Marls known as the Manchester Marls Formation; this is a 45 to 60m thick red marl (calcareous mudstone and siltstone) with thin beds of fossiliferous marine limestone and dolomite; locally green; sandy in places especially in the top part; local breccias and pebbly beds (Tonks et al, 1931, 165; Taylor et al, 1963, 53).

3.1.4 The Manchester Marls occur at surface as a thin band running South-East to North-West across central Manchester. The canal intersects it in the vicinity of Lower Moseley Street and the Bridgewater Basin.

3.1.5 In the last million years what is now Manchester has been subject to repeated glaciations and this has both shaped the landscape and has left a legacy of superficial ("drift") deposits. The main river valleys probably originate as sub-glacial meltwater channels and were heavily modified by high flow regimes in the Late-Glacial and early Post-Glacial.

3.1.6 Evidence of glaciation comes in the form of extensive areas of Glacial Till ("Boulder Clay") to the north and east of the canal corridor and relatively high level expanses of Devensian sands and gravels (fluvio-glacial outwash) across the surface of both the Chester Pebble Beds Formation and the earliest Tills.

3.1.7 Rapid climate change in the late glacial and early post-glacial is shown by areas of high level alluvial terraces adjacent to both the River Irwell and River Medlock. More recent Holocene deposits are also found along these river valleys but are at a lower level and consist of finer grained, more organic, silts and clays.

3.1.8 The canal runs across both Holocene and Late Glacial alluvial deposits as it leaves the River Irwell and climbs to the western tunnel entrance.

3.1.9 Soils across the canal corridor probably originally reflected their parent materials; today they are almost entirely anthropogenic and reflect 300 years of intensive urban activity.

3.1.10 At the western end of the canal corridor there are extensive areas of made ground (heavily modified surfaces) most notably in the former Goods Depot and Granada Studios site where little of the visible surfaces can be considered to be near their pre-industrial level.

3.1.11 At the eastern end the landscape is entirely built over and no natural or semi-natural soils can be observed.

3.2 Water

3.2.1 The canal crosses the low watershed between the River Irwell and its tributary the River Medlock. The Medlock joins the Irwell approximately 500m south west and downstream of the canal. The Irwell is itself a tributary of the River Mersey. All three rivers are heavily canalised for navigation and drainage. These rivers form part of the Mersey Catchment plan area.

3.2.2 The River Irwell is confined by retaining walls for much of it length through Manchester. It was one of the drivers (literally) of the industrial revolution and as it flows into Manchester it runs from mill weir to mill weir. The last major weir is at Hunts Bank just north of Victoria Station, from that point the River Is navigable past the entry to the M&SJC and the Manchester Bolton & Bury Canal (MB&BC) and discharges into the Manchester and Salford Docks Complex. Prior to the construction of the Manchester Ship Canal it continued as a canalised navigable river to its junction with the River Mersey at Irlam 8 miles west of Manchester. The arrival of the MSC raised and stabilised the water levels in the upper Irwell increasing the reliability of navigation.

3.2.3 The River Medlock runs in a deep walled trench for much of its length through Manchester. It once fed many of the early mills in the town. It feeds and joins the Bridgewater canal which uses the course of the river from Little Peter Street to the Castlefield Wharfs where an overflow weir discharges back into the original course. This then joins the River Irwell near Victoria Quay.

3.2.4 The Irwell and Medlock were heavily polluted from Georgian times to the late 20th century. For much of that time they served as open sewers for the burgeoning new city of Manchester. Modern mains drainage arrived in fits and starts and the basis of the modern system was laid in the 1890's (REF). Notwithstanding, the discharge of industrial waste to the river continued until the 1960' and 70's and in consequence water quality was slow to improve.

3.2.5 With the decline of industry since the 1980's and the enforcement of stricter pollution control regulations the quality of the river water has shown a marked increase. While not yet clean both Rivers are described by the Environment Agency as improving.

3.2.6 There is still scope for considerable improvement. A co-ordinated plan for catchment improvement is now in place which aims to deliver improved water quality and enhance aquatic and terrestrial ecology (Environment Agency 2012).

3.2.7 The reinstatement of the M&SJC would have little impact on the overall catchment basin plan:

- Water movement along a restored through-route would involve water movement within the Irwell-Medlock Catchment and not between major catchment basins.
- Water movement along a restored short stub and basin at the western end would involve extraction from the Irwell by pumping and the return of that water to the Irwell via a by-wash cascade or lockage – in both cases the evidence suggests that the water will have an increase in oxygen content after such a circular movement (IWAC 2008).
- Initial filling of any stub and basin could be accomplished during high flow periods on the Irwell. The volumes are relatively small (see engineering calculations below)

and hence should have no discernible effect on the flow of the river (cf. Environment Agency flow rates for the Irwell).

- During periods extreme low flow both the putative through route and the stub/basin options could be closed off and lockage restricted. With modern lining materials and lock gates in good repair leakage should be minimal.
- The new route or stub and basin would offer opportunities for developing new areas of wetland ecology in the area.
- There is potential to use the canal as a storm-water flow balancing ponds for surface water drainage offers (see 3.3 below). The incorporation of reed beds in this system would offer opportunities for removing suspended sediment and improving the quality of run-off water.

3.3 Flooding

3.3.1 The Environment Agency Flood Maps show the potential flooding risks along river corridors. The maps are advisory and not a replacement for a full flood risk analysis, they are, however, a useful starting point for considering flood risk.

3.3.2 The flood risk map for the M&SJC Corridor suggests that the tunnel and the eastern end of the corridor lie in areas of extremely low alluvial flood risk. There is still potential for localised surface water (rainfall event) flooding but this is limited by the generally shedding location of the sites. The western end is more complex.

3.3.3 Lock No.1 is immediately adjacent to the River Irwell and lies within Flood Zone Three (3a). Sites in Flood Zone Three face a high probability of flooding and have a 1 in 100 or greater annual probability of river flooding (>1%) in any year. Faced with a high flood risk the recommendation is that this zone should not be used for development, however exceptions apply for non-sensitive features such as for water infrastructure which would include returning the lock to working condition provided that it:

a. Is non-operational (“fails-safe”) in times of flood;
b. Results in no net loss of floodplain storage;
c. Does not impede water flows; and
d. Does not increase flood risk elsewhere.

3.3.4 As the lock is an existing feature and it surrounding garden one of the few areas of flood relief along the Irwell a case can be made for its retention and return to operation. This is comparable to the entrance lock from the Irwell to the Manchester Bolton & Bury Canal sited 100m downstream on the opposite bank. The lock will eventually integrate in the Irwell River Park which is opening up the banks of the River and creating additional floodplain capacity.

3.3.5 Lock No.2 and the western part of the canal as far as the former tunnel mouth lies on the first alluvial terrace and within Flood Zone Two. Sites in Flood Zone Two face a medium probability of flooding and have between a 1 in 100 and a 1 in 1,000 annual probability of river flooding (1% – 0.1%) in any year.

3.3.6 Development is possible provided a full flood risk assessment is carried out and the most vulnerable uses (hospitals, etc.) are avoided. Government policy in this medium risk zone is to “seek opportunities to reduce the overall level of flood risk in the area through the

layout and form of the development, and the appropriate application of sustainable drainage systems". In particular to:

- Reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;
- Relocate existing development to land in zones with a lower probability of flooding; and
- Create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

3.3.7 A reinstated waterway could play a role in (a) flood mitigation and (b) surface water drainage. For example:

3.3.8 (a) Inland waterways are controlled waters which can be used for temporary rainfall storage – Increased freeboard on channel wharfs and channels can vastly increase water storage capacity – doubling the freeboard from 250mm (9 inches) to a free board of 500mm (1ft 6 inches) doubles storage to 0.5 cubic metre of stored water for every metre of waterspace. A considerable increase in temporary storage which can then be released in a controlled fashion. [Freeboard is the distance from normal water level to a level where overtopping occurs].

3.3.9 It is also possible to create sunken areas next to the water way in the form of urban squares or plazas that are only a small distance above water level – these will preferentially overbank and flood adding to the storage capacity of the main channel. Careful design enables the main route ways to remain open around the edges of these slightly lower areas.

3.3.10 (b) Surface water drainage is an issue on urban sites with extensive hard landscaping. Waterspace provide obvious balancing storage for surface water runs off. Several development schemes (cf. Chesterfield Waterside) have designed sustainable urban drainage systems for surface water which capture water in a series of flat bottomed swales which form a cascade of ponds. These ponds are planted with reeds to trap suspended sediments before discharging to the main canal which has raised freeboard and thus acts as balancing pond and floodwater relief.

3.3.11 Drainage throughout the canal corridor is now entirely artificial and thus anything which can be used to promote biodiversity and mitigate extreme rainfall events might be considered a clear benefit to development.

3.4 Pollution

3.4.1 The Environment Agency has no records for known pollution sources past or present along the canal corridor (EA 'WIYB' Website 2016). Nevertheless, as a location sharing in the rapid growth of 19th century Manchester it is likely that the corridor will have a history of potentially polluting, activities. None of these will have left records to enable the pollution to be assessed and quantified. In consequence all work on the site should be based on the precautionary principle and assume that pollution – hydrocarbons, chemicals, asbestos, etc., will be present. Contaminant testing will be required before each stage and mitigation measures such as disposal of arisings to controlled landfill will be required.

3.5 Ecology

3.5.1 The canal corridor lies in the heart of one of the most urban environments in the UK and there is precious little space given over to greenery of any type. In brief:

3.5.2 The eastern end of the canal is buried under buildings and has no ecology. Any potential canal restoration would require extensive underground works to manmade structures and would have no direct ecological impact. This length will not be considered further here.

3.5.3 The Tunnel has no known ecology, but this has the potential to change depending on how it is developed in future. For example, changes in water level may have temporary indirect effects on drainage or the opening up of the entrance may provide access for bats.

3.5.4 The western end is also largely built upon but does have some adjacent areas of potential interest, including the mature gardens to the north of the western Tunnel Mouth, the pocket park area around Lock No.1 and the River Irwell. While these may be locally important pockets of greenspace there is no evidence they contain species of conservation significance.

Protection of the Natural Environment

3.5.5 The Canal Corridor contains no sites of local, regional or national conservation value. For example, there are no statutorily protected or designated sites such as Sites of Special Scientific Interest (SSSI), RAMSAR sites, etc., even non-statutory sites are absent from the Canal Corridor and adjacent areas.

Protected Species: Bats

3.5.6 The tunnel section has the potential for the presence of Bats. As far as can be determined none are present. This is most likely the result of the tunnel being sealed at both ends and access only being possible through existing buildings. Notwithstanding a very early requirement of any proposed development involving the canal tunnel would be to undertake a full bat survey.

3.5.7 If the tunnel were to be reopened it would provide a potential bat roost. How this can be managed should be considered from the outset.

3.6 Conclusion

3.6.1 There is nothing in the available evidence to suggest that reinstatement of the M&SJC would have a negative impact on the environment of central Manchester. It could be argued that the waterway would provide a green-blue corridor which has many positive benefits for creating a greener environment. The introduction of managed water into the site is potentially of significant value for the management of local flooding and climate change mitigation.

4 Engineering

4.1 Introduction

4.1.1 This section explores the engineering issues facing the possible restoration of the M&SJC. It examines the route, the individual structures, utility constraints and the water supply. In each case it looks at (a) their historic design and attributes, (b) their current condition (as far as can be established) and (c) the likely works required to bring them back into commission.

4.1.2 The basis for assessing feasibility and undertaking initial costing of works is explored in Section 5.

4.1.3 **NOTE:** As a rapid scoping study we have been unable to undertake detailed engineering appraisal of the route or surviving structures. This evaluation is based on inspection where possible, records and photographic records where available. Should any element in this report be taken forward the first stage will be a full (and if necessary, invasive) survey of those elements which form part of the adopted scheme.

4.2 Canal Gauge

4.2.1 The M&SJC as built was a broad canal with locks capable of taking boats 14ft 4 inches wide by 72ft 11 inches long, with a draught of 4ft and a headroom of 10ft (Bradshaw 1904).

4.2.2 The width of the open channel (based on maps and plans) was between 30 and 45 feet – roughly three boats width.

4.4.3 The two lower locks (Nos. 1 & 2) are intact (below) and restoration to the original gauge is rational and cost effective. The restoration of the connection to the Rochdale Canal does raise questions over possible gauge: –

- At present the short arm off the Rochdale Canal to which the revived M&SJC would link has been narrowed both in channel and at the Great Bridgewater Street Bridge and is only capable of navigation by narrow beam boats.
- The turns required to enter and leave the M&SJC at both Bridgewater basin and at the Rochdale Canal are sharp and would mitigate against use of full size broad beam boats.
- A broad beam connection between the Rochdale/Bridgewater Canals exists at Pomona Lock (replacing the earlier Hulme Locks Branch which operated from 1838 to 1995).

4.4.4 As land-take, construction costs and water usage for a narrow canal are considerably smaller than those for a comparable broad beam canal there may be value in considering a narrow-beam only connection. This is discussed further in costings below.

4.3 Historic Route (Canal Track)

4.3.1 The route is described from Irwell or western end of the canal and works up-hill to the eastern end at the Rochdale Canal – it uses the four sections or lengths employed in the historical descriptions. Note that street names in this area have changed several times – here for the avoidance of confusion the current, modern names are used. A summary of the current condition of the historical route and structures is given in Figure 4.1, below. Detailed discussion of possible restoration is in section 4.4 onwards.

Western

4.3.2 As built the Western Length extended from the Irwell through two locks to the west portal of the Tunnel. It includes the Brunswick Basin which was at the tunnel pound level.

4.3.3 In this length the route of the waterway largely survives albeit largely buried within the former Granada Studios site.

4.3.4 The canal commences at the River Irwell with a high stone wall with curved entry to Lock No.1. The Lock is open and clear.

4.3.5 At the head of Lock No.1 is a widening of the channel to the full width of the canal (c.15m). The widening has stone wash walls and forms a curving extension of the lock headwall.

4.3.6 Within 20m of the top gate of Lock No.1 is the "Irwell Bridge" which carries Water Street over the Canal. The bridge once spanned the full width of the canal and gave access to both north and south chambers of Locks No.2. It appears to have been narrowed while in use then then finally sealed off completely.

4.3.7 Water Street has north-south utility runs for Water, Gas and Electricity.

4.3.8 Beyond Water Street the canal is infilled to slightly above the level of Water Street.

4.3.9 Locks No.2 was situated c.30m east of Irwell Bridge and consisted of two parallel chambers. The Lock and the canal channel as far as the approximate location of the entrance to the Brunswick Basin arm is infilled. The main carpark lies over the canal and several small structures overlap the edge of the waterway.

4.3.10 On opening a steam pumping engine was located on the north bank of the canal about 100m east the top of Locks No.2. This took water from the River Irwell via tunnel under Water Street to the pumping station. No trace of this pumping station remains although it is possible the water supply tunnel has survived.

4.3.11 From the approximate location of the entrance to the Brunswick Basin to the western entrance to the Tunnel the canal is built over. The buildings in question are Studio 12 and the southern end of the main Granada office building. Both buildings are substantial and will have required deep foundations. There is little prospect for the canal channel surviving in this length.

4.3.12 The Brunswick Basin was infilled by 1948-49. It is now under the site of the Studios 2, 6, 8 & 12. Given the depth of foundations and piling for these structures it is highly unlikely that more than fragments of the basin survive.

4.3.13 A towpath bridge spanned the entrance to the Brunswick Basin when it opened in 1841. On the 1850-51 OS map is described as an "Iron Bridge". With the first closure of the tunnel in 1875 the bridge was no longer required to give access to the tunnel towing path

and may well have interfered with towing boats into the Basin. It had been removed by the time of the 1891 OS survey. The bridge was not replaced when the tunnel was re-opened in 1899 – no bridge is shown on the abandonment survey and it is also absent from the 1948-49 survey. To date no photographs have come to light.

Tunnel

4.3.14 As opened in 1839 the Tunnel ran for 499 yards from Grape Street under Camp Street to emerge at Watson Street. The tunnel was blocked at the Watson Street portal during the construction of Manchester Central Station in 1875 and closed (although it remained in water). The Tunnel was re-opened with the arrival of the Great Northern Goods Warehouse in 1892 and continued in use until 1922.

4.3.15 The majority of the 1839 tunnel is intact. Blocking walls seal off the tunnel at each end and several cross walls have been inserted to divide the tunnel into a series of bays for use as an air raid shelter in WW2 but in each case these appear from photographs to be only lightly bonded into the tunnel wall and the arch and invert appear intact. Damage was, however, caused by the insertion of multiple access staircases to allow the tunnel to be used a shelter.

4.3.16 The section the tunnel modified and widened during the creation of the Great Northern Warehouse in 1892 is intact. Two new side arms for goods transhipment led north off the widening under the Great Northern Warehouse. The western of these two arms has been infilled and blocked off. This was done between the end of goods traffic in 1922 and the Second World War as this arm was not used as a shelter at that time.

4.3.17 The western entrance is blocked by a wall and the basement of the former Granada Offices building. The ground levels here have been raised considerably by infilling and a small garden now exists over the initial few yards of the tunnel before it crosses under Lower Byrom Street. The tunnel then runs below Camp Street to the GN Warehouse.

4.3.18 The Eastern (or Watson Street) entrance is also blocked by a wall. Part of the arch for this entrance may be visible in the walls of the undercroft of the former Manchester Central Station. The undercroft has been extensively modified for use as a car park on two levels.

Eastern

4.3.19 As built the eastern section consisted of two paired locks – Locks No.3 and Locks No.4 - rising to a summit pound. To the north of the summit pound was a reservoir and a pumping station which raised water from the foot of Locks No.3 to the summit pound. The summit pound ended at a stop gate or stop lock below Lower Mosley Street Bridge.

4.3.20 The route of the M&SJC is now entirely under the former Manchester Central Station (now an exhibition centre), Lower Mosley Street and possibly part of the Bridgewater Hall (concert hall). Elements in the undercroft of the former station which have been ascribed to the Canal, and a pedestrian tunnel under Lower Mosley Street which has coping stones allegedly from the canal towpath are certainly NOT parts of the original canal. The site was completely excavated and reworked during the construction of the station and nothing of the canal era will have survived (cf. Dow 1985, 138-140).

4.3.21 As Manchester Central is a listed structure any modifications to the undercroft to accommodate a waterway would need to be carried out with great sensitivity and consequently would be expensive.

4.3.22 Adjacent areas suffered bomb damage during the Second World War and were also comprehensively re-developed during the construction of the Bridgewater Concert Hall and, more recently, links for the Tram system. This is likely to have obliterated the location of the Lower Mosley Street Bridge and Stop Lock and hence the Junction with the Rochdale Canal Arm.

The Rochdale Canal Arm

4.3.23 As built the route of the M&SJC ended where it joined the Rochdale Canal arm at a stop lock at Lower Mosley Street Bridge. The Rochdale Canal arm which led to the eastern entrance to the M&SJC at Lower Mosley Street was not a part of the M&SJC but would obviously be an essential part of any through restoration and for that reason is considered as part of this study.

4.3.24 The original Rochdale arm came off the north side of the Rochdale Canal 20 m beyond the top of Rochdale Lock No.89 (Tib Lock). It headed northwards before passing under Great Bridgewater Street and reaching a further junction. The mainline continued north-east and then turned south-east in the vicinity of Hall Street where it ran parallel to Oxford Street until it again reached Great Bridgewater Street where it terminated. The side arm headed north-west to Lower Mosley Street and an end on junction with the M&SJC.

4.3.25 Today, the arm has been terminated at the point where the main arm and the side arm to the M&SJC joined. A small canal basin – Bridgewater Basin - has been formed here and there is no visible trace of the canal arm to the north east or north west. The arm southward to the Rochdale remains but has been partly narrowed from broad (Pennine) to narrow gauge, most notably at the Great Bridgewater Street Bridge where the "bridge hole" is now around 7ft 6" wide.

4.3.26 The arm appears navigable but the entrance is chained off with a floating barrier below the Great Bridgewater Street Bridge.

4.3.27 Immediately south of the Great Bridgewater Street Bridge is a short modern metal swing bridge. This is locked in the closed position (i.e. open for towpath use). This is another recent introduction as the towpath originally passed up and over Great Bridgewater Street Bridge at this point. The bridge appears serviceable (CRT Grade C).

4.3.28 Beyond the swing bridge the canal widens and splays outwards to join the main line of the Rochdale Canal immediately above Tib Lock (Rochdale Lock No.89).

4.4 Structures I: Locks

4.4.1 The plan for the canal produced by John Gilbert in 1836 shows many differences from the canal as finally built. In particular the canal as first designed has many more locks and none of the locks as drawn have more than one chamber. At some point this design was altered to a smaller number of deeper locks with paired (parallel) chambers.

4.4.2 When it opened the canal had four locks four locks which raised the canal from the Irwell to the Rochdale Canal. From the West to the East these were:

Lock No.1 Irwell River Lock

4.4.3 **History:** This was the entrance to the canal from the River Irwell. The river entrance to the lock consists of a two substantial wing walls leading into the lock chamber. The northern (upstream) wall consists of a moderately sharply curved (r = 3m) wall of massive fine-grained sandstone blocks, a short length of red brick walling with sandstone coping stones and then further massive stone blocks forming the gate recess and lock sill. The southern (downstream) lead in wall is segmented with curved junctions: A short length parallel to the river, turns 45 degrees and then after 3m turns again to reach the gate recess and sill. The entire leading wall is made of massive fine-grained sandstone blocks. Map evidence suggest this is the original layout.

4.4.4 The lock itself consists of a single chamber lock with double mitred gates. The chamber walls were built in a hard red brick with massive stone copings and gate recess quoins. The coping stones have pronounced rounding on the lock side.

4.4.5 The fall on the lock is small and the primary function of the lock appears to have been to permit entry to the river under different heights of river flow. There are rectangular recesses behind both the upper gates which may have been the water entry for the culverts leading to ground paddles and thence to the lock chamber but there is no evidence for the paddle mechanisms on the lock side (although the lock side paving appears to be a recent replacement). Water depth and opacity prevented establishing where the culverts discharged to the lock chamber. It is also possible that, in common with some other broad locks, the chamber was filled by gate paddles only. Further investigation is required. No information has yet come to light concerning the style of paddle gear used on the M&SJC Locks.

4.4.6 Photographs taken in the 1960's show the lock partially infilled with building debris (bomb damage clearance?). It is recorded as partially infilled in 1989/90 (Fletcher 1990). It has since been re-excavated, the walls pointed and the chamber hung with (non-operational) lock gates. The lock side has been fenced off by the addition of "heritage" cast iron style railings (more suited to a seaside resort than a canalside).

4.4.7 The area around the lock has been landscaped as part of a hotel development. During that development a timber lifting bridge was built over the river entrance to the lock to create a riverside walkway. There was no entrance bridge on the original waterway. See Bridges, below.

4.4.8 **Current Condition: Lock Chamber:** Standing. Chamber walls shows superficial wear and tear/minor deterioration of surfaces. Some perishing. Structurally insignificant cracking. No corrosion staining. No apparent wall movement (walls visually straight and to section) (comparable to CRT Grade B). The invert was not visible and could not be inspected but the absence of lock wall movement suggests it is sound. Silt accumulation in lock and prominent "bar" at lock entrance. Some very minor vegetation growth on upper walls. The lockside coping stones have been drilled to accept the Iron railings.

4.4.9 **Current Condition: Lock Gates:** Standing. The current gates were new when installed by Callis Mill during refurbishment in the late 1990's (J. Fletcher, Pers.Comm., 2016). A pumping mechanism was installed "by the lower gate on the Irwell upstream bank which allowed the lock to be filled by pumping from the river. I only saw it filled the once – to help the planks swell immediately after fitting" (J. Fletcher, Pers.Comm., 2016). The gates are now in poor condition (CRT Grade D). They are fitted with paddle gear that appears

largely cosmetic and is currently non-operational. The gate hinges and mounts are present. The lock-side railings would probably interfere with the lock gates being swung or operated.

4.4.10 **Works Required:** Chamber: Dredging, removal of vegetation growth, cleaning. Installation of paired lock ladders. Removal of lock side railings or reconfiguration to enable the gates to swing and operate. Lock Gates: Removal of cosmetic gates and replacement with new gates with operational paddle gear of appropriate style.

4.4.11 **Issues:** Condition of Invert. Condition of by wash tunnel and restorability of original by weir arrangements – design of alternative if required. Need for sump for back pumping? Public safety (lock ladders & railings).

Locks No.2 (not named)

4.4.12 **History:** This paired Lock was c.10 m east of the Water Street (Irwell) Bridge. As built it consisted of two parallel chambers each with double mitre gates (hence the M&SJC description of "Locks No.2" plural). There was no side pound and it is likely that locks were intended to at least part-discharge to the adjacent chamber to conserve water.

4.4.13 The paired lock arrangement is shown on the 1850-51 and 1891 town plan OS surveys. By the 1891 survey the northern chamber has been converted into a dry dock with a grid iron for the drying out and repair of barges and narrowboats. On the 1891 map several small buildings are marked adjacent to the lock and it is described as a "boat repair yard".

4.4.14 In 1988 the Greater Manchester Archaeology Unit carried out a trial excavation of part of the southern lock chamber and recorded that the lock walls were in excellent condition. The excavation showed that the lock has been infilled with building rubble between 1945 and 1948 (Fletcher 1990).

4.4.15 The chamber was found to be 6m deep at the centre of the invert, the walls consisted of:

Sandstone coping stones forming lock edge, curved edge. (1.6 m long by 0.42 m deep)
Hard Red Brick – 16 courses, English Bond. (1.32 m deep)
Sandstone string course – slightly protruding (1.6 m long by 0.42 m deep)
Hard Red Brick – 21 courses, English Bond. (1.70 m deep)
Sandstone string course – slightly protruding (1.6 m long by 0.42 m deep)
Hard Red Brick – 13 courses, English Bond. (1.08 m deep)
Sandstone string course – faceted to receive the face of the brick invert (0.42 m deep)
Hard Red Brick Invert – stretcher bond, surface curved (0.32 m deep).

4.4.16 The Hard sandstone string courses protruded very slightly from the wall and appear to be built-in rubbing strakes. Based on the position of these bands the locks rise or fall would have been circa 2.1 m or 6ft 11".

4.4.17 **Current Condition:** The Lock Chambers are intact but buried. The fill appears to be demolition rubble. It is likely that the upper part of the chamber was capped with concrete after the archaeogical investigation concluded. There is no surviving gate work.

4.4.18 **Works Required:** Excavation, removal of concrete capping if present. Repairs to walls and stonework. Repointing. Installation of new lock gates and paddle gear.

4.4.19 **Issues:** The condition of the north (dry dock) chamber is unknown. Contamination level of fill is unknown. *Note potential to reinstate / build blocking wall at down end and re-water the chamber and use as a berth for a floating activity.*

Locks No.3 and Locks No.4 (not named)

4.4.20 **History:** These locks were paired staircase locks and hence should be considered as a single element. They sat 100m east of the Watson Street portal of the canal tunnel.

4.4.21 Locks No.3 and Locks No.4 consisted of two parallel chambers but here both sets of chambers were linked to form two parallel staircase locks (where the top gates of the lower chamber, No.3, are the bottom gates of the upper chamber, No.4).

4.4.22 Other than maps and plans nothing else survives of these structures. It is reasonable to infer that they were of a similar design to Lock No.2 as described above. If so, then they were built largely of hard red brick with stone copings and quoins. Like Lock No.2 the lock walls probably had alternating bands of hard red brick and very slightly protruding bands of sandstone as in-built rubbing strips.

4.4.23 In 1875 the locks were completely removed during the construction of Manchester Central Station.

4.4.24 **Current Condition:** Destroyed. Location now under Manchester Central.

4.4.25 **Works:** Construction of entirely new locks required. Five options have been considered. All of these require considerable ground works to create a suitable open cutting(s) for the sitting of the locks and all would require utility path modification. Those that involve less utility modification generally require greater earthworks – there is not a low cost option here. The options are:

4.4.26 Option 1: Linked or staircase locks sited between the eastern side of the station and the western side of Lower Mosley Street. This would raise the canal to the level of the Bridgewater basin before passing under Lower Mosley Street. This would be a high level track which would require a relatively shallow bridge deck and may require modifications to the utility tracks in the Road.

4.4.27 Option 2: Linked or staircase locks sited between the eastern side of Lower Mosley Street and Bridgewater Basin. This would involve tunnelling from the undercroft and then under Lower Mosley Street before reaching the staircase lock. This could be a cut-and-cover or bored tunnel and would interfere little with utility paths.

4.4.28 Option 3**:** Single locks separated by a short pound. Lock No.3 would be located between the eastern side of the station and the western side of Lower Mosley Street and Lock No.4 would be between the eastern side of Lower Mosley Street and Bridgewater Basin. This would involve a shot intermediate pound that would form a mid-level passage under Lower Mosley Street which should provide sufficient clearance for utility paths.

4.4.29 Option 4**:** Single Deep Lock or Shaft Lock – entered by a tunnel from the Undercroft below Lower Mosley Street to a deep lock between the eastern side of Lower Mosley Street and Bridgewater Basin. This look would have a fall or rise of c.20ft (6.1m). This would be comparable with the rebuilt Tule Lane Lock on the Rochdale Canal (replacing two locks) which has a rise of 19ft 8½ inches and Bath deep lock (again replacing two locks) on the Kennet & Avon Canal with a rise of 19ft 5 inches.

4.4.30 Option 5**:** A boat lift. In the past it has been suggested that the locks could be replaced by a boat lift. This would presumably take the form of a single lift tank with hydraulic or water tank counter weighting. This has high initial costs, high maintenance costs and high operational (energy and staffing) costs.

4.4.31 It is considered that the option of a single deep lock, while clearly not impossible to build or operate, should be rejected on the grounds of (1) requiring staff to operate (both Tule Lane and Bath are manned), (2) safety of operation where the entry and exit points are constricted by the road tunnel and exit points for crews would be limited and (3) safety for visitors to the canal – a deep lock is a potential hazard in an urban setting where there are children and late night revellers.

4.4.32 The potential for a Boat lift is also limited. The structure would be unique and, given the location, difficult to construct and hence costly. Based on the experience of the Falkirk Wheel in Scotland, iconic structures need to be highly visible and accessible to attract significant visitor numbers, a lift at this location would be nearly invisible to the visiting public. Like Falkirk, it would have high maintenance costs which could further threaten long term viability, especially when due for major repair or replacement. In our view a boat lift at this location would not be a viable, or cost effective, solution to this relatively minor rise.

4.4.33 It is concluded that the best solution would be to use conventional locks with come standardisation of rise/fall to reduce manufacturing costs or gates, ladders, etc. At present it is our view that Locks Option 3 – with two separate locks – one each side of Lower Mosley Street – offers the best and most cost effective solution. This may be revised as more information becomes available.

4.4.34 **Issues:** The original location is now under Manchester Central – It will not be possible to restore these locks in their historic location. Key issues are the very dense urban setting, the very cramped sites available, competing uses and the costliness of existing infrastructure in the area (e.g. Tramway).

Stop Gate (Stop Lock) (not numbered or named)

4.4.35 **History:** The short M&SJC joined the Rochdale Canal Arm at a stop lock (unnumbered) immediately to the west of Lower Mosley Street Bridge.

4.4.36 The map evidence (OS town plan of 1850-52) shows a single long parallel sided structure running under the bridge with recesses on both banks at both eastern and western ends. Since the structure is the width and length of a M&SJC Lock and the recesses are the same dimensions as those for lock gates it suggests that what was originally planned here was a further lock as shown in Gilbert's 1836 Plan (shown as "3 inch lock"), presumably required to keep the M&SJC top pound 3 inches above the Rochdale pound level as required by the M&SJC Act of Parliament.

4.4.37 There is no record of a lock here (contemporary accounts only mention a stop lock or gate); it appears that the chamber was never gated at both ends and a stop gate was substituted at the top end before the completion of the waterway. If the M&SJC pound was maintained above the Rochdale pound this would have required either lowering the pound to permit the stop gate to open or forcing the gate.

4.4.38 Other than maps and plans no other record survives of this structure. It is likely that it was built as a standard lock chamber and was probably of a similar design to Lock No.2 as described above.

4.4.39 In 1875 the site of the stop gate and the west end of the lock structure was removed during the construction of Manchester Central Station. The east end of the lock remained visible until the 1948-49 survey by which time it had been infilled. Lower Mosley Street bridge was infilled during the construction of the Bridgewater Concert Hall and the site further modified when the Tram system was built in the early 2000's.

4.4.40 **Current Condition:** Destroyed. Location now under Lower Mosley Street and the Bridgewater Concert Hall.

4.4.41 **Works:** None

4.4.42 **Issues:** It is assumed that a stop lock will not be required as it will no longer be necessary to keep the upper pound level above that of the adjacent waterway. But see Water Supply below.

4.5 Structures II: Bridges

Bridge at Irwell Entrance to Lock No.1

4.5.1 **History:** There was no entrance bridge on the original waterway.

4.5.2 During the cosmetic restoration of Lock No.1 a new walkway was designed / intended to run along the bank of the Irwell at this point – this footbridge provided connectivity.

4.5.3 This is therefore a new footbridge over the entrance of the lock from the River Irwell. This takes the form of a wooden lift / bascule bridge evidently modelled on the Leeds and Liverpool lift bridges.

4.5.4 **Current Condition:** The bridge is fundamentally sound and operational but requires maintenance (CRT Grade C to D).

4.5.5 **Works:** Overhaul. Reinstatement of the lift mechanism to enable the bridge to be lifted as required. Need for locking mechanism (CRT Key operated to release)

Irwell Bridge (Water Street) (not numbered)

4.5.6 **History:** The first, original bridge, on this site was a single span stone arch bridge which spanned the full width of the canal. The wide span enabled barge access to both the north and south chambers of Lock No.2 which lay immediately east of the bridge.

4.5.7 The second bridge on the site was built around 1900 and consists of a flat bridge built of steel girders on abutments of red and engineering blue brick. A single Island Pillar was installed in the centre of the canal beneath the bridge. These modifications may have been required by the extension of the tramway system along Water Street in the early 1900's.

4.5.8 At some time after the construction of the second bridge the northern side of the bridge was infilled with solid brick, leaving only the southern passage open. This probably coincided with the conversion of the north chamber in Lock No.2 to a dry dock.

4.5.9 The south side of the bridge may have been open as recently as 1988 (Fletcher 1990) but appear to have been bricked up shortly thereafter.

4.5.10 **Current Condition:** Standing but bricked up. The bridge deck appears intact.

4.5.11 **Works:** Structural survey and assessment; Re-opening by removal of blocking brickwork to create a towpath on the north side and a canal channel on the south. Reconstruction of bridge parapets.

Bridge at Entrance to Brunswick Basin (not numbered)

4.5.12 **History:** This towpath bridge spanned the entrance to the Brunswick Basin and was built for the its opening in 1841. It is marked on the 1850-51 survey as an "Iron Bridge" (either cast iron or a wrought iron lattice arch). It had been removed by the 1891 survey. Most likely it was removed after the first closure of the tunnel in 1875 as the bridge would have no longer been required to connect the towpath either side of the basin and it would have got in the way of horse drawn boats being drawn into the Brunswick Basin. It does not appear to have been replaced when the tunnel was re-opened in 1899 – no bridge is shown on the 1936 survey and it is also absent from the 1948-49 survey.

4.5.13 **Current Condition:** demolished and removed. Foundations under buildings (Studio 12).

4.5.14 **Works:** None – the bridge will not be required for reopening.

Lower Mosley Street Bridge (not numbered)

4.5.15 **History:** The bridge was built by the M&SJC. A relatively flat bridge is indicted by the plans but no further information has yet come to light.

4.5.16 The Stop Lock ran under this bridge. When the M&SJC was truncated the bridge hole appears to have been infilled leaving, in 1894-96, half the lock visible.

4.5.17 By 1948-49 the bridge site had been infilled. The remains of the bridge were finally removed during the tram link works in the early 2000's.

4.5.18 **Current Condition:** Demolished and infilled. Potential for survival of foundations only.

4.5.19 **Works:** IF the restoration of through navigation is to be attempted a new replacement bridge will be required. The site is complex:

4.5.20 There is little potential for alternative routes as the location is hemmed-in to the south by the Bridgewater Hall and to the north by heritage buildings, while the route has to connect the Rochdale Arm to the Manchester Central undercroft.

4.5.21 The location of the former bridge has been infilled and is now occupied by a road to the east and the lower part of the bridge which forms the linking ramp to take the new metro-tramway up to the level of the former railway which it follows to the west and south. The foundations of one of the bridge piers lies in the projected canal path.

4.5.22 Lower Mosley Street contains gas, electricity, telecoms, water and sewage utilities.

4.5.23 A pedestrian underpass passes under the site and links Bridgewater Hall and Manchester Central. This is often conflated with the canal but has no relation to the M&SJC. It does provide a least one utility free corridor. Albeit far too small for repurposing as a waterway.

4.5.24 Given the restricted site and the need to maintain the road and tramway connections working in this location will prove to be a challenging operation.

Great Bridgewater Street Bridge (not numbered)

4.5.25 **History:** The Bridge was built by the owners of the Rochdale Canal arm sometime around 1810. The bridge hole was originally wide enough to take broad beam barges. The current bridge is only suitable for narrowboats and is clearly a replacement.

4.5.26 **Current Condition:** Standing but narrowed. Useable for narrowboats. In good to fair condition (CRT Condition B to C).

4.5.27 **Works:** If through navigation is to be attempted for broad beam boats then a new replacement bridge will be required. If the route is to be used by narrow boats only then the current bridge will suffice.

4.6 Structures III: Tunnel

4.6.1 **History:** The M&SJC Tunnel ran for 499 yards from the junction of Atherton Street and Charles Street turning slightly north to run under Camp Street before turning slightly south and running under Alport Town (road) before passing under Watson Street where it emerged into open air and the foot of the paired Locks No.3 and Locks No.4.

4.6.2 Engineered by John Gilbert Junior the Tunnel took nearly three years to construct. As built it was a brick-vaulted tunnel with some lower sections constructed of red sandstone. The towpath was carried through the tunnel on the north bank, the towpath had deep sandstone copings similar to those seen on the locks

4.6.3 The tunnel is 18 ft wide and 18 ft high with a 3 ft 6 inch wide towpath set alongside the northern wall. Originally the canal was 8 ft deep at the sides, 10 ft in the centre of the invert. The tunnel was lit by gas light along the wall on the towpath side.

4.6.4 The Tunnel entrance at the western end appears to have been between brick retaining walls – effectively a brick box where the tunnel passed through loose alluvial and glacial sediments before encountering bedrock. This box structure was approximately 30 yards long. The eastern entrance was a simple brick arch with stone quoins & voussoirs and opened into a shallow cutting below Watson Street.

4.6.5 The canal tunnel was modified during the construction of the Great Northern Warehouse in 1892. The tunnel below the warehouse was widened and two side arms were driven at 90 degrees to the original tunnel to provide loading banks, these were linked by a foot tunnel. Hoists were installed in two shafts to take goods directly from the boat level to the warehouse. The stub from the loading areas passing under Watson Road would appear to have been closed off at this time. Based on photographs the modifications and additions to the tunnel were in hard red brick with some engineers blue brick for details.

4.6.6 The tunnel was abandoned in 1922 when traffic to the GN warehouse ceased. It was drained shortly thereafter. In 1939 the tunnel was appropriated for the construction of an air raid shelter which operated from early in 1940 to 1945. The remaining structures within the tunnel are an outstanding survival of a municipal deep air-raid shelter and consequently were listed as such in 2012.

4.6.7 **Current Condition:** The western entrance appears to have been partially dismantled and then buried and is covered by a graded fill. The eastern entrance has been bricked up and can be seen in the west undercroft wall of Manchester Central (now the car park). The surviving central section, approximately 475 yards in length is accessible from two points:

the former Deansgate/Great Northern Goods Station & Warehouse and the basement of Granada Studios. Parts of the tunnel – mostly between Lower Byrom Street and Deansgate is flooded and not accessible on foot.

4.6.8 It did not prove possible to inspect the tunnel during this preliminary study. The following description of the interior of the tunnel is therefore quoted verbatim from the English Heritage (now Historic England) Listing documentation (EH 2012)

From "English Heritage 2012 List Entry Summary. Name: Manchester & Salford Junction Canal Tunnel. List entry Number: 1405199

EH1 The canal tunnel is a brick-vaulted structure with some lower sections of walling constructed of red sandstone. The tunnel is 18' wide and 18' high with a 3'6" wide towpath set alongside the northern wall. Originally the canal was 8-10' deep, but poured concrete floors were inserted during its conversion to an air-raid shelter, raising the floor level. Following its conversion to an air-raid shelter the tunnel is divided into separate bays by reinforced-brick blast walls, inserted to prevent blasts travelling along the tunnel. The surviving section of the tunnel retains a series of reinforced-brick, arched stairwells and reinforced-concrete stairs, which were inserted to provide access to the shelter. The tunnel brickwork appears to have been painted white during its use as a shelter, presumably to create as light an environment as possible, and much of the paintwork survives. Brick skin walls inserted into the tunnel shelter to prevent damp largely survive, but gas-pipe handrails on the stairs have been removed, although some of their supports survive, along with some ceiling lights. The bay numbering starts with Bay 1 at Watson Street and ends with Bay 16 just beyond Atherton Street (this bay is now partly blocked-up).

EH2 Bays 1-5 lie underneath Deansgate and the former Deansgate/Great Northern Goods Station & Warehouse and retain their original, bay-to-bay air-raid shelter access, which consists of a passageway through each blast wall with brick bulkhead walls at either side with reinforced-concrete roofs. The bulkhead walls are annotated with arrows pointing the direction of travel and the bay numbers. This section of the tunnel is accessed via an 80ft-high stair well (formerly a c1900 lift shaft/hoist well used to transport goods up to the warehouse above) contained within the former Deansgate Goods Station & Warehouse, which leads down to a short, brick-vaulted passageway that provides access on to the towpath of Bay 2 (an identical passageway and lift shaft/hoist well leading off from Bay 3 to the west have been in-filled).

EH3 Bays 2 & 3 are wider than the rest of the tunnel, resulting from the extension of this part of the tunnel in c1900 to form a wharf that served the warehouse above. The former wharf is 31' wide and 23'6" high with a 8'6" wide towpath that retains an original, cast-iron mooring bollard in Bay 2. Steps have been inserted from the towpath down on to the raised canal floor. Bay 2 contains a reinforced-brick structure to the south-west corner, which is believed to have functioned as a toilet block during the tunnel's use as an air-raid shelter. Surviving on the north wall of the structure are painted instructions (now heavily faded) for users of the shelter. Further toilet blocks survive in Bays 1 & 4; that to bay 4 contains an original Elsan chemical toilet. A metal gas-proof screen survives to the western bulkhead wall and passageway in Bay 2, and Bay 1 retains the upper section of the canal tunnel's original west portal, including stone voussoirs.

EH4	Bay 5 has a split-level floor with a large, reinforced-brick, air-raid shelter structure (original reinforced-concrete roof now removed) set alongside the south wall of the tunnel and arranged on both floor levels. The eastern end of the structure, which is set upon the higher ground level, is formed by a warden's post, which has look-out window openings to the east and north sides, and a doorway (door removed) to the north side. A short flight of steps provides access down on to the original canal floor (now submerged under several feet of water), and to two (men's and women's) first-aid posts, which are separated internally by a brick dividing wall incorporating an access doorway. Entrance doorways and air vents exist to the north and west sides. Two stairs, forming this bay and the shelter's Deansgate entrance, have been inserted through the north wall of the tunnel. A warden's look-out with a corrugated metal roof also exists to Bay 1, along with a stair that served the Watson Street entrance.
EH5	Bays 6-12 lie underneath the area between approximately Deansgate and Lower Byrom Street and are flooded by several feet of water. However, photographs taken in 2010 show that they share the same level of survival as the rest of the tunnel, including a raised towpath, annotated bulkhead access walls, Byrom Street air-raid shelter entrance stairs, and some surviving air-raid shelter structures, including toilet blocks and a further warden's look-out. Bay 9 also contains a heavily degraded painted notice for shelter users adjacent to one of the bulkhead walls.
EH6	Bays 13-16 lie underneath the area between approximately Atherton Street and Lower Byrom Street and are accessed via a later inserted entrance contained within the Granada Studios building. Although the tunnel has been drained, groundwater seepage means that the canal is partly filled with water. Bay 16, located at the north-western end of the tunnel, has been truncated and sealed-off by a mid-late C20 concrete wall. The original air-raid shelter access from bay-to-bay, via a passageway through each blast wall with brick bulkhead walls at either side, has been blocked-up, although the bulkhead walls still survive and are annotated with painted lettering and arrows pointing the direction of travel and the bay numbers. Access between the bays is now via later doorways inserted through the blast walls at towpath level. Two air-raid shelter staircases, forming the Lower Byrom Street entrance, exist to Bay 13 and have been inserted through the northern wall of the tunnel. Set in between the stairs is a warden's look-out, which consists of a small, square, reinforced-brick structure built on the canal floor and against the towpath, with window openings to the east and west sides and a doorway (door removed) to the south side. The look-out's original reinforced-concrete roof has been removed.

4.6.9 The English Heritage Statement goes on to report a short section of tunnel passage at the eastern end, described as an “additional chamber”, which “incorporates an in-filled, formerly open-air reservoir and two truncated, brick, pump-engine housings (machinery now removed). It was also originally the site of the canal's open-air, upper locks. The chamber is not of special interest and is excluded from the listing”. This is clearly in error as the locks, canal reservoir and pumping station were large structures sited some distance from the tunnel and were definitely removed to make way for Manchester Central station. Whatever remains exist in the “additional chamber” (the author was unable to visit to examine) must post-date the blockage of the route in 1875 and most probably date to either the use of the Great Northern Warehouse wharf or to Manchester Central station.

4.6.10 **Current Condition:** The tunnel survives in relatively good condition. The current condition of the interior is described in the box above. It is a protected (listed) site and not under any immediate threat.

4.6.11 **Works:** To restore the canal to navigation is not technically difficult and the minor repairs required (where for example blocking walls have been keyed into the main arch or holes broken through for stair wells) are not insurmountable obstacles.

4.6.12 The re-opening of the western entrance would require the reconstruction of the revetment box and the creation of a new portal. Depending on the approach adopted to the use of the tunnel the revetment box could incorporate visitor facilities. The eastern portal is still standing and visible in the wall of the Manchester Central Undercroft – opening up the tunnel is a relatively simple task – the reconstruction of the Manchester Central Undercroft to accept the canal is considerably more difficult (below).

4.6.13 **Issues:** The central issue is the listed status of the air raid shelters and their importance to the history of Manchester. Removal of these shelters would arguably do considerable harm to the historic environment record of the city. Under the current listing demolition is prohibited and thus any proposals to remove the shelters would be immediately rejected at the initial stages of a planning application.

4.6.14 There is thus a clear conflict between the display and interpretation of the heritage of the Second World War and the operational use of the transport heritage of the late Georgian era. *See appraisal below.*

4.7 Structures IV: Reservoir and Pump Houses

4.7.1 As built the water supply for the canal came from the River Irwell. To maintain water in the M&SJC required pumping. This was accomplished by two steam pumping engines which lifted the water from the Irwell to above Locks No.2 (the Lower Pump House) and then from below Locks No.3 to above Locks No.4 (the Upper Pump House). The pump houses together with their boiler houses and coal stores were sited on the north bank of the waterway. A small reservoir was located adjacent to the Upper Pump House.

Lower Pump House and Pump House Tunnels ("Bye Water Tunnel")

4.7.2 **History:** Open 1839 to 1922: The Lower Pump house was situated on the north bank of the canal at the junction of the main line with the Brunswick Basin. It was orientated at 90 degrees to the Basin and hence was at an angle to the main line. The 1850-51 plan shows the pump house as three conjoined buildings – by scaling from the drawings it can be estimated that the main "engine house" was around 30ft long and 12ft wide and joined on the west side by a smaller building approximately 9 ft. 6 inches long by 7 ft. 6 inches wide. To the north of both buildings, and joined to them, was the boiler house (marked "Boilers") – a much larger building approximately 74 ft. long by 25 ft. wide.

4.7.3 There is currently no information on the type of pumping engine used but the dimensions of the boiler house suggests a bank of relatively low pressure Mill or "Lancashire" boilers.

4.7.4 A "Bye Water Tunnel" is shown passing from the River Irwell under the north bank of the canal and then under the engine house and boiler house before discharging to the main line of the canal near the entrance to the Brunswick Basin (marked "overflows" on the 1850-51

map). This is the middle or Tunnel Pound. The Bye Water Tunnel has a branch to the short pound between Lock No.1 and Locks No.2 where it again "overflows". The presence of several sluices on the Bye Water Tunnel suggests it could be used to draw water from the Irwell to either or both pounds depending on need.

4.7.5 The outline of the engine house and boiler house shows the addition of a further small outbuilding attached to the west end of the engine house but the overall outline remains the same. Although not marked as an engine house the same outline appears on a 1923 plan. The outline remains the same in 1948-49 when it is marked as an "Engineering Works" – by this time the canal locks, channel and Brunswick Basin have all been infilled.

4.7.6 Remarkably the outline of the engine & boiler house can still be traced in the first decade of operation of the Granada Studios appearing in the 1957 and 1961 plans of the site and possibly surviving as late as 1971. The building was gone by the early 1980's.

4.7.7 **Current Condition:** Demolished, site under other buildings (Studio 12).

4.7.8 **Works:** None. Evidence for the foundations of the lower pump house may be found under Studio 12 and the current car park area when the area is eventually cleared. This should be factored into any plan for archaeological investigation.

4.7.9 **Issues:** The need for a new water supply system if the canal is restored – The options for such a system are considered below (4.8).

Upper Pump House and Pump House Tunnels

4.7.10 **History:** Open 1839 to 1875: The Upper Pump House was situated on the north bank of the canal midway between the top of Locks No.4 and the Lower Mosley Bridge. To the immediate west was the Top Pound Reservoir.

4.7.11 Map evidence suggests that the Upper Pump House consisted of a similar arrangement of buildings with similar dimensions to the Lower Pump House, suggesting that they were of the same design. The engine house was located to the west of the larger boiler house and the group was end-on (at 90 degrees) to the canal line.

4.7.12 The water pumping tunnel is marked only as "tunnel" and runs from below the bottom of Locks No.3 along the north side of the canal, under the reservoir, to the engine house. From the large scale plans it looks as though water which had been pumped up was then discharged to the reservoir. The reservoir then discharged to the top pound above Locks No.4.

4.7.13 The pump house closed when through navigation was abandoned in 1875 to make way for Manchester Central Station. Given the depth of foundations required for the station it is considered probable that the site was effectively obliterated and that no evidence is likely to survive.

4.7.14 **Current Condition:** Demolished and site is now under Manchester Central.

4.7.15 **Works:** None.

4.7.16 **Issues:** The need for a new water supply system if the canal is restored – The options for such a system are considered below (4.8).

Top Pound / Great Mount Street Reservoir (adjacent to Upper Pump House)

4.7.17 **History:** 1839 to 1875: The reservoir was situated to the west of the Upper Pump House and occupied land between the canal and Great Mount Street. Nothing is known about construction

4.7.18 Along with the upper pump house, the reservoir was destroyed (along with Great Mount Street) during the construction of Manchester Central Station.

4.7.19 **Current Condition:** Demolished and site is now under Manchester Central.

4.7.20 **Works:** None.

4.7.21 **Issues:** The need for a new water supply system if the canal is restored – The options for such a system are considered below (4.8).

4.8 Water Supply

4.8.1 As built the water supply for the canal came from the River Irwell. To maintain water in the M&SJC required pumping.

4.8.2 In water supply terms the original canal can be divided into three pounds (from west to east):

- The Bottom or Short Pound – this extended from the head of the Irwell River Lock No.1 under Irwell Bridge to the bottom of Lock No.2.
- The Middle Pound – this extended from the head of Lock No.2 through the Tunnel to the foot of Locks No.3 & No. 4 (a staircase).
- The Top Pound – this extended from the head of Locks No.3 & No.4 to the stop gate at the entry to the Rochdale Canal arm.

4.8.3 The original canal suffered water supply problems. Providing a suitable water supply for a reinstated waterway would be a challenge. There would appear to be four possible sources:

Pumped Feed from the River Irwell

4.8.4 This would involve a similar arrangement to that on the original canal with water being lifted in two stages from the River Irwell to the Middle Pound and then from the Middle to the Upper Pound. The most probable arrangement is a two stage / state electrically powered system: A continuous low volume feed pump is used to maintain pound levels while a separate large volume short run pump system is used to back-pump lock discharge.

4.8.5 Key issues surround cost, water quality and supply.

4.8.6 The cost of water pumping is a major factor. Modern continuous feed pumps are considerably cheaper to install and run that their steam counterparts but they none the less have ongoing operating costs. It may be possible to mitigate this by the use of locally generated solar power (wind power is considered problematic in urban settings). Power drain from a small continuously operating “top-up” pump might be quite low. The use of short-run high -volume pumps for back-pumping is well proven technology on Britain’s inland waterways. The cost of pump operation could be recovered by a direct charge on users through a ‘passage fee’.

4.8.7 Water quality is an issue as the River Irwell was once heavily polluted. Water quality has improved dramatically in the last 20 years and although many reaches still register as poor the overall trend is towards improvement and recovery (Environment Agency 2007 & website).

4.8.8 Water flow in the Irwell is highly variable but the lower reaches are to some extent buffered by linkage to the Manchester & Salford Docks system (EA 2007). Abstraction may therefore be possible within certain limits based on river height and flow rates.

Gravity Feed from the Rochdale Canal

4.8.9 The act for the original M&SJC prevented the company from abstracting water from the Rochdale Canal and demanded that it had to maintain its uppermost pound at a level three inches above that of the adjacent arm of the Rochdale Canal. As part of an integrated national system this prohibition may no longer apply. If the waterway was to be reinstated as a through route then abstraction from the Rochdale Canal could be considered.

4.8.10 This would enable a gravity feed of the entire system and has the advantage of eliminating or greatly reducing the need for back pumping.

4.8.11 The potential point of abstraction would be through the Rochdale Canal Arm which joins the Rochdale Main Line above Lock No.89 (Tib Lock). At that point the Rochdale Canal is carrying the combined flows of both the Rochdale and the Ashton and Peak Forest Canals. Water which is abstracted for the M&SJC cannot be compensated for by increasing flows in the Rochdale Canal as it has only a very limited water supply with no spare capacity. There is, however, potentially some spare capacity in the Ashton / Peak Forest Canal feed which may be used.

4.8.12 A key issue is that any water abstracted to feed a restored M&SJC would ultimately discharge to the River Irwell. This would divert water from the Castlefield Wharfs, the Bridgewater Canal and the Pomona Lock (or Hulme Locks Branch if reinstated). If insufficient flow is available to satisfactorily feed both the M&SJC and the existing Rochdale Canal then it is possible that reduced flows in these sections would lead to oxygen depletion with consequent impacts on fish and other aquatic life. These problems would be most acute during the summer season when boat movements are at their highest and water supply recharge is at its lowest.

4.8.13 To understand these issues in detail will require a full water resource and use study and hydrological modelling of the operational canals in this area. At present, however, it is considered unlikely that any significant abstraction from the Rochdale to feed the M&SJC would be either operationally or ecologically acceptable.

Groundwater

4.8.14 As noted above the M&SJC tunnel runs through the Chester Pebble Beds (Triassic Sandstones) which underlie much of central Manchester. These red sandstones are regionally important aquifers and there several industrial extraction boreholes in the surrounding area (Griffiths, Shand & Ingram 2003). The porosity of the sandstones is undoubtedly why the tunnel remains wet and over much of its length has become, and remains, re-flooded.

4.8.15 The point source flow rate is undetermined but based on bore hole data is likely to be low – around 0.00006 to 0.0007 cubic metres per second (BGS). The potential collection area is however quite large and thus groundwater discharge may be of some value, especially if augmented by a new borehole. Given the topography of the canal any groundwater feed would only effectively benefit the Middle or Tunnel Level Pound.

4.8.16 Key issues facing groundwater abstraction include the potential impact on existing groundwater resources and the local water table, together with the limited flow rates and the cost of an abstraction licence.

4.8.17 In consequence groundwater may play a small part in keeping the Middle and Bottom Pounds of any reinstated canal feature "topped up" at the tunnel level but it is very unlikely to supply sufficient volume to feed the demands of lockage.

Surface Water Drainage

4.8.18 A considerable proportion of the area adjacent to and above the canal line is covered by buildings or is hard landscaped. This type of impermeable surface can result in rapid run-off and will exasperate rainfall event peak-flows in rivers. As the intensity of extreme rainfall events is predicted to increase in the next 30 years there is a pressing need for more sustainable surface water drainage in urban areas.

4.8.19 Development schemes in Swindon, Stroud and Chesterfield are using new lengths of navigable waterway as forms of surface water drainage. Methods employed include:

- Building / restoring lengths of canal / basins as balancing ponds for surface run off.
- Building / restoring channel sides with an increased freeboard - a small increase (200 to 300 mm) over an extended length can dramatically increase water storage capacity.
- Creating bounded / contained canal-side plazas or green spaces along lengths of canal side where the canal bank is designed with a slightly reduced freeboard. These areas will preferentially flood during extreme rainfall events to further temporarily increase water storage capacity. The surfaces and street furniture are designed for rapid post-flood recovery and utility infrastructure is either routed around these areas or is made flood proof.
- Forming integrated networks of reed beds across a development site. These can be an attractive feature which can take surface run off, retain suspended sediments and clean water flow before it is discharged to the main canal channel.

4.8.20 The application of these principles to the M&SJC would not only reduce and control surface water run-off but would also provide a significant top up to the water levels in the restored canal. It would not, however, be of sufficient volume to feed the demands of lockage through the canal.

Interim Conclusion

4.8.21 Water supply will be a major issue and will require detailed study early in the process. In the interim it is considered likely that a combined approach based on back pumping to retain and reuse a limited water supply drawn largely from the River Irwell and supplemented by a limited gravity feed from the Rochdale/Ashton and a new borehole will

provide the necessary volume and security of supply to enable the canal to operate under most currently forecast conditions.

4.9 Utilities

4.9.1 A detailed utility search has yet to be conducted over the entire route. From the information available:

4.9.2 Irwell Bridge (Water Street): The Irwell Bridge carries all the main utilities across the canal line. The bridge is intact but bricked up. Provided it is structurally sound there should be no reason to move the utilities at this point. If the bridge requires replacement then allowance will have to be made to incorporate the existing runs within the new structure.

4.9.3 Locks No.2 to West Tunnel Entrance: The canal track within the Granada Studios site has not been used as a utility path, however, the line is crossed by Telecoms, electricity and water connections to the main buildings. These are distributary connections only and relatively easily re-positioned.

4.9.4 Canal Tunnel: The tunnel is crossed by all types of utility. The depth of the tunnel below the surface does, however, mean that those utilities will not be affected by the proposed re-opening. Note will need to be taken of those utilities in the risk assessment for the use of the tunnel.

4.9.5 East Tunnel Entrance to Lower Mosley Street: This section is now under Manchester Central. Full utilities undetermined, but it is evident that the area has all the major utilities. High potential risk.

4.9.6 Lower Mosley Street Bridge: The road over the site of the bridge carries all utilities. Any new replacement structure will need to make allowance to incorporate the existing runs.

Structure / Element	Structure Extant (re-use possible with repair)	Structure Buried (re-use possible with major works)	Structure Demolished/Removed and Site Built Upon
Entry Bridge (not original to Canal)	●		
Lock 1	●		
Irwell (Water Street) Bridge	●		
Channel: Irwell Bridge to Lock 2		●	
Locks 2		●	
Lower Pump House			●
Channel: Lock 2 to Entry of Brunswick Arm		●	
Bridge at Entry of Brunswick Arm			●
Channel: Brunswick Basin (Potato Wharf)			●
Chanel: Entry of Brunswick Basin to Tunnel			●
West Tunnel Entrance Arch		●	
Tunnel		●	
East Tunnel Entrance Arch		●	
Channel: Tunnel to Lock 3			●
Locks 3			●
Locks 4			●
Channel: Lock 4 to Stop Lock			●
Upper Pump House			●
Canal Reservoir			●
Stop Lock			●
Lower Mosley Street Bridge			●
Rochdale Canal Arm (Including Bridgewater Basin)	●		
Great Bridgewater Street Bridge	●	●	
Entry to Rochdale Canal Including towpath swing bridge (modern)	●		

Figure 4.1: Summary of Initial Condition Assessment of the Historic Route & Historic Structures on the Manchester & Salford Junction Canal

Those elements shaded green are visible and potentially restorable with relatively minor cost, those shaded in yellow survive but require more extensive rebuilding, those shaded red have been destroyed and removed or their sites are now located under major buildings and hence will require completely new replacements often in alternative locations. Note that the Tunnel, because of its length, has sections that require little action and other lengths (including the tunnel entrances) which would require extensive rebuilding to meet modern safety standards.

5 Opportunities, Constraints and Options

5.1 Introduction

5.1.1 The reintroduction of a waterway into an urban environment offers considerable opportunities for economic and tourism development. It is also bounded by a number of constraints, specifically the presence of the tunnel and the existing regeneration proposals.

5.1.2 This section reviews the opportunities within, and constraints placed on, the canal corridor. This includes current land holding along the canal corridor.

5.2 Opportunities

5.2.1 Waterway projects across the UK now have a proven record of delivering economic and social benefits both to the communities through which they run and to the wider surrounding region (see for example Maer & Millar 2004; Jacobs 2009, and 'benefits' below).

5.2.2 This record is supported by government policy and evidence drawn from national, regional and local studies which show how waterways can produce measurable benefits through acting as a focus and catalyst for economic, social and environmental regeneration.

5.2.3 In consequence, reference to the potential value of waterways can be found in a wide range of strategies, policies and planning policies extending across many Government Departments. These appear across policy themes and support a wide range of Government agendas, including:

- sustainable communities
- housing growth and renewal
- urban renaissance
- place making and place shaping
- rural development and diversification
- visitor economy and sustainable tourism
- sustainable transport
- health and well-being
- climate change, carbon reduction and environmental sustainability
- social inclusion and cohesion.

5.2.4 This is illustrated by the range of planning policies in which waterways appear. To take one example; the contribution of towpaths to healthy exercise is recognised in NICE "Public Health Guidance 8: Promoting and Creating Built of Natural Environments that Encourage and Support Physical Activity" (2008) and also the Department of Health publication "Be Active, Be Healthy: A Plan for Getting the Nation Moving" (2009). This has led to projects, promotion and marketing which has nearly doubled healthy activity along waterway corridors, especially in urban areas (see CRT annual reports for 2012, 2013, 2014).

5.2.5 The opportunities along, and connected with, the Manchester & Salford Junction Canal corridor are equally varied and involve activities which cross over between different policy areas. The key economic, social and environmental opportunities include the following:-

Green/Blue Strategy for Sustainability

5.2.6 Waterways are an integral part of the Manchester City Council vision for a sustainable future (MCC 2015). There are notably few elements in the current (or previous) masterplans for the St. Johns site which address sustainability – the introduction of waterspace might go some way towards addressing issues including:-

Integration of Urban Development with the New Irwell River Park

5.2.7 The canal and associated towpath/cycleway would provide a direct access route to the Irwell River Park currently in development. The Irwell River Park is intended to re-open the Irwell to greater use. The River Park is intended to link the transformed Manchester and Salford Docks now home to Media City, the Lowry and NWM North to the city centre. The formerly heavily polluted river is today improving in ecological status.

5.2.8 One of the potential drivers for the regeneration of the Irwell corridor is the reintroduction of boating and activity on the water to this length of river (Apem 2004). This has not yet happened – largely because of the absence of any destinations on this length of water and the absence of any means of access to the water – the lack of moorings and mooring pontoons on the river is one obvious issue. The possible re-opening of the M&SJC (even if only as a basin) would provide a destination and would require a landing stage or mooring pontoon at the canal entrance to enable users to safely operate Lock No.1. The canal could therefore be seen as part of the integrated approach to the reinvigoration of the River Irwell.

Green/Blue Corridors – Pocket Parks and Cooling Islands

5.2.9 The Green/Blue Strategy for Manchester (MCC 2015) identifies the central district as one which has particular problems in the supply of adequate green infrastructure. In consequence it is the central district that is assessed to have the greatest chance of human life threatening heatwaves under current predictions of human induced climate change.

5.2.10 The introduction of even small areas of Green/Blue infrastructure in the form of a canal could have a significant effect by encouraging greening in bankside pocket parks and providing important 'cooling islands' within dense urban settings.

Passive Urban Cooling and Heating Systems for Buildings

5.2.11 Canal Basins can also be used as part of passive urban cooling and heating systems. Water source heat pumps can be used to heat and cool residential or industrial developments in both new and existing sites. The restoration of the Paddington Basin Arm in 2008 included installation of a heat exchange system within the bed of the canal. This provides summer cooling and winter warming to three major office developments surrounding the Arm. Other successful projects on Canal & River Trust waterways include data centres, hotels and universities.

5.2.12 With predicted increases in summer temperatures due to climate change there is scope for the development of these low carbon solutions along the M&SJC corridor. The new basin

proposed under Option B for example, below, could be linked to the passive cooling and heating of a re-developed Bonded Warehouse.

Sustainable Urban Drainage

5.2.13 Canals can provide interception of surface water flow, temporary storage and gradual release of storm flow and have the capacity to act as integral part of sustainable urban drainage if properly designed. The expectation is that the M&SJC could provide this for the St. Johns development.

Making best use of Hidden Heritage Assets

5.2.14 Heritage plays a key role in shaping the identity and character of a given place. Places which work and which have a long term resilience – which are able to evolve and grow – tend to have a backbone of heritage buildings and structures which make users feel rooted in the locality.

5.2.15 The western end of the canal, St Johns, lies within the Castlefield Conservation area, on the defining characteristics is the presence of a network of historic waterways. In character terms returning at least part of the M&SJC to water would play to that local character.

5.2.16 The M&SJC is an important part of the history of central Manchester. It is a lost fragment of that story – by bringing it out into the open it can act as an anchor for the development and help the new community feel rooted to the locale.

The Avoidance of Sterility

5.2.17 Waterways are untidy, they attract untidy people and spontaneous activity – they are places which encourage alternative approaches. The introduction of water if properly done could do much to promote the quirky creative atmosphere which seems to be one of the aims of more recent development plans.

5.2.18 Water can be a positive feature in design – it has aesthetic qualities which can break up and soften hard urban edges and through reflection of image and light makes spaces feel larger and brighter.

5.3 Constraints

5.3.1 As will be apparent the route of the M&SJC differs from that of most potential canal projects in that it (a) runs through the centre of a vibrant city which is undergoing rapid regeneration and reinvention as the central hub of the Northern Powerhouse, (b) a considerable portion of its length is within a tunnel and (c) a significant length of what was open canal now lies under major landmark buildings.

5.3.2 It is obvious that any proposals for the restoration of this waterway will need to be integrated into the long term development strategy for the city centre. This section therefore sets out to review the potential constrains upon any possible restoration, in whole or in part, of the M&SJC.

Local Government Strategy for Central Manchester

5.3.3 **Strategic Plan for the City Centre 2015 – 2018**. Manchester City Council 2015. Adopted in 2015 this refreshed plan takes into account the rapid changes in the city centre since 2010.

5.3.4 This has three main concerns (a) Performance of the economy of the region and sub region (b) Reaching full potential in education and employment and (c) Neighbourhoods of Choice. It identifies the St Johns area as a priority development area and places stress on the need for vibrant creative communities. Diversification of the offer is also a theme.

5.3.5 The M&SJC could be developed in several alternative ways all of which could play into the idea of St. Johns as a quirky new-maker, art and design hub. See option B.

5.3.6 **Manchester Green and Blue Infrastructure Strategy 2015**. Manchester City Council. This promotes an overarching vision for the future of Manchester's green spaces and waterways. It identifies the City Centre as being distinct and with significant challenges due to the relatively low level of Green/Blue infrastructure.

5.3.7 It notes that "enhancing appropriate provision is particularly important for the city centre in helping to create an attractive location for residents, workers and visitors" (2015, p.67). It goes on to note the constraints of a dense urban fabric and considers the application of new green infrastructure through the retrofitting of green roofs, enhancing canal corridors, urban street networks and creation of new GI through development (2015, p.67, emphasis mine).

5.3.8 **Greater Manchester Destination Management Plan - The Visitor Economy Action Plan 2014-17.** Provides a framework for tourism development in the city.

5.3.9 The plan identifies many of the established assets of the city and the ways in which these can be promoted with the aim of Manchester becoming a world class destination. The focus is high level but in heritage terms clearly wishes to build on the status of Manchester as the "World's First Industrial City".

5.3.10 Within that large scale destination framework the M&SJC could be seen as a very minor component, nevertheless, there are opportunities to use the primary draw of the Museum of Science and Industry (MOSI) and position the M&SJC as what would effectivity be a subsidiary destination to the MOSI Complex. In that way the canal would be adding value to the Castlefield area, possible providing a more personal story of events (in contrast to the big picture view of MOSI). As a focal point outside MOSI it might provide an alternative focus for non-museum activity – for example in the arts and thereby encourage longer dwell times.

Existing Development Strategy for the St. Johns (Granada Studies Site)

5.3.11 Several masterplans have been proposed for St Johns (the Granada Studio site). Earlier masterplans tended towards a dense urban form with high rise elements along the edge of the River Irwell. More recent plans have adopted a block metric which is inspired by that of the surviving Georgian streets to the east of the site. Unfortunately the block metric used is a far too regular and results in a uniform distribution of relatively tall blocks across the site. This does not accord with the irregularity, variability, spacing, height and massing of the Georgian street scene perceived by those moving through it.

5.3.12 The most recent plans for the site embrace a long term phased development focusing on the creative industries and the "new makers". With an emphasis on creativity and the unusual, the development will re-use many of the key elements of the old studio including the main office suite and studios. While ancillary buildings on the canal line will be removed the retention of Studio 12 will effectively block the canal line beyond the putative new basin (see appraisal) and prevent boating access to the tunnel. Should the tunnel be developed as a tourist attraction – especially around the Manchester Blitz Story - this will not be an issue.

5.3.13 Proposals for the canal will break up the regularity of the proposed street pattern and may go some ways towards engendering a more off-beat atmosphere (and which does not look like every other new development in Manchester) into the location in line with the most recent proposals for the site. For example the proposed new canal basin would deliver the desire to create new public open space in front (north of) the Bonded Warehouse as well as proving sustainable heating and cooling.

Existing Development Strategy for the Great Northern Warehouse.

5.3.14 The Great Northern Warehouse has been subject to several development proposals and in many ways has the feel of unfinished business. Several proposals are current for conversion car parking area to flats which would increase the night time vitality of the area which at present appears slightly marginal to the city centre.

5.3.15 The proposed development of the canal tunnel which runs under the warehouse has the potential to provide an additional visitor attraction at this location. There are, however, constraints on development and design which include ventilation, health and safety, ease of access for emergency services and the potential for fire or explosion in the confined space beneath the warehouse if boats with internal combustion engines were used there.

Existing Development Strategy for Manchester Central

5.3.16 Manchester Central is one of the main events, exhibition, conference and concert venues in Manchester. It is highly successful and has recently undergone further refurbishment an improvement. The former station is a listed structure and any modifications to the undercroft to accommodate a waterway would need to be carried out with great sensitivity.

5.3.17 The undercroft currently provides onsite parking for the majority of Manchester Central's users and visitors. While the corridor required for a canal through the undercroft would be relatively narrow it will impact on both parking space and both vehicle and pedestrian circulation. Any solution will require careful design.

5.4 Landownership

5.4.1 Mixed landownership is a major constraint upon the integrated development of the canal corridor.

5.4.2 Landholding along the canal corridor is complex. This is an artefact of the gradual breakup of the canal corridor created by the original Act of Parliament.

5.4.3 The land vested in the Manchester & Salford Junction Canal Company passed, through takeover, to the Mersey & Irwell Navigation in 1842 and then to the Bridgewater Canal

Company in 1872. The corridor began to be broken up in 1875 when the section west of Watson Street was sold to the Cheshire Lines Committee Railway to build the new Manchester Central station. The remaining length of the waterway was then transferred to the Manchester Ship Canal when it purchased the Bridgewater Canal in 1887. With the formal closure, and act of abandonment for the waterway in 1936, significant sections at the western end of the canal were sold off.

5.4.4 The tunnel was occupied for shelters by the Manchester Corporation in late 1939 but was not formally transferred to their ownership unit 1941. This is now believed to be held by Manchester City Council.

5.4.5 During the 1960's the land parcels at the western end of the waterway were reassembled to create the Granada Studios site. This land was sold to Allied London in the early 2000's.

5.4.6 Landownership will require further investigation but at present it would appear that the landholding is a follows:

- Irwell & Lock No.1 to Irwell Street: Unknown.
- Irwell Street Bridge – Manchester City Council. But note it is possible that the land under the bridge may still be retained by another, residuary, body.
- Irwell Street Bridge to West Portal and tunnel and Land over first 100m of Tunnel: Allied London.
- The Tunnel: Manchester City Council.
- Land over Tunnel: Landownership over the tunnel and ownership of the former air-raid shelter entrances is held by individual property owners along the route (approximately 50 plus properties are involved).
- Tunnel Wharf under the Great Northern Warehouse: The owners of the Great Northern Warehouse, Peterson Group (in partnership with Trilogy Property) own the access point to the tunnel but do not appear to own the actual tunnel shelter area as this was vested in the Council in 1941. This is possibly a contested ownership and needs further investigation.
- Tunnel from Great Northern Wharf to Manchester Central (under Watson Street): Unknown – possible held by Railway Residuary authority.
- From the East Portal of the Tunnel to Lower Mosley Street: Manchester Central (Manchester City Council).
- Tram Bridge: Metro Link
- Lower Mosley Street: Manchester City Council
- Bridgewater Basin: Canal & River Trust.

6 Options for Development of the M&SJ Canal Corridor

6.1 Introduction

6.1.1 This section explores the options for the re-use of the Manchester & Salford Junction Canal corridor in the context of the ongoing regeneration of central Manchester.

6.1.2 It looks at potential re-use of the tunnel and suggests four main options based on the engineering assessment and the opportunities identified. It is not definitive or final.

6.2 The 'do nothing' option

6.2.1 Given the range of very difficult issues facing this waterway it would be reasonable to initially consider the option of "do nothing". This would have no cost impact on existing proposal or development but would have no positive benefits either and opportunities for tourism and visitor attraction development would be lost along with their potential revenue.

6.2.2 'Do nothing' is not neutral as it would result in the irretrievable loss of a valuable part of the heritage of Manchester. Without the waterway the value of the site as a "place" would be degraded, its significance and meaning buried, and its ability to trigger creativity and invention diminished.

6.2.3 As place making and shaping is one of the goals of the Manchester city centre strategy we have focused here on exploring positive interventions for the waterway and the canal corridor. Place shaping is as much about capturing the essence of the history of the place – keeping the ghosts if you will – as it is about bricks and mortar. The options below reflect that by suggesting a range of interventions.

6.3 Options for the Development of the Tunnel

6.3.1 One of the key features of the M&SJC corridor is the presence of the Canal Tunnel. This is both a major constraint and a major benefit. There are two groups of opportunities surrounding the re-use of the tunnel:

- First, those developments which presuppose keeping the tunnel in it is current "dry" condition and retaining the listed Second World War Air Raid Shelters.
- Second, those developments which presuppose the removal of the air raid shelters and the return of the tunnel to water and navigation.

Use of the Dry Tunnel

6.3.2 At present the tunnel can be accessed from the basement of the Granada office building at the western end and the basement of the Great Northern Warehouse at the eastern end. The central part of the tunnel is flooded because ground water has ponded behind the blast walls inserted in the canal tunnel to create the air raid shelters.

6.3.3 Given the heritage resource which is present there is a strong case for the development of the tunnel as a tourism destination. At its simplest this could be guided tours of the tunnel and air raid shelters with trained 'in character' guides. The living interpretation would

focus on the story of Manchester during the Second World War – from everyday life on the home front to the Manchester Blitz. Potential for sound and light installations to recreate the feel and sounds of the shelter when occupied at the height of the bombardment.

6.3.4 A more complex option would be the creation of a unique underground museum – 'Cottonopolis' where one would walk through history and experience the sights and sounds of Manchester from Georgian innovation through Victorian growth to the Second World War, the Manchester Blitz and beyond using interactive sound and light installations.

6.3.5 There is already a strong interest in visiting the air raid shelters but recent concerns about health & safety have precluded access from either current entrance. The adjacent Museum of Science and Industry (MOSI) attracts around 680,000 visitors a year (Visit England 2016) and this provides an initial target pool of visitors to begin audience growth based on combined visits.

6.3.6 Nationally underground attractions continue to be popular (Visit England 2016). Comparable attractions such as the Clearwell Caves – ironstone mines on the edge of London which were adapted to form air raid shelters – attract around 60,000 visitors a year. Locally the Stockport Air-Raid Shelters bring in around 24,000 visitors a year.

6.3.7 Small inner city "new generation" niche museums such as the Museum of the Jewellery Quarter in Birmingham currently attract around 25,000 to 35,000 visitors per year. With the growth of city destination short-holidays the demand for unusual city museums, venues and activities is strong and the Canal Tunnel properly integrated into the St. Johns site could provide one such attraction.

6.3.8 A further opportunity could come from the opening up of the tunnel entrance at the St. Johns or western end and it's restoration to its original (or near original) appearance. This would enable the tunnel to be accessed for tours but might also enable the tunnel to be used for other activities.

6.3.9 Removal of the most westerly bay of the shelter system would provide a linear covered area adjacent to the main development site. This could be developed as a unique underground street market complimenting the higher end offer around the new public square proposed for the area to the north of the Bonded Warehouse. This would certainly offer something unusual to add to the slightly eccentric and creative vibe which is a feature of current plans. The loss of one part of the shelter system might be justified in order to provide (a) safe access to the system and (b) sufficient long term income to protect and maintain the rest of the shelter system.

Works required to Open the Tunnel as a Museum

6.3.10 Opening up the tunnel as a visitor attraction will require investment. The tunnel itself is in good condition and requires relatively little maintenance work. Attention will need to be paid to:

- **Access to Tunnel** - The entrance to the tunnel at the Western end is currently buried under a steeply sloping earth ramp. Current entry points from the basement to the Granada Building and the GN Warehouse are not suitable for mass visits and in security terms are incompatible with the planned uses of both buildings. A new entrance will need to be created most probably at the Western end. This could take

the form of a new entrance excavated through the earth ramp or the uncovering and rebuilding of the original entrance.

- **Access within Tunnel** – careful design work is required to enable access for all to the site without irreversible modification of the air-raid shelters. Control of access at key points (through the use of 'floating' walkways, handrail barriers, etc.) will be required to prevent damage to the heritage.
- **Drainage** - New drainage through the length of the tunnel would be required as there are areas of pooling water trapped by blocking walls within the air raid shelter structure.
- **Ventilation** – ensuring an adequate natural flow of air through the tunnel is vital. There are several options depending upon how long a length of tunnel is re-opened. These might include opening up a new mid-point access shaft which could double as air vent and emergency exit. If the full tunnel entrance was uncovered it is unlikely that forced draught ventilation will be required.
- **Lighting** – Lighting would need to be provided – this could be tied to the eventual uses of the tunnel – if used to tell the Manchester Story some form of variable sound and light show might be indicated – capable of replicating using modern electric light the ambience of the original gas lighting of the working canal tunnel as well as the "bare bulbs" of the 1940's shelters.

6.3.11 To fully develop the site for mass tourism a new visitor facilities building would be required, this would house ticketing, a small exhibition area, a café and toilets. This could be sited near the tunnel entrance (controlling access) or it could located in removable pods (a reversible intervention) immediately inside the tunnel itself.

Use of the Tunnel as a Navigation

6.3.12 The second group of uses are those developments which presuppose the removal of the air raid shelters and the return of the tunnel to water and navigation.

6.3.13 It should be noted that the removal of the air raid shelters would constitute a major and irreversible impact on the heritage of the Tunnel. The tunnel is listed because of the presence of the air raid shelters and the case for such a radical intervention would need to be very strong and would require considerable preparatory explorations.

6.3.14 Prior to any consideration of removal the air-raid shelters would need to be recorded in great detail and a series of archaeological excavations undertaken to gather evidence of their construction and use during the Second World War.

6.3.15 Should permission for removal of the air-raid shelters, in part or in whole, be granted the entire process of removal would need to be undertaken under controlled conditions and professionally recorded.

6.3.16 Should these conditions be met then there is no engineering reason why it would not be possible to restore the tunnel to navigation. The use of the tunnel as a navigation would depend on whether it was opened only as far as the Great Northern Warehouse or as through route.

6.3.17 If restored only as far as the Great Northern Warehouse opportunities include:

- Operation of an electric or hybrid trip boat from Brunswick Basin to the Great Northern Warehouse. The use of an almost silent electric boat would enable the trip to be accompanied by a sound and light show. This would tell the story of Manchester as a centre for innovation and in particular how - shaped by the waterways which supplied coal and raw materials and took away the finished goods – it became "Cottonopolis" - the world's first industrial city.
- Operation of a water bus from the Great Northern Warehouse / Manchester Central via St. Johns / MOSI and the River Irwell to Media City, the Lowry and the Imperial War Museum North. This would provide an alternative leisure travel route linking entertainment and museum clusters in an interesting way.
- Use of the tunnel for special events – for example water festivals. During these events private boats would be permitted to explore this unique part of the canal network in limited numbers. Restrictions would be placed due the ventilation challenges posed by internal combustion engines in a confined pace.

6.3.18 If restored as a through navigation opportunities include:

- Trip boat operation as above but with an extended route under Manchester Central to add to that story.
- Water Bus operation as above but starting at Manchester Central / Lower Mosley Street (with better links to the tram and bus network).
- Through operation of private and hire boats making passage from the Irwell to the Rochdale Canal (or vice versa). With both tunnel portals fully open the tunnel would resemble any other short canal tunnel and the ventilation of engine fumes would not be an issue.

6.4 Options for Above Ground Interpretation and Memorialisation

6.4.1 At present the canal corridor is lost to the casual visitor and there are few signs the waterway, or its afterlife as an air-raid shelter, ever existed.

6.4.2 There are opportunities to make better use of this hidden resource through above ground interpretation. Especially the creation of a walking and cycling corridor along the line of the waterway to link the key elements of the story together. The arrangement of the corridor would be complemented by on-site interpretation and animated by sculpture and artworks inspired by the locality.

6.4.3 It may also be appropriate to memorialise the layout of the canal by using it to delimit blocks of development within St. Johns so that the memory – the ghost if you will – of the waterway is still present in the new block layout of the site. The location the locks and channel could be demarcated by paving. Potential for boat shaped / styled street vendor / market stalls along line to play up to the theme.

6.4.4 Although not essential there is a case for re-opening the blocked Irwell Bridge to create a pedestrian route under Water Street. Imaginatively developed and lit, this would provide an effective, traffic free, link between the Irwell River Park and the St. Johns Quarter.

6.4.5 The above ground interpretation would effectively advertise the presence of the hidden tunnel should it be developed as a tourism destination.

6.5 Options for the Restoration of Navigation

6.5.1 The restoration of navigation to the Manchester & Salford Junction Canal is challenging. There would appear to be three main options for reintroducing an element of navigation:

Irwell to New Brunswick Basin

6.5.2 Restore only the short length from the River Irwell to the centre of the Granada / St. Johns site where a new canal basin will be formed. This would lie immediately north of the Bonded Warehouse and would be a major focal point within the site.

6.5.3 This option would require restoration of the extant Irwell River Lock (Lock No.1), Irwell Bridge and the currently buried, but largely intact, Lock No.2. The new canal basin would be designed to make best use of the water, both as a leisure facility and for sustainable urban drainage and passive heating / cooling systems.

6.5.4 The dimensions of the basin are negotiable – potentially from a relatively small area of the former canal channel to a mid-sized basin capable of taking 30 to 50 boats. This would still be a far smaller area of water than seen in the 19th century and would consequently have restricted impact on current development proposals.

6.5.5 The reinstated canal would have foot and cycle ways on both banks to create a movement corridor through the site and form the spine of the new block layout. These would provide a traffic free route from the site to the Irwell River Park.

6.5.6 This option would enable retention of the Tunnel Air-Raid shelters and there development as a tourism destination separate to the water based activities around the New Brunswick Basin.

Irwell to Great Northern Warehouse

6.5.7 Restore the canal from the River Irwell to the Great Northern Warehouse. This would include:

- Reinstatement of the canal from the Irwell to the New Brunswick Basin (as above).
- Re-excavation of the canal channel from the end of the basin to the western tunnel portal (given the location this would involve either modifications to the corner of the Studio 12 building or a minor realignment of the canal channel).
- Excavation, reconstruction and reopening of the western tunnel portal
- Removal of the air-raid shelters following intensive archaeological study and recording.
- Reinstatement of navigable depth water to the Great Northern Warehouse widening, arms and underground wharf.
- Creation of new access points along the canal for emergency exits (these could in part be reopened air-raid shelter entrances) and ventilation.
- Improvements to better access the wharf at the Great Northern Basin to enable it to be used for a water bus service, etc.

6.5.8 The result would be similar to the situation recorded by DeSalis in 1904. There is sufficient water-space at the tunnel wharf below the GN Warehouse to enable short trip boats to turn.

Irwell to Rochdale Canal

6.5.9 Restore the canal from the River Irwell through to the Rochdale Canal. This would include all the steps identified in the first two options and in addition:

- Removal of the remains of the Second World War Machinery room at the east end of the canal tunnel (approximately under Watson Street) following intensive archaeological study and recording.
- Re-opening of the eastern portal of the tunnel as it enters the undercroft of Manchester Central.
- Reconstruction of the undercroft of Manchester central to accommodate the new canal line. This will include major modifications to the northern end of the existing upper deck of the car park which was inserted into this space in the 1980's.
- Construction of a new Lock No.3 between the east side of Manchester Central and West side of Lower Mosley Street.
- Construction of a new bridge or box culvert to carry the canal under Lower Mosley Street.
- Construction of a new Lock No.4 between the east side of Lower Mosley Street and the west side of Bridgewater Basin.
- Modifications to the canal arm from Bridgewater Basin to the Rochdale Canal to ensure it is fit for navigation.
- Navigation of Great Bridgewater Street Bridge is possible using narrow beam craft. If access is to be enabled for broad beam craft then the bridge will require rebuilding.

6.5.10 This would result in the reinstatement of the link between the Irwell and the Rochdale Canal lost in 1875. It would, via the Irwell, link to the start of the Manchester Bolton and Bury Canal currently under restoration. This would be similar to the condition of the canal when it opened in 1839; the canal would once again be a through route.

6.6 Summary of Options

6.6.1 It is concluded that there are four key options (with some subsidiary embellishments) for the possible development of the M&SJC corridor:

6.6.2 **Option A: Remembered Water / A Memory Space** – create a walking and cycling corridor along the line of the waterway. May be linked (Option A Plus) with the development of the canal tunnel as a tourist destination in its own right.

6.6.3 **Option B: New Brunswick Basin** – Reinstate the canal from the River Irwell to the centre of the St. Johns site. May be linked (Option B Plus) with the development of the canal tunnel as a tourist destination in its own right.

6.6.4 **Option C: Irwell to Great Northern Warehouse (or 'The 1904 Canal')** – Reinstate the canal as far as the underground wharf below the Great Northern Warehouse.

6.6.5 **Option D: Irwell to Rochdale Canal (or 'The 1839 Canal')** – Reinstate the entire waterway and recreate a through navigation to the Rochdale Canal.

Option	Non-Navigation	Navigation (lengths)			Use of Tunnel	
	Above Ground Interpretation & Memorialisation	Irwell to New Brunswick Basin	Brunswick Basin to GN Warehouse	GN Warehouse to Rochdale Canal	Tunnel as Air-Raid Shelter Attraction / Museum	Tunnel as Navigation
A	Yes	None	None	None	Yes = A Plus	NA
B	Yes	Yes	No	No	Yes = B Plus	NA
C	Yes	Yes	Yes	No	Removed	Yes
D	Yes	Yes	Yes	Yes	Removed	Yes

Figure 6.1: Summary of Options for the development of the Canal Corridor

7 Costs

7.1 Introduction

7.1.1 This section looks at the costs of restoring or partially restoring the M&SJC for each of the four options and variants suggested above. The purpose is to set out an initial estimate of the overall costs under different options.

7.1.2 These are initial estimates made with insufficient data for accuracy. One of the first tasks in taking forward any option will be to pin down the design and operational parameters to enable the more detailed exploration of cost.

7.2 Basis for Costing

7.2.1 The costing is approximate as within an initial scoping study assumptions have to be made on the evidence available without ground/site investigation. The rationale for these assumptions is given here. Each will have to be examined and investigated before any further, more accurate, costing can be generated. These assumptions are a major project risk and must be a priority for action in order to progress the project.

7.2.2 The estimated costs reflect project delivery by full time professional engineering contractors and sub-contractors. While it is recognised that volunteer workers can, and do, make substantial contributions to many heritage projects this is a complex urban setting facing significant time pressure to ensure the rapid completion of interventions. Further, the potential hazards of urban sites and the demands of complex construction techniques – most notably in the tunnel and the undercroft conversion – can only be carried out by professional specialists. It is therefore difficult to foresee conditions under which volunteers could be successfully engaged and all cost estimates are solely on the basis of full cost delivery by professionals.

Assumptions

7.2.3 Lock No.1, the Irwell Lock, is in reasonable conditions and can be brought back into navigation use without extensive works. Dredging, repointing, clearance of ground paddle chambers, re-paddling and re-gating.

7.2.4 The canal channel between Lock No.1 and Locks No.2 survives in an infilled condition and can be re-excavated and re-used with only minor patching of the wash walls and puddle clay lining. There is no contamination of the canal fill requiring specialised treatment.

7.2.5 The Irwell Bridge (Water Street Bridge) has been bricked up but is essentially intact and can therefore be restored to use with only relatively minor repairs.

7.2.6 Locks No.2 survives as a buried structure beneath the car park. The structure can be uncovered and restored in-situ without extensive works. This assumption is supported by archaeological evidence.

7.2.7 The first 70 m of the canal channel above Locks No.2 survives in an infilled condition and can be re-excavated and re-used with only minor repairs to the north wash wall and patching of the puddle clay lining. It is further assumed that no more that 40 % of the fill is

contaminated (requiring export to closed landfill) and that at least 50% of the fill can be used on site as balancing fill.

7.2.8 It will be possible to excavate a basin to the south of the first 70 m of canal channel. This new basin will lie in front of the Bonded Warehouse. It is further assumed that this area has little archaeological heritage and that there are few utility paths.

7.2.9 The canal channel beyond 70m east from Lock No.2 is infilled and has been extensively built upon and is therefore likely to require complete reconstruction. In costing terms, it is considered a new feature.

7.2.10 The original Brunswick Basin (Potato Market Wharf) is infilled and has been extensively built upon. The current masterplan has key elements of the existing building remaining across the site of the Basin and Market. It is therefore excluded from any costing.

7.2.11 The Western Portal of the Canal Tunnel is infilled and will require almost complete reconstruction either to permit access by boats or by pedestrians.

7.2.12 The canal tunnel from the former studio site to the Great Northern Warehouse is in essentially in good repair and does not require exceptional work. There is no contamination of the canal fill requiring specialised treatment.

7.2.13 The canal tunnel from the Great Northern Warehouse to the site of Manchester Central Station is infilled and will require re-excavation and the removal of blocking walls but is essentially in good condition. Again it is assumed that there is no contamination. The Eastern Portal of the Tunnel is in good condition and appears to only require unblocking.

7.2.14 The canal channel from the Eastern Portal to Locks No.3 & 4 and from the top of the locks to Lower Mosley Street Bridge was completely removed by the construction of Manchester Central Station in the 1880's.

7.2.15 the entire section from the Eastern Portal to Lower Mosley Street will require replacement. This will be a new route and will need to be threaded through the undercroft of Manchester Central. This will be complex.

7.2.16 Locks No.3 and No.4 will require re-positioning to accommodate Manchester Central, the tram link and Lower Mosley Street. Because of their location these will be new and complex structures.

7.2.17 Lower Mosley Street Bridge will require replacement with an entirely new bridge.

7.2.18 The Rochdale Canal Arm will require minor works to bring it back into a navigable condition for narrow beam boats, more significant works for broad beam boats.

7.2.19 **Arising's:** Estimates for arising's are made on the basis of the known dimensions of the M&SJC and upon the standards of the adjacent Broad Canals. It is assumed that all infilled locks and channels are overfilled. The % overfill has been added to the fill to give an approximate total volume or excavation. Overfilling can vary from 10% to 200%.

<u>Evidence Employed in the Cost Estimate</u>

7.2.20 The costing is based on

- Indicative rates for Civils and Services Infrastructure construction.

- Current rates for waterway civil engineering, including both reconstruction, major reconstruction and new build.
- Actual on-site real-time costs for reconstruction and new build as recorded during recent canal projects including the Cotswolds, Chesterfield, Basingstoke, Droitwich, Lancaster, London Olympic site, Monmouthshire & Brecon, Wey & Arun and the Falkirk Wheel. This is to ensure that there is no "optimism bias" and that results are robust and evidence based.
- Current rates for tunnel construction and infrastructure works derived from major urban projects.

7.2.21 It should be noted that the estimates incorporate considerable margins and contingencies for unknown factors and un-quantified risks. Again attention is drawn to the level of unquantified risk at this initial stage.

7.3 Summary of Project Costing

7.3.1 A spreadsheet detailing the individual project elements (the smallest unit of project delivery) is provided in Appendix A. This includes:

- A breakdown of the engineering requirements to delivery each of the four options. This lists all structures and lengths of channel, etc., and itemises their dimensions and construction methods.
- An analysis by construction element type (bridge, locks etc.) which calculates the element costs using established industry multipliers. From this the overall option costs are generated.

7.3.2 A summary of the key costs is given in Figure 7.1 below.

7.3.3 It will be noted that the cost is not a linear progression based on length. The reopening of existing canal channel in Option B is comparable to the costs seen on other waterway restorations. Options C & D require significant engineering works to re-open the Tunnel and modify the undercroft of Manchester Central – the costs reflect that and are comparable to similar urban re-engineering projects.

7.3.4 It should also be noted that the project costings are independent of sustainability. That is, the cost of a given option does not reflect the potential value which may accrue from the option. Cost / Benefit is discussed in Section Nine, below.

The Tunnel Works

7.3.5 The tunnel is understood to be in good condition at present and will not require substantial reconstruction (there are no failing sections or collapses, etc.). The costs includes the physical remove of the Second World War air raid shelters, the repair of alterations made to the tunnel by the construction of the shelters, the reconstruction of the tunnel portals, the creation of new emergency entry and exit points.

The Modification of the Undercroft

7.3.6 The undercroft is the series of interlaced brick arches supporting the main platform level of Manchester Central. This 'basement' area was used for the storage of semi-perishable

good that required stable temperatures, most notably beer and cheese. It was designed to admit railway wagons and is relatively open.

7.3.7 Modification of this area is possible. The design and construction of Manchester Central is very similar to St. Pancras Station in London. At St. Pancras the undercroft has been very successfully modified to form the main concourse and shopping area of the revitalised station. Costing for the modifications required in Manchester are comparable.

The re-sited replacement Locks No.3 & No.4

7.3.8 The location of the original staircase locks has been lost under Manchester Central. While it might be possible to build new locks under the former station this is a restricted and difficult site and hence costly to build and eventually maintain.

7.3.9 The costing is based on the third option (Lock Location Option 3) considered in the engineering section above – this involves splitting the locks and placing them either side of Lower Mosley Street. At this time this option appears to best balance the competing costs of excavation and utility path change with the costs of structural construction.

7.3.10 The option of a boat lift was considered in detail has been rejected on the grounds of high construction cost, high operating costs, the potential difficulty of maintenance in this restricted location and a site which mitigates against tourism development.

Reduction of Costs

7.3.11 Risks are at presently largely unquantified. The reduction or quantification of risk improves the overall accuracy and reliability of the estimate.

7.3.12 Next steps should be directed at reducing unknowns and quantifying risks. This can be done by (1) increasing the evidence base for the route by field survey and ground investigation, and (2) through the initial concept design of structures to test the deliverability of the solutions proposed.

7.3.13 Reduction of risk through better understanding of the project may lead to a significant reduction in overall costs. Other projects have seen a reduction in costs by between 10 and 15% following detailed design work. Over the detailed design stage further un-quantified risks will be capable of removal leading to a further reduction in costs.

7.3.14 In addition work should be undertaken on the elemental cost estimates (the unit costs per lock, etc.) to ensure that the cost estimates are as robust as possible.

Land Value

7.3.15 The costing does not take account of Land Value.

7.3.16 It is assumed that the project can only proceed with the full backing of the key landholders.

7.3.17 Land value transfer will potentially be a significant way in which those landholders can provide a financial contribution to enable the project. A peppercorn lease of at least 125 years is considered by HLF to be a “gift” and is valued by them at the full land value. This can be used as match funding to release significant HLF support. As the land is leased it remains an asset of the landowner.

Canal Corridor Works	Option A	Option B	Option C	Option D
Existing Structures - Repair	£ 250,000	£ 250,000	£ 2,930,000	£ 3,600,000
New Structures - Construction	£ -	£ 25,000	£ 355,000	£ 7,575,000
Existing Locks to be Repaired	£ -	£ 445,000	£ 445,000	£ 445,000
New Locks to be Constructed	£ -	£ -	£ -	£ 1,200,000
Earthworks	£ 2,117	£ 462,743	£ 527,507	£ 696,291
Channel Structures	£ -	£ 189,900	£ 229,900	£ 625,500
Puddle / Liner (waterproofing)	£ -	£ 151,920	£ 183,920	£ 770,700
Towpath	£ 5,386	£ 14,707	£ 264,587	£ 283,297
Water Supply	£ -	£ 320,000	£ 820,000	£ 1,200,000
Utility Diversions	£ 2,575	£ 634,464	£ 1,667,091	£ 2,593,000
Other (Excluding Contingency)	£ 69,015	£ 577,769	£ 1,694,331	£ 4,070,070
Contingency	£ 26,008	£ 249,373	£ 742,300	£ 1,898,879
Totals	£ 355,101	£ 3,320,876	£ 9,859,636	£ 24,957,736
Cost per linear Metre	£ 7,247	£ 12,778	£ 13,889	£ 21,599
Treatment of Tunnel Interior	Option A Plus	Option B Plus	Option C	Option D
Opening of Tunnel Air Raid Shelters (Options A Plus & B Plus)	£ 337,750	£ 337,750	£ -	£ -
Removal of Tunnel Air Raid Shelters (Options C & D)	£ -	£ -	£ 410,800	£ 410,800
Contingency	£ 33,775	£ 33,775	£ 41,080	£ 41,080
Totals	£ 371,525	£ 371,525	£ 451,880	£ 451,880

Figure 7.1: Summary of Costing

(This Figure is a summary of the spreadsheet provided in the annex to this report).

8 Benefits

8.1 Introduction

8.1.1 This section looks at the potential benefits of reinstating the M&SJC for each of the four options and variants suggested above. The purpose is to set out an initial idea of the overall economic benefit resulting from different levels of intervention.

8.1.2 This is an initial statement of potential benefits which may derive from each of the project options. Some key factors remain undefined but there is, however, sufficient evidence to indicate the relative benefit values of each of the proposed canal restoration options in terms of the main benefit categories (cf. Jacobs 2009, T&CPA 2009, 2015a, 2015b).

8.1.3 One of the first tasks in taking forward any option will be to pin down the design and operational parameters to enable the more detailed exploration of potential benefit.

8.1.4 A spreadsheet detailing the individual project elements (the smallest unit of project delivery) is provided in Appendix A. This includes a breakdown of the potential financial benefits which would derive from the different options.

8.1.5 A summary of the key benefits is given in Figure 8.1 below.

8.2 Evidence of the Benefits of Inland Waterways

8.2.1 The Inland Waterways of England and Wales are a major economic resource. The current network of canals and navigable rivers is around 5000 km long and attracts over 270 million visits each year. The 3500 km of the network managed by the Canal & River Trust is estimated to contribute benefits worth around £1.2 to £1.4 billion to the UK economy (Jacobs 2009).

8.2.2 Over the last ten years the rate of growth of the inland waterways economy (all those activities directly related to the use of the inland waterways such as boating and angling) has averaged around 5 to 8 % per annum and has generally grown faster than the national economy (Canal & River Trust 2015).

8.2.3 There is strong national evidence that waterways restoration and development can bring significant benefits to the areas in which it occurs. Independent studies of the economic impact and actual outcomes of canal restoration projects include:

- The Kennet & Avon Canal (reopened in 1990, closed for substantial repairs and then fully reopened in 2001): Ecotec (2002, 2006), Millar & Maer (2004).
- The Huddersfield Narrow Canal (reopened in stages from 1980 to 2001): Ecotec (2003).
- The Rochdale Canal (reopened in stages from 1995 to 2001): Ecotec (2003) Paylor, Marshal & Wearne (2004).

8.2.4 The positive economic impact of high-profile waterside-based regeneration projects may also be noted, in particular the Gas Street Basin (Brindley Place) area in Birmingham.

8.2.5 In each case there were pre-existing studies of predicted outcomes and it was possible to compare these with the actual outcome. Interestingly, while certain elements (such as

visitor spend by anglers) had been overestimated, other elements (such as property value increases) had been underestimated and the overall results for the pre- and post- studies were surprisingly close.

8.2.6 The overall economic impact of canal restoration was found to be almost entirely positive with all schemes reporting the creation of new waterside business and the general uplift of entire districts near to new water. An example of this process can be seen at the former mill town of Slaithwaite, West Yorkshire, where the restoration of the Huddersfield Narrow Canal created a new public focus for the community and transformed its external image. Reopening of the canal was followed by substantial private investment in new housing and conversion of character mill buildings to offices and flats leading to the rejuvenation of the local housing and property market. This was accompanied by the opening of new shops, a café and the transformation of a run-down waterside public house. The effect has been to significantly improve the fortunes of the town and make it an attractive and interesting place to live and work.

8.2.7 A general overview of the economic impacts of restoration is given by Maer & Millar (2004). A more comprehensive review of the benefits provided by Inland Waterways (and the methods used to determine them) was undertaken by Jacobs (2009) on behalf of the Inland Waterways Advisory Committee and DEFRA. The Jacobs (2009) survey employs the Ecosystem Services Approach which has been developed to value green infrastructure projects where the outcomes are not always immediate. This approach values waterways as a form of multi-function green infrastructure. Each function can be thought of as a benefit of waterway investment and for the majority it is possible to generate a direct monetary value (Town & Country Planning Association 2009, 2015a, 2015b).

8.3 Potential Benefits: Economic Growth & Investment

8.3.1 Waterways support the visitor economy and act as a focus for urban regeneration and rural diversification. In the context of the Manchester & Salford Junction Canal the canal corridor lies within a vibrant and rapidly developing city centre. While this may appear to diminish the case for using waterways for regeneration, there is a case for seeing them a catalysts for shaping the type of quirky off-beat creative locations which the developers appear to be seeking for the St Johns Quarter. The restored canal basin and Bonded Warehouse might provide the core of a northern 'Camden Lock'.

8.3.2 The presence of water can be a powerful draw for restaurants & cafés (e.g. the Brayford Pool waterfront development at Lincoln). There is potential for such development both around the new basin and also adjacent to Lock No.1 and the River Irwell. The latter location could also tap into passing trade in the developing Irwell Park corridor.

8.3.3 The reflective contemplative atmosphere provided by inland waters is conducive to artistic endeavour and waterfront galleries and studios seem popular visiting points. The key is not to price the creatives out of the market place and to use them to draw in visitors and users – a sort of "living loss-leaders".

Land & Property Values

8.3.4 An increase in land value and property price is observed for properties adjacent to or near restored waterways. The uplift varies across the country and is most pronounced in urban

settings and countryside locations (Jacobs 2009). It is least pronounced in sub-urban and settlement edge locations. Based on values observed over the last ten years we can predict:

Property adjacent to restored / new canal	15 to 25 % increase
Property within 100 m of restored / new canal	10 to 15 % increase
Property within 500 m of restored / new canal	5 to 10 % increase

8.3.5 The existing proximity of water to the site may well reduce uplift in this location, but it is still likely to yield an increase of approximately 15% for properties with waterfrontage and approximately 5% for non-water frontage within the same development.

8.3.6 The increase in value (the waterfront premium) may be sufficient to offset the additional cost of restoring or introducing the new active waterspace.

8.3.7 In the context the Manchester & Salford Junction Canal it is apparent that the uplift would only apply to the western end of the canal corridor where it is possible to develop new waterfront buildings – or to adapt existing buildings such as the Bonded Warehouse.

8.3.8 The Tunnel section obviously generates no uplift as the water is hidden. The Eastern end will run through the undercroft of Manchester Central and then under Lower Mosley Street emerging between established buildings. There is no scope for additional new build in this area and the uses of the surrounding buildings, such as the Bridgewater Hall, are already settled. In consequence only Option B can realise a significant proportion of its costs in uplift benefit. Because the additional canal in Options C & D is in a tunnel or in an undercroft this amount will then remain constant – unlike a conventional waterway where the uplift benefits rise as the waterway is extended.

8.3.9 In the benefits spreadsheet no attempt has been made to model this uplift due to the uncertainties involved at this preliminary stage. In consequence the Benefits figures do NOT contain any element for land/property uplift. If they did they would be considerably higher.

8.3.10 It is possible, however, to indicate qualitatively (based on the above rationale) that the relative uplift for each option will be:

Option A & Option A Plus:	No Water:	Uplift Negligible to Low.
Option B & Option B Plus:	Basin:	Uplift Moderate to High.
Option C:	Tunnel:	Uplift Negligible to Low.
Option D:	Undercroft:	Uplift Negligible to Low.

Property Development

8.3.11 The western end of the canal corridor lies with an area already undergoing regeneration. While the proposed waterway would not replace the drivers for that already ongoing process, it would help to shape the character and sense of place that is core to a successful development.

8.3.12 The central area and eastern end of the corridor lie within already developed areas. The canal would provide additional attractions in these areas but is unlikely to stimulate property development.

8.3.13 In the Benefits model no allowance is made for any additionality in quanta for property development which may stem from the presence of a waterway. None of the current development proposals are waterway based and while they might benefit from the presence of a waterway (uplift) they are not predicated upon it. For that reason they are not included as a financial benefit.

Quality of place

8.3.14 Waterways are being utilised as vehicles in place-making and place-shaping. On the M&SJC place shaping opportunities take several forms including:

- New market place
- Craft studios
- New Makers
- Informal spaces for 'things to happen'
- Galleries
- Offbeat (non-chain) cafés
- Pop-up galleries
- Pop-up shops

8.3.15 In each case the waterway provides a tangible link to the trading and mercantile past of Manchester and its role as the great innovator of the industrial revolution while at the same time looking forward to a more sustainable future. The key is in to make the managed look unmanaged and unofficial – creativity thrives best when uncontrolled.

8.3.16 The primary benefits again accrue at the western end of the canal corridor. The tunnel section has few alternative uses and the section under Manchester Central while having some possibilities is unlikely to be a suitable focus for non-waterway development.

8.4 Potential Benefits: Employment

8.4.1 Waterways infrastructure supports Small & Medium Enterprises and jobs in craft manufacturing, tourism and service sectors. The waterside atmosphere is a positive benefit for staff engagement and moral – improving labour productivity and retention (Jacobs 2009).

8.4.2 Several studies (e.g. Ecotec 2007, Jacobs 2009) have demonstrated that canal restoration generates employment in three ways:

- Construction Jobs
- Direct Jobs
- Indirect Jobs

8.4.3 Construction Jobs are those jobs created as a result of the reconstruction of the canal. They include all activities which support construction such as civil engineering design, construction management, supply of materials and equipment, as well as those directly involved in on-site work.

8.4.4 The number of construction jobs created is related to the amount of inward investment. AINA (2003) estimated that an investment of circa £50,000 to £60,000 supported one person-year of employment. Gibb (2001) for the Chesterfield Canal used a figure of

£65,000. Jacobs (2008) recorded that on the Leeds Waterfront regeneration between £55,000 and £80,000 of investment created one person- year's work while on the Union Canal in Scotland the figures were £55,000-£65,000. Jacobs reached the conclusion that a figure of £55,000 supports one person-year of employment where the work was largely restoration of existing structures and a figure of £80,000 supports one person-year where the works involved new construction on a brown or greenfield site.

8.4.5 The reinstatement of the M&SJC will involve both restoration and new build. Based on the above we suggest that £75,000 of investment will result in one person-year of employment. On that basis the person-year-equivalent temporary construction employment by option is:

Option A	4.7	person years
Option A+	9.7	person years
Option B	44.3	person years
Option B+	49.2	person years
Option C	137.5	person years
Option D	338.8	person years

8.4.6 As might be expected the greater the investment the greater the construction employment. The eventual total number of construction jobs generated will depend upon the engineering solutions adopted and the total budget committed.

8.4.7 The more telling output is direct jobs – this is the long term employment which might arise from tourism and leisure activity around the new waterway. As Jacobs (2009) noted all jobs created are a by-product of business creation – however, job creation is a significantly easier total to measure and for which there is a body of data. The data for waterways suggests that in urban areas a full time equivalent job is created for each £25,000 of tourism and leisure expenditure.

Option A	2.7	FTE
Option A+	19.7	FTE
Option B	41.0	FTE
Option B+	49.8	FTE
Option C	52.1	FTE
Option D	52.7	FTE

8.4.8 In spite of the considerable greater expenditure required to achieve Options C & D they do not create a significantly larger number of jobs. This is another facet of the hidden canal problem noted with respect to property value uplift and development.

8.4.9 Indirect Jobs are those created in the wider economy by the presence of the property developments alongside the waterway. These jobs can be estimated from the floor area of the new office and business premises created. Allowance must be made for displacement of existing local work premises to the new location (Jacob, 2009, suggest this could account for up to 40% of the apparent job creation). As the mixture of premises and floor areas is not yet established no attempt has been made to estimate indirect employment.

8.5 Potential Benefits: Learning, Training & Skills

8.5.1 Waterways offer striking and rich learning environments which have been widely promoted for that purpose by government and industry bodies (Waterways for Tomorrow 2001; IWAC 2001; 2005; AINA 2005).

8.5.2 The restoration or partial restoration of the M&SJC appears to offer the potential to develop (1) learning programmes with local schools and (2) training programmes in heritage skills for young people and those wishing to retrain.

8.5.3 It can be demonstrated that waterways can provide strong educational and behavioural benefits for children through purposeful outdoor activity. For example, fieldwork positively reinforces the link between affective and cognitive learning, outdoor activities improve student's personal efficiency and mixing with people in an informal setting improves exposure to a range of cultures, talents and interests as well as improving social skills through participation and interaction. There is also evidence that outdoor education contributes to children's creative development and ability to cope in a variety of real-life situations. Overall, there is strong evidence of both short-term and long-term positive effects. These benefits are most marked for children from low-income or disadvantaged backgrounds.

8.5.4 The school's programmes could be as simple as providing a website with "teachers notes" tied to the key stages. The M&SJC programme could integrate with "Wild Over Water" - a national initiative supported by the Inland Waterway Association and the Canal & River Trust to enthuse, involve and inspire children and young people about Britain's waterways. The focus of WOW is upon primary learning (and contains some strong embedded safety messages). The current key stage two modules are used by around 28,000 pupils each year.

8.5.5 More complex approaches involving guided field visits would depend on the Options adopted – the opening of the air-raid shelters for example would be tied to the Second World War section in the history curricula, etc. There is potential to link and work with the education programme at MOSI.

8.5.6 The diversity of the waterways' environment provides a rich vein of training opportunities for heritage skills. The M&SJC could support several projects working with young people, those seeking to change careers and those seeking employment, to enable participants to gain transferable practical skills through participation in the work of maintaining and managing the waterways' infrastructure. (cf. Monmouthshire & Brecon Canal "14 Locks Project" and the Cotswolds Heritage Academy).

8.5.7 Estimating the economic value of the learning and training opportunities provided by the restoration of a canal is difficult (Jacobs 2009). Nevertheless, the literature does present clear qualitative evidence for educational and behavioural benefits.

8.6 Potential Benefits: Tourism, Leisure & Recreation

8.6.1 The tourism, leisure and recreation economy of the inland waterways is significant and growing. The current inland waterways network is over 5000 km long and attracts approximately 270 million visits a year while the spend on waterways leisure in general continues to grow faster than inflation at around 5 to 8 %.

8.6.2 Each year the 3200 km of the network owned and managed by the Canal & River Trust generates directly around £230 million in amenity/ recreation/ tourism value and a further £30 million in attracting overseas visitors or in overseas visits foregone (British Waterways 2008, Jacobs 2009).

8.6.3 Evidence from the restoration of the Kennet & Avon, the Huddersfield Narrow and the Rochdale Canals shows how this value is made up of a wide range of tourism and leisure activities. These include boating, canoeing, angling, walking and cycling, all of which make both direct and indirect contributions to the economy and thus drive local economic growth.

8.6.4 Waterways are both destination and corridors – forming visitor attractions in their own right as well as linking together visitor destinations. On the M&SJC the main opportunities and potential benefits are:

New Brunswick Basin

8.6.5 This is common to Options B, C & D. The basin would accommodate about 30 boats. 20 berths would be reserved for home moorings; assuming 80% occupancy gives an annual income of c. £48,000 per year. It should be noted that mooring income does not rise as the canal is extended as no mooring sites exist outside the western end.

Boating Expenditure

8.6.6 Estimates of boat movements by non-resident boats have been made using the AINA methodology (2004):

Boat Movements	Basis	Number
Option A & Option A Plus	No boats!	0
Option B & Option B Plus	Assumes 25 % of boats will visit basin	321
Option C	Assumes 30 % of boats will visit basin	386
Option D	Assumes 50% of boats will use route	643

Annual estimates based on average Manchester lockage of 1285 (CRT 2014).

8.6.7 Visiting boats will spend around £25 per person per night and it can be assumed that there are two people on each boat. For obvious reasons there is no boating spend under Options A and A Plus. This yields an annual spend by private boats in the local economy under option B and B Plus of £16,063. Extending the waterspace into the Tunnel (Option C) will attract a small additional number of visitors and the total spend rises to £19,275. The opening of the through route (Option D) sees a major leap in visiting boats and the spend rises to c. £32,125

8.6.8 Mooring and passage fees for boats visiting and transiting the canal are a further source of revenue. Using the same boat movement numbers we arrive at income of £8,031 for Option B, £9,638 for Option C and £16,063 for Option D and the through route.

General Visitor Expenditure

8.6.9 Waterside locations are popular destinations for casual visitors and holiday makers. The location of the western end of the M&SJC corridor next to the Museum of Science and Industry is helpful. At present the area immediately around MOSI does not offer alternative experience or destinations. If the area around the Brunswick Basin offered a range of cafés, galleries and small non-chain shops together with a constantly changing hotchpotch of "pop-up" features then it may well be able to capitalise upon the proximity to MOSI and its existing substantial visitor numbers.

8.6.10 This diversification of the offer and a conscious move towards local on-off ventures rather than large chains would help cement the reputation of St. Johns as a creative hub.

8.6.11 The financial model here assumes that of the roughly 678,000 people who visit MOSI each year around 10% can be persuaded to extend their visit to include the Brunswick Basin. It further assumes that of those visitor around 80% will be day trippers / casual visitors and the other 20% will be holiday makers. Visit England estimates that the spend for casual visitors is on average £6 per person per visit, while that for holiday makers is around £25 per person per visit. Based on these figures we can estimate general visitor expenditure:

Option A	£ 122,040
Option A+	£ 203,400
Option B	£ 664,440
Option B+	£ 664,440
Option C	£ 664,440
Option D	£ 664,440

8.6.12 Option A and A Plus assume a much lower level of participation as there is no clear focal point and the attraction of the basin is missing. A useful comparison is the area around the Brindley Place development in Birmingham where the waterside locations are notably more successful (in terms of visitor numbers, demand for premises and rental values) than those situated away from the water.

8.6.13 The figures plateau with Option B because, again, Options C and D do not add any further identifiable attraction space or space to develop additional retail or hospitality premises.

8.6.14 The figure of 10% of the MOSI audience going on to this site is untested but highly conservative. Given the vacuum in which MOSI currently sits there is no reason why this figure could not be considerably higher. Indeed, with appropriate branding and marketing there is no reason why the "Northern Camden Market" should not rapidly begin to attract its own audience quite independent of the MOSI audience. The 10% figure is simply an arbitrary starting point.

Tunnel Air Raid Shelters

8.6.15 There is a very strong case for the development of the listed air-raid shelters in the canal tunnel as an independent visitor destination. The required investment is relatively low and the attraction would, if accessed from St. Johns, perfectly compliment the offbeat nature of the site – it would be "something different".

8.6.16 The model assumes that around 5% of the visitors to MOSI will also want to go on and visit the Tunnel Shelters. Based on comparable sites, such as the Clearwell Caves near London,

a per person per visit charge of £6.50 is suggested. This produces a revenue of around £220,350 on a gate of 33,900. These gate numbers are similar to those reported by other underground attractions of this type (Visit England 2013, 2014, 2015).

Tunnel Wharf Boat Trips

8.6.17 If the air-raid shelters are removed and the tunnel returned to water it will be possible to run boat trips into the tunnel accompanied by a suitable sound and light presentation to tell the story of the tunnel and the canal. Comparable tours operate in the Dudley No.1 Tunnel, Birmingham, where the charge for a 45 minute trip is an average of £6.00.

8.6.18 The model again assumes that initial visitor numbers will also be drawn from those visiting MOSI and that around 5% will want to take the boat journey.

8.6.19 Under Option C the boat journey would run from the Brunswick Basin through the tunnel to the Great Northern Warehouse Wharf and then back. This short trip would be charged at £6 per head and would yield around £203,400 per year.

8.6.20 Under Option D the boat journey could be extended through the entire length of the tunnel and up the locks to the Bridgewater Basin and return. This longer trip would be charged at £9 per head and would yield around £305,100 per year.

Water Bus

8.6.21 There is potential to run a water bus from the Brunswick Basin to Salford Quays, the Lowry and the Imperial War Museum North. This would provide an alternative 'pleasurable travel' option for moving between the docklands museums and MOSI. There is also potential for 'park and glide' services at peak holiday periods.

8.6.22 The model is based on the operation of the bus fulltime for around 6 months of the year and at weekends and holidays only for the other six months. It assumes the average fare is £8 – more expensive that local public transport but comparable to the Thames River busses. As a starting point it assumes that 5% of those visiting MOSI will also use the service.

8.6.23 The likely outturn would be £346,894 for Options B, C and D. Although under Option A there is no water within the site to work from, it would be possible to modify Lock No.1 to provide a landing stage or dock for a water bus. This jetty could then be linked by paths under a re-opened the Irwell Bridge to the main St. Johns site. This latter option is not included in the costing for Option A but should be looked at further.

Paddle Sports

8.6.24 Paddle sports (canoeing, rowing etc.,) is one of the fastest growing areas of water-sport. The potential on the M&SJC is relatively limited but it would attract a few urban adventurers. The model assumes a modest spend of £12 per head and further assumes that visits will rise as length of waterway increases. The likely benefits are:

Option A	no visits	£ 0
Option A+	no visits	£ 0
Option B	300 visits per year	£ 3,600
Option B+	300 visits per year	£ 3,600

Option C	500 visits per year	£ 6,000
Option D	700 visits per year	£ 8,400

Angling

8.6.25 Angling is the most popular leisure activity in England. Unfortunately, there is little realistic prospect of building an effective fishery on this very short length of water where canal bank uses will be strongly contested. It is anticipated that angling may well be restricted and in consequence there will be no income from angling.

8.7 Potential Benefits: Health & Well-being

8.7.1 Waterways and towing paths form part of the 'natural health service', acting as 'blue gyms', encouraging and supporting physical and healthy outdoor activity. The value of such blue / green gyms expressed as potential cost savings to the NHS due to increased healthy activity is to £33,400 per Km per year in rural areas rising to £340,000 per Km per year in urban areas (Peacock et al 2005, Jacob 2009). This is similar to dedicated off-road multi-user trails (Sustrans).

8.7.2 The new path network at the western end of the canal corridor is 0.52 km long and will give access to the River Irwell Park. Based on the target demographic of the St. Johns development it is likely to be heavily used for healthy activity, giving a benefit in the order of £173,613 per year to the NHS.

8.8 Potential Benefits: Environment

Flood alleviation & management

8.8.1 The reinstatement of the M&SJC provides an opportunity to develop features which can retard water run-off from extreme rainfall events, reduce surface water flooding and provide sustainable urban drainage. Jacobs (2009) noted several attempts to monetarise these benefits but this has not been attempted here as there are too many uncertainties about design and integration with existing masterplan designs. In qualitative terms it is clear that Option A, because it has no waterspace, offers few opportunities. Options B has significant capacity to hold surface runs off and create sustainable urban drainage. Options C & D do not greatly extend this capacity although a floodwater retention role could be designed into the new build sections.

8.8.2 Overall a reinstated M&SJC will produce a significant contribution to flood alleviation and management and from which financial benefits can ultimately be derived.

Climate change adaptation & mitigation

8.8.3 A reinstated M&SJC could offer additional adaptations to climate change beyond the management of water from extreme rainfall events. Faced with increasing urban temperatures an open water body can provide substantial passive urban cooling. In addition, the canal could also offer sustainable urban cooling and heating via the use of water source heat pumps. These have been used with great success on the Paddington Arm in London. The heat exchange system would be designed into the new basin from the

start and would greatly reduce the energy costs and carbon footprints of surrounding buildings.

8.8.4 While such systems are considered highly desirable they have not been included in the costs of construction nor have they been added to the financial benefit model. This is because there are too many uncertainties surrounding the water area and the footprint of adjacent potential beneficiary buildings at this time.

8.8.5 Other sustainable energy sources will also be explored but none are counted as a benefit in this model.

Land & biodiversity

8.8.6 Waterway corridors are important wildlife routes and act as stepping stones for mitigation against habitat loss, dispersal and genetic exchange of plants. The M&SJC Corridor is very heavily urban and partly underground limiting it value as a green routeway. Notwithstanding, any green space that can be introduced or protected within the dense urban core of Manchester is potentially of great value as a calming space offering passive cooling and mental relaxation.

8.8.7 Here the linkage of the corridor to the Irwell River Park is probably of the greatest value. At this stage no financial outturn has been attributed to that linkage.

Products from the land

8.8.8 This is one area where we are unlikely to see any benefits along the M&SJC, however, there is potential for the creation of allotments with the Irwell River Park scheme which could be accessed via the canal corridor. These, however, lie outside the scope of the financial model and are not accounted for here.

SUMMARY	Option A	Option A+	Option B	Option B+	Option C	Option D
Sub-Total For Land/Property Uplift	*negligible*	*negligible*	*high*	*high*	*low*	*low*
Sub-Total for Waterway Related	£ -	£ -	£ 346,894	£ 346,894	£ 354,113	£ 375,788
Sub-Total General Tourism & Leisure	£ 122,040	£ 423,750	£ 664,440	£ 884,790	£ 867,840	£ 969,540
Sub-Total Health & Well-Being	£ 16,366	£ 16,366	£ 173,613	£ 173,613	£ 237,107	£ 385,937
Sub-Total for F/O wayleaves	£ -	£ -	£ -	£ -	£ -	£ 15,000
	£ -	£ -	£ -	£ -	£ -	£ -
Total for each option for One Year	£ 138,406	£ 440,116	£ 1,184,947	£ 1,405,297	£ 1,459,059	£ 1,746,265
Total for each option for Five Years	£ 692,030	£ 2,200,580	£ 5,924,735	£ 7,026,485	£ 7,295,296	£ 8,731,323
Total for each option for Ten Years	£ 1,384,060	£ 4,401,160	£11,849,470	£14,052,970	£14,590,591	£17,462,645
Land / property uplift values have not been calculated but the likely relative uplift for each option is noted qualitatively.						
Note that no account has been taken here of potential property development values						

Employment	Option A	Option A+	Option B	Option B+	Option C	Option D
Constuction Jobs in Person Years	4.7	9.7	44.3	49.2	137.5	338.8
Tourism/Leisure Jobs in FTE Jobs	4.9	17.0	40.5	49.3	48.9	53.8
Other business jobs not calcuated						

Figure 8.1: Summary of Headline Benefits for each option.

9 Initial Appraisal

9.1 Introduction

9.1.1 This section considers the four main options for the development of the Manchester & Salford Junction Canal in the terms of the key issues facing any proposal for canal restoration. These are:

1. Engineering: Is the project feasibly deliverable within a reasonable timeframe that is respectful (see 2), realistic (see 3 & 4) and supportable (see 5)?
2. Built and Natural Heritage: What impact will reinstatement have upon the Historic and natural environment record of the areas it will pass through?
3. Cost/Benefit: Do the potential financial benefits outweigh the potential costs? If they do not does, the project have some specific non-financial benefits which justify the expenditure required?
4. Realism: Is the land and funding available?
5. Support: Is there the public & political support required to make it happen?
6. Sustainability: Does the proposed waterway have the potential to be able to sustain itself financially and environmentally over the longer term?

9.1.2 No project option will have a perfect score in all of these areas, rather it is the balance of different factors which renders a project or project option deliverable. These issues are considered further below.

9.2 Engineering

9.2.1 For each engineering problem encountered here there is an appropriate and tested solution. That solution might be expensive but in each case examples of similar interventions and constructions can be produced.

9.2.2 Option B poses few problems – the majority of the structures are intact and their restoration using heritage materials employs established methodologies widely employed by the Canal & River Trust and similar bodies.

9.2.3 Option C poses considerably greater challenges and requires the modification existing buildings to accommodate the reinstated canal track.

9.2.4 Option D requires major engineering works in the undercroft of Manchester Central. The undercroft has already been heavily modified to create increased car parking space through the introduction of a mezzanine floor level. Further modification would be needed to re-organise the entry and exit ramps of the car park to accommodate the line of the waterway at the lowermost level. The exit from the undercroft on the east side will involve considerable use of bored pile construction.

9.2.5 The alterations of the undercroft, while not technically difficult, will impact on the use of Manchester Central during the construction period. This may result in additional costs for wayleaves and compensation for lost business

9.2.6 The passage under the tram-route and Lower Mosley Street will involve interference with tram and road traffic with compensation potentially required.

9.2.7 The preferred solution to getting the waterway from the tunnel pound level to the Rochdale Canal level is a lock either side of Lower Mosley Street. The notion of a boat lift at the Bridgwater Basin has been rejected on the grounds of both constructional and operational cost.

9.2.8 The complexity of the solutions required for the re-opening of the tunnel to navigation and the creation of the undercroft passage is reflected in the cost of each section.

9.3 Historic Environment (Built Heritage)

9.3.1 Option A is entirely positive in that it has no effect on the historic environment other than to ensure that key elements of the Manchester Story are not forgotten.

9.3.2 Option B will ensure the preservation and use of the historic structures of Locks No.1 and No.2. Both elements are in sufficiently good condition to not require significant changes. Any repairs required would be made using traditional skills and using identifiable heritage materials.

9.3.3 The New Brunswick Basin would employ composite construction. A modern curtain wall faced with heritage materials similar in appearance to the original work but sufficiently different to ensure that it is identifiable as of a different era. Heterogeneity, not uniformity, is one of the most notable signature characteristic of canal corridors.

9.3.4 In both Option A and B there is the potential to develop the canal tunnel and air-raid shelters as a major tourism destination. This is an opportunity to develop an ongoing conservation management strategy for the shelters. This would include a maintenance regime and interpretation strategy.

9.3.5 On balance the interventions required in Option B would result in a net positive outcome for the Historic Environment Record.

9.3.6 Both Option C and Option D will undertake the same positive programme of conservation for the section from the Irwell to the New Brunswick Basin, however, they will also require the removal of the air-raid shelters from the tunnel before they can be returned to water and navigation. While, as noted above, this is not impossible given a sufficiently rigorous programme of archaeological investigation and recording, it is concluded that at present the benefits of the use of the tunnel as a navigation do not outweigh the potential significance of the Tunnel Shelters to the history of Manchester.

9.3.7 Options C and D are therefore considered to have a net negative outcome for the Historic Environment Record.

9.4 Natural Environment (Natural Heritage)

9.4.1 All four options will have negligible impact on the natural environment.

9.4.2 All four options create additional blue/green space at the western end of the canal corridor.

9.4.3 Option B: The excavation works required to create the New Brunswick Basin take place in an entirely brownfield environment with no known ecological significance. It will introduce

an island of waterspace into a dense urban context and offers the opportunity to create reed-beds as an element in in a sustainable urban drainage system. While the bankside vegetation will create a linear pocket park

9.4.4 Options C & D involve works in entirely anthropogenic environments where there is no existing ecological interest.

9.4.5 The through linkage between the Irwell and Rochdale Canal offered by Option D is of little potential environmental consequence as both lie within the same water catchment management area and both already share principle characteristics and, within urban Manchester, species. The intervention in considerably downstream of the significant SSSI on the Rochdale Canal.

9.4.6 It is believed that the tunnel does not, at present, have a resident bat population. However this needs to be established by survey before any attempt it made to open up the tunnel for either tourism development or navigation.

9.5 Cost Benefit

9.5.1 The key benefits stem from the enhancement of a unique sense of place and the creation of a characterful destination. The shaping of St. Johns as a place focused on creativity and the 'new makers' offers an opportunity to shape a location which has a different feel and appeal to more corporate city centre offerings which might charitably be described as sterile.

9.5.2 Figure 9.1 below shows a comparison of total project costs with the projected five year return on investment. For each option it will be noted that:

Option A and Option A Plus

9.5.3 Option A produces very limited financially identifiable benefit. Its returns are diffuse and while benefitting the developments character and sense of place they do not have such strong financial returns as to be easily separated out from the returns from the redevelopment as a whole.

9.5.4 Option A Plus opens up the canal tunnel air-raid shelters as a tourism destination. This considerably increases costs but produces a more positive return on investment in the short and five-year term

Option B and Option B Plus

9.5.5 Option B produces a reasonable base line return on investment. Even without property uplift Option B produces reasonable benefits with a five-year baseline.

9.5.6 Option B Plus (like A Plus) opens up the canal tunnel air-raid shelters as a tourism destination. Relative to the whole package for Option B this only slightly increases costs. It is a valuable part of the potential package but if taken separately it can alone yield a positive return on investment in the short and five-year term.

Option C

9.5.7 Option C produces only a small increase in benefits over option B and in consequence does not produce a satisfactory ROI over a five-year base line but can be seen to do so after around eight to ten years.

Option D

9.5.8 Option D produces an increase over that in Options B and C but only marginally and hence, again, does not produce a satisfactory ROI even over a generous ten-year baseline.

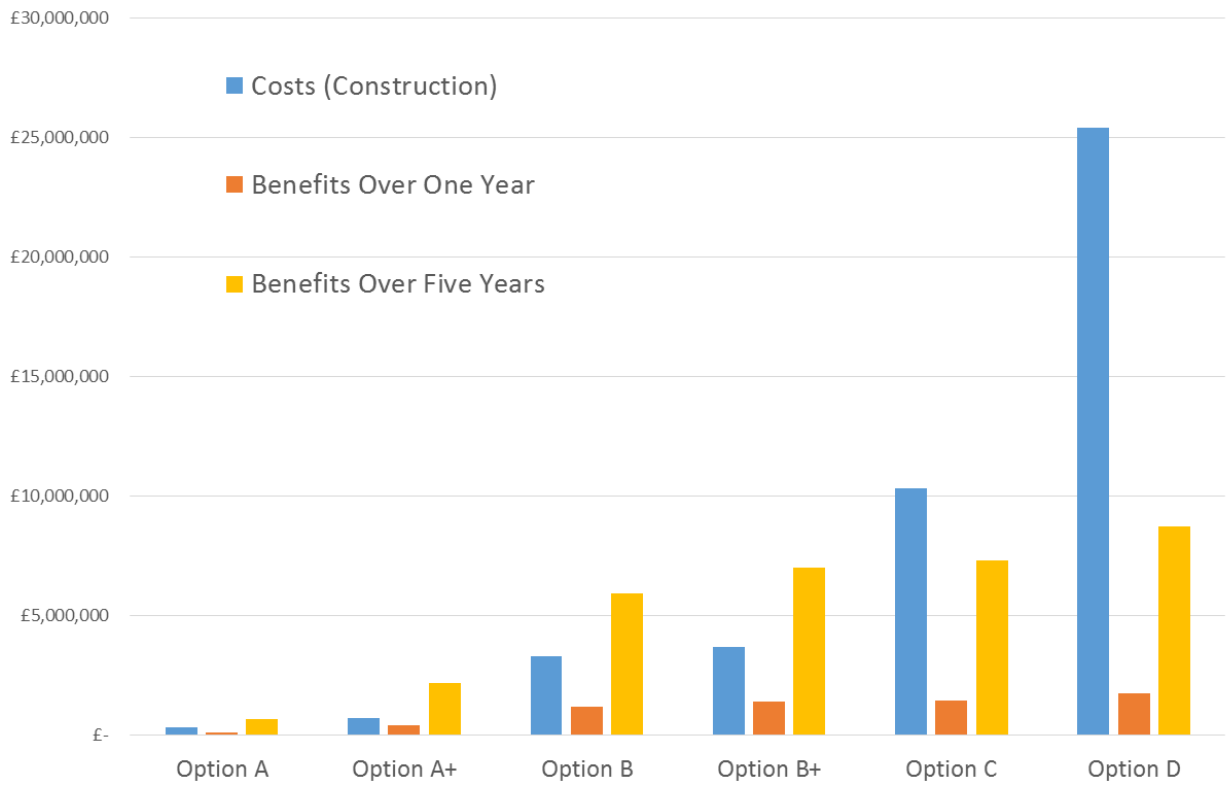

Figure 9.1: Comparison of total project costs with selected benefits over one year and five years

9.6 Land Ownership

9.6.1 Landholding along the canal corridor appears complex but accords well with the proposed development options.

9.6.2 Options A and B lie with the area owned by Allied London. The 'plus options' involve the tunnel held by Manchester City Council. Options C & D involve further land held by the City Council. The key unresolved issue is the relationship between the tunnel ownership and the Great Northern Warehouse.

9.6.3 It will be vital to engage the land owners at the earliest possible stage.

9.7 Funding

9.7.1 Funding will require a separate funding development study. Initial consideration suggests:

9.7.2 Option A requires only minor adjustments to the current masterplan. Funding is therefore already allocated to many of the items specified (although not necessarily in the locations indicated by Option A). The development of surface interpretation could be the focus of an HLF bid provided there was a public engagement element and the match funding could be found from sponsors.

9.7.3 The funding strategy for Option B would engage different funders and funding sources to delivery different elements of the project. For example:

9.7.4 The restoration of Irwell Bridge and Locks No.1 and No.2 to working order could be the subject of an HLF bid with match funding from land transfer value and from donations / corporate sponsorship.

9.7.5 The construction of the basin would be partly funded by the developer; recognising the additional value gained from the uplift in the property values of those buildings benefiting from the new canal basin. Additional funding would come from the returns on the investment in using the canal for cooling and heating, the reduction in water discharge through sustainable drainage, etc.

9.7.6 The use of multiple funding sources and the returns on investment made directly in the canal (such as heat exchangers) should enable Option B to be as close to cost-neutral as possible.

9.7.7 Both Option A Plus and Option B Plus include the development of the Tunnel as a fully interpreted heritage site / museum. Funding for this development would form a separate package from that for the canal reinstatement. It is envisaged that a separate trust would be established to undertake the creation and operation of the proposed air-raid shelter museum. To that end applications would be made to the Heritage Lottery Fund for funding to open up the tunnel to visitors. The required 20% match funding could be largely derived from the value of land "gifted" to the trust by landowners (the gift could be framed as a peppercorn lease over a term of at least 125 years). The land required from Allied London would be relatively small – effectively the entrance area of the tunnel (which was not identified for development). No other footprint is required as interpretation and entrance facilities could be located immediately inside the tunnel portal. The tunnel is owned by Manchester City Council which has experience of this type of funding arrangement. Donations and corporate sponsorship would provide the minimum 5% cash element.

9.7.8 Funding for the far more ambitious Options C and D is, at present, potentially much harder to obtain. The sums involved are considerable and the returns on investment seemingly poor. The key problem is that in order to undertake each stage in the development requires significant funding – to put the M&SJC proposals into perspective the Cotswolds Canals were given one of the largest HLF awards at £6.1 Million pounds. This delivered a total of 6 miles of semi-urban canal and some five locks. In contrast the extension through the tunnel alone (Option C) is likely to require around £9.9 million pounds and given its limited access is liable to be seen as poor value for money by HLF when national and charitable funding is constrained.

9.7.9 It is considered that there is little realistic prospect of raising the full amounts required for either Option C or Option D in the current financial climate. This does not mean that this will always be the case, but it does suggest that the simpler options are more likely to be deliverable in the short and medium term.

9.8 Support

9.7.1 The scheme is supported by a relatively new society – the 'Friends of Manchester Underground Canal'. This group is growing rapidly and is responsible for commissioning this report.

9.8.2 Public support has yet to be gauged. Where the FMUC group has held events these have been well attended and there appears to be a genuine interest in the project which now needs to be translated into membership and activity.

9.8.3 Political support appear so the forthcoming but has yet to be formalised. This is vital if this scheme is to be taken forward.

9.8.4 A key sticking point for options C & D will be the proposal to remove the Air-Raid shelters from the tunnel. These listed structures are considered vital heritage assets by the Manchester Civic Society and others. There is likely to be the strongest possible public opposition to the removal of the shelters.

9.9 Sustainability

9.9.1 There are two, interlinked, aspects of sustainability – environmental and financial:

9.9.2 For a project to be sustainable it must have an environmental impact which is minimal and is supported long-term by available, and projected, natural resources. Where possible these resources should be renewable.

9.9.3 In the case of the M&SJC the principle environmental concern is with the water supply. To conserve water, pumping will be required but this consumes energy. There is limited potential for alternative energy generation. Some of this environmental cost, or dis-benefit, may be offset by the use of the canal as part of a heating and cooling system for adjacent buildings (see for example the developments around the Paddington Arm, London).

9.9.4 For a project to be financially sustainable it must be capable of generating sufficient annual income to (a) cover its own annual operating costs and (b) maintenance costs (based on a five year rolling average).

9.9.5 The cost benefit study suggests that only Option B has capacity to generate more income than it will consume in operation. Options C & D may generate sufficient to cover operational costs but given the requirements of the key structures are unlikely to cover maintenance costs.

10 Conclusions & Recommendations (next steps)

10.1 Conclusions

10.1.1 This study has identified four options for the restatement - in memory, in part or in whole – of the Manchester & Salford Junction Canal.

10.1.2 **Option A: Remembered Water / A Memory Space** – create a walking and cycling corridor along the line of the waterway. May be linked (Option A Plus) with the development of the canal tunnel as a tourist destination in its own right.

10.1.3 **Option B: New Brunswick Basin** – Reinstate the canal from the River Irwell to the centre of the St. Johns site. May be linked (Option B Plus) with the development of the canal tunnel as a tourist destination in its own right.

10.1.4 **Option C: Irwell to Great Northern Warehouse (or 'The 1904 Canal')** – Reinstate the canal as far as the underground wharf below the Great Northern Warehouse.

10.1.5 **Option D: Irwell to Rochdale Canal (or 'The 1839 Canal')** – Reinstate the entire waterway and recreate a through navigation to the Rochdale Canal.

10.1.6 Options A and B are compatible with the development of the historically significant Tunnel Air-Raid Shelters as a visitor destination and / or museum.

10.1.7 Options C & D require the removal of these significant historic monuments and this is considered to be a major stumbling block in their short term development.

Headline Costs and Benefits

10.1.8 Only Option B is capable of producing a reasonable return on investment in the medium term (five years) and of covering its own annual operational and maintenance costs.

10.1.9 Only Option B can contribute effectively and cost effectively to the sustainability of the St. Johns site as a whole through providing cooling and heating, flood relief and sustainable urban drainage.

Issues facing any waterway development

10.1.10 A key issue is that the potential benefits of waterway restoration are almost entirely concentrated upon the western or St. Johns end of the canal corridor. This open section benefits from property uplift, health and environment improvements.

10.1.11 The addition of the extra length to the Great Northern Warehouse offers some potential for additional income from tourist boat trips – for example a water bus running from the Great Northern Warehouse to St. Johns and then onwards down the Irwell to Media City. However, these minor additional income streams do little to compensate for the greatly increased cost of the restoration and the damage this would do to the heritage of the air raid shelters.

10.1.12 The legal status of the canal will require investigation. As the Waterway was formally abandoned in an Act of Parliament for the Manchester Ship Canal Company in 1936, all rights of navigation and access to water are extinguished. Legal opinion should now be sought on the legal basis for any reinstatement.

10.2 Overall Recommendation for Direction of Travel

10.2.1 This report recommends the adoption of Option B Plus.

10.2.2 It is suggested that this would provide the optimum balance between the needs of the historic environment and the commercial needs of development. It would enable the development of the tunnel air-raid shelters as a museum which would partner and, by providing a very human story, complement the adjacent Museum of Science and Industry.

10.2.3 Further Option B Plus would not preclude the development of options C or D at some point in the future when the funding climate, financial circumstance and development pressures may have changed considerably. The Tunnel and the Manchester Central undercroft are not going anywhere in the short to medium term.

10.3 Recommendations for Next Steps: Navigation

10.3.1 This has been an initial scoping study. In order to pursue the development of the recommended option the following actions now need to be undertaken

10.3.2 (1a) Discussion with Allied London and their agents to determine the feasibility of incorporating Option B into the development plan for the former Granada Studios site. This is the absolutely essential next step.

10.3.3 (1b) Discussion with Manchester City Council to determine the feasibility of incorporating Option B into the development plan for the former Granada Studios site. This is the absolutely essential next step.

10.3.4 Provided both these discussions are positive then the next step would be to explore how the project could be delivered – especially how the development stages to get to major funding from the HLF and similar bodies might be funded. It is suggested that the FMUC look to:

10.3.5 (2) Draw up a Strategic Delivery Plan for New Brunswick Basin (Option B). The Strategic Delivery Plan would set out the project goals, management framework and the means of generating the initial funding to undertake the technical studies required for a Design Study or Technical Plan.

10.3.6 (3) Secure funding for technical development.

10.3.7 (4) Undertake a design study for the basin. This will have sufficient detail to enable an accurate quantity survey and costing to be generated.

10.3.8 (5) Undertake a detailed economic analysis of the impact of the basin. The key economic and social issues are the likely return on investment, the potential benefit to regeneration schemes versus the costs to the same schemes, tourism income streams, the operational costs, potential staffing and employment together with the potential displacement of activity.

10.4 Recommendations for Next Steps: Tunnel Air-Raid Shelters

10.4.1 To maximise the potential return the group should now seek partners to develop the Tunnel Air-Raid Shelters in parallel with the development of Option B. Following initial discussions with the landowner and the local authority the FMUC should seek to:

10.4.2 (1) Draw up a Strategic Delivery Plan for the Tunnel Air-Raid Shelters (Option B Plus).

10.4.3 The plan would set out the potential delivery pathway, including key themes, identify key partnership and scope out funding options. This would be the precursor to any Design Study or Technical Plan as it would identify the means of funding such work.

10.4.4 (2) The Tunnel Air-Raid Shelters will require a different support network and partnership from the canal project (this is welcome as it diversifies the groups involved overall). A key stage in the development of the project will be to seek out potential partners and start to build this new network using the Strategic Delivery Plan as a calling card. To that end the initial Strategic Delivery Plan should not be too prescriptive as the new partners will wish to bring their own priorities to the table.

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Appendix A: Summary of Costings

Design Element	Element Costs*	Elements in Each Restoration Option							
BRIDGES & TUNNEL		Option A		Option B		Option C		Option D	
		No. of	Cost	No. of	Cost	No. of	Cost	No. of	Cost
Length of Section (metres)		na		260		654		875	
Existing Structures - Repair & Upgrade									
Tunnel to GN Widening (420m)	£2,680,000				£0	1	£2,680,000		
Tunnel Full Length (475m)	£3,100,000							1	£3,100,000
Main Road Bridges	£ 250,000	1	£250,000	1	£250,000	1	£250,000	2	£500,000
Minor Road Bridges	£ 60,000			0	£0	0	£0	0	£0
Foot & Cycle Bridge - Stand alone	£ 10,000			0	£0	0	£0	0	£0
Foot & Cycle Bridge - Lock Tail	£ 5,000			0	£0	0	£0	0	£0
			£250,000		**£250,000**		**£2,930,000**		**£3,600,000**
New Structures - Construction									
Modifications to Man.Central Undercroft	£4,450,000							1	£4,450,000
Main Road Bridge (Lower Mosley St)	£2,550,000							1	£2,550,000
Minor Road Bridges (St.Johns Internal link)	£ 355,000					1	£355,000	1	£355,000
Foot & cycle Bridge - Stand alone	£ 145,000							1	£145,000
Foot & cycle Bridge - Lock Tail	£ 25,000			1	£25,000			3	£75,000
			£0		**£25,000**		**£355,000**		**£7,575,000**
Sub-Total Bridges			**£250,000**		**£275,000**		**£3,285,000**		**£11,175,000**

* *For discussion and justification of element costs please see text.*

Design Element	Element Costs	Elements in Each Restoration Option							
LOCKS		Option A		Option B		Option C		Option D	
All Broad Locks		No. of	Cost	No. of	Cost	No. of	Cost	No. of	Cost
Existing Locks to be Repaired									
Lock No.1 (single chamber, one rise)	£ 205,000			1	£205,000	1	£205,000	1	£205,000
Lock No.2 (double chamber, one rise)	£ 240,000			1	£240,000	1	£240,000	1	£240,000
			£0		**£445,000**		**£445,000**		**£445,000**
New Locks to be Constructed									
Locks No.3 & Locks No.4 (Staircase, 2 rise)	£1,200,000							1	£1,200,000
			£0		**£0**		**£0**		**£1,200,000**
Sub-Total Locks			**£0**		**£445,000**		**£445,000**		**£1,645,000**

Design Element	Element Costs	Elements in Each Restoration Option							
CHANNEL		Option A		Option B		Option C		Option D	
Length Restored (metres)		49		259.9		709.9		1155.5	
		Vol	Cost	Vol	Cost	Vol	Cost	Vol	Cost
Earthworks	cost per m3								
Excavation	£ 6	40	£240	8731	£52,386	9953	£59,718	13138	£78,825
Fill (50% of excavation)	£ 5	20	£100	4366	£21,828	4976	£24,882	6569	£32,844
Disposal off site (10%)	£ 25	4	£100	873	£21,828	995	£24,882	1314	£32,844
Disposal off site - Contamin.(40%)	£ 105	16	£1,678	3492	£366,702	3981	£418,024	5255	£551,778
			£2,117		**£462,743**		**£527,507**		**£696,291**
		Dist	Cost	Dist	Cost	Dist	Cost	Dist	Cost
Channel Structures	cost per m								
Wash walls both sides	£ 1,000	0	£0	190	£189,900	230	£229,900	626	£625,500
Structural (integral) *		0		70		480		530	
			£0		**£189,900**		**£229,900**		**£625,500**
		Dist	Cost	Dist	Cost	Dist	Cost	Dist	Cost
Channel Liner (waterproofing)	cost per m								
Clay Puddle	£ 800	0	£0	190	£151,920	230	£183,920	467	£373,200
HDPE/Concrete Largely under Man Central	£ 2,500		£0	0	£0		£0	159	£397,500
Structural (integral) *			£0		£0		£0		£0
(* ie cost included in stucture)			**£0**		**£151,920**		**£183,920**		**£770,700**
		Dist	Cost	Dist	Cost	Dist	Cost	Dist	Cost
Towpath	cost per m								
Towpath surfacing (c.2.5m width)	£ 25	49	£1,225	260	£6,498	710	£17,748	1156	£28,888
Fencing	£ 6	74	£441	260	£1,559	1065	£6,389	1733	£10,400
	per item								
Access Furniture	£ 520	0	£0	5	£2,600	10	£5,200	12	£6,240
Directional Signs	£ 165	8	£1,320	10	£1,650	10	£1,650	18	£2,970
Interpretation Board	£ 1,200	2	£2,400	2	£2,400	3	£3,600	4	£4,800
Sound & Light Installation	£ 230,000					1	£230,000	1	£230,000
			£5,386		**£14,707**		**£264,587**		**£283,297**
Sub-Total Channel & Track Works			**£7,503**		**£819,270**		**£1,205,913**		**£2,375,788**

Design Element	Element Costs	Elements in Each Restoration Option							
Water Supply		Option A		Option B		Option C		Option D	
		No. of	Cost	No. of	Cost	No. of	Cost	No. of	Cost
Water Supply	per item								
Pumping system from River Irwell to Brunswick Basin (pumps & piping)	£ 320,000	0	£0	1	£320,000	1	£320,000	1	£320,000
Pumping system from below Lock3 No.3 to above Locks No.4 (pumps & piping)	£ 380,000	0	£0	0	£0	0	£0	1	£380,000
Ground Water (bore hole)	£ 500,000	0	£0	0	£0	1	£500,000	1	£500,000
			£0		**£320,000**		**£820,000**		**£1,200,000**
Sub Total All Works Less Utitlites			**£257,503**		**£1,859,270**		**£5,755,913**		**£16,395,788**

Design Element	Element Costs	Elements in Each Restoration Option							
Utilities		Option A		Option B		Option C		Option D	
		No. of	Cost	No. of	Cost	No. of	Cost	No. of	Cost
Utility Diversions									
Minor Services % at...	% of works	1.0	£2,575	5.0	£92,964	10.0	£575,591	20.0	£0
Telecoms (underground)	£ 175,000		£0	0	£0	1	£175,000	3	£525,000
Electricity Cable (underground)	£ 190,000		£0	1	£190,000	1	£190,000	3	£570,000
Gas Mains	£ 210,000		£0	0	£0	1	£210,000	3	£630,000
Water Mains	£ 186,500		£0	1	£186,500	1	£186,500	2	£373,000
Main Sewer	£ 165,000		£0	1	£165,000	2	£330,000	3	£495,000
			£2,575		**£634,464**		**£1,667,091**		**£2,593,000**
Sub Total All Works			**£260,078**		**£2,493,734**		**£7,423,005**		**£18,988,788**

Design Element: Options APlus & B Plus	Element Costs	Elements in Each Restoration Option							
Air Raid Shelter Opening		Option A Plus		Option B Plus		Option C		Option D	
		No. of	Cost	No. of	Cost	No. of	Cost	No. of	Cost
Other Items	Est works								
Site Investigations & Design	£ 25,000	1	£25,000	1	£25,000				
Ecological Works	£ 5,000	1	£5,000	1	£5,000				
Archaeological Works (general & watching brief)	£ 40,000	1	£40,000	1	£40,000	**Air Raid Shelter opening and display works do not apply to Options C & D**			
Detailed Design % at...	5	1	£11,250	1	£11,250				
Preliminaries % at…	12	1	£27,000	1	£27,000				
Accommodation Works % at…	2	1	£4,500	1	£4,500				
Main works (access ways, AV, interpretation, etc)	225,000	1	£225,000	1	£225,000				
SubTotal Other			£337,750		£337,750				
Contingency % at...	10	1	£33,775	£1	£33,775				
Total Other & Contingency			**£371,525**		**£371,525**				

Design Element: Options C & D	Element Costs	Elements in Each Restoration Option							
Air Raid Shelter Removal		Option A		Option B		Option C		Option D	
		No. of	Cost	No. of	Cost	No. of	Cost	No. of	Cost
Other Items	Est works								
Site Investigations & Design	£ 25,000					1	£25,000	1	£25,000
Ecological Works	£ 5,000					1	£5,000	1	£5,000
Archaeological Works (recording, excvation & controlled removal of WW2 shelters)	£ 320,000	**Air Raid Shelter Removal Works do not apply to Option A and A Plus and Option B and B Plus**				1	£320,000	1	£320,000
Detailed Design % at...	5					1	£16,000	1	£16,000
Preliminaries % at…	12					1	£38,400	1	£38,400
Accommodation Works % at…	2					1	£6,400	1	£6,400
SubTotal Other							£410,800		£410,800
Contingency % at…	10						£41,080		£41,080
Total Other & Contingency							**£451,880**		**£451,880**

Design Element	Element Costs	Elements in Each Restoration Option							
Other		Option A		Option B		Option C		Option D	
		No. of	Cost	No. of	Cost	No. of	Cost	No. of	Cost
Other Items	est. per m								
Site Investigations & Design	£ 200	1	£9,800	1	£51,980	1	£141,980	1	£231,100
Ecological Works	£ 50	1	£2,450	1	£12,995	1	£35,495	1	£57,775
Archaeological Works (general)	£ 150	1	£7,350	1	£38,985	1	£106,485	1	£173,325
Detailed Design % at...	5	1	£13,004	1	£124,687	1	£371,150	1	£949,439
Preliminaries % at…	12	1	£31,209	1	£299,248	1	£890,761	1	£2,278,655
Accommodation Works % at…	2	1	£5,202	1	£49,875	1	£148,460	1	£379,776
SubTotal Other			£69,015		£577,769		£1,694,331		£4,070,070
Contingency % at…	10	1	£26,008	1	£249,373	1	£742,300	1	£1,898,879
Total Other & Contingency			**£95,023**		**£827,143**		**£2,436,631**		**£5,968,948**

Cost Summary

Navigation Restoration

Elements	Elements in Each Restoration Option			
	Option A	Option B	Option C	Option D
Existing Structures - Repair	£ 250,000	£ 250,000	£ 2,930,000	£ 3,600,000
New Structures - Construction	£ -	£ 25,000	£ 355,000	£ 7,575,000
Existing Locks to be Repaired	£ -	£ 445,000	£ 445,000	£ 445,000
New Locks to be Constructed	£ -	£ -	£ -	£ 1,200,000
Earthworks	£ 2,117	£ 462,743	£ 527,507	£ 696,291
Channel Structures	£ -	£ 189,900	£ 229,900	£ 625,500
Puddle / Liner (waterproofing)	£ -	£ 151,920	£ 183,920	£ 770,700
Towpath	£ 5,386	£ 14,707	£ 264,587	£ 283,297
Water Supply	£ -	£ 320,000	£ 820,000	£ 1,200,000
Utility Diversions	£ 2,575	£ 634,464	£ 1,667,091	£ 2,593,000
Other (Excluding Contingency)	£ 69,015	£ 577,769	£ 1,694,331	£ 4,070,070
Contingency	£ 26,008	£ 249,373	£ 742,300	£ 1,898,879
Totals	£ 355,101	£ 3,320,876	£ 9,859,636	£ 24,957,736
Cost per linear Metre	£7,247	£12,778	£13,889	£21,599

Treatment of Tunnel

Elements	Elements in Each Restoration Option			
	Option A Plus	Option B Plus	Option C	Option D
Opening of Tunnel Air Raid Shelters (Options A Plus & B Plus)	£337,750	£337,750		
Removal of Tunnel Air Raid Shelters (Options C & D)			£410,800	£410,800
Contingency	£33,775	£33,775	£41,080	£41,080
Totals	£371,525	£371,525	£451,880	£451,880

Appendix B: Summary of Benefits Identified to Date

Benefit	Description of Benefit (Rationale)	Evidence	Unit Value	Option A	Option A+	Option B	Option B+	Option C	Option D	Unit
Property Price & Land Value Premium										
Property adjacent to restored / new canal	15 to 25 % increase	Gibb 2001, Ecotec 2007, Jacobs 2009.		Quanta for site not yet known therefore not calculated. But may be assumed to be comparable with current site wide figures.						
Property within 100 m of restored / new canal	10 to 15 % increase									
Property within 500 m of restored / new canal	5 to 10 % increase									
Property Development										
Residential units		Gibb 2001, Ecotec 2007, Jacobs 2009.		Quanta for site not yet known therefore not calculated. But may be assumed to be comparable with current site wide figures.						
Commercial / industrial m2										
Leisure m2										
Development Investments (over project life)										
Development Revenues (over project life)										
Sustainable Heating and Cooling	NB: Costs of system installation NOT included in COSTING			Financial Benefits of system not calculated (floor areas unknown) and NOT included in BENEFITS. But liable to produce substantial savings to occupants						
Employment Created:										
Temporary Construction Jobs (person years)	£75,000 of construction spend = 1 person years of employment . Therefore cost divided by 75,000 = number of person years employment	Gibb 2001, Ecotec 2007, Jacobs 2009.	75000	4.7	9.7	44.3	49.2	137.5	338.8	Person Years
Long Term FTE Jobs in Tourism & Leisure (jobs)	£25,000 of expenditure = 1 FTE. Therefore total leisure spend divided by 25,000 = number of FTE	Gibb 2001, Ecotec 2007, Jacobs 2009.	25000	4.9	17.0	40.5	49.3	48.9	53.8	FTE Jobs
Long Term FTE Jobs in general business (jobs)	based on property investment between 16.9 and 20.2 sq. m. will generate one FTE job in business - use mean of 18.6 sq..	Gibbs 2001	18.6	Business property quanta not known and hence not calculated, however, unlikely to differ markedly from existing calculations for the St. Johns site.						FTE Jobs
				Option A	**Option A+**	**Option B**	**Option B+**	**Option C**	**Option D**	**Unit**
Waterway Related Activity Expenditure	*See Boat Movement Numbers below*									
Visiting Private Boats (overnight mooring fees and passage)	average of £25 per night for visiting boats.	Gibb 2001 revised in light of Jacobs 2009	25	0	0	8,031	8,031	9,638	16,063	Pounds
Spend by Private Boats in Local Economy	Spend of £25 per person and assumes two people per boat = £50 per boat	Gib 2001, Jacobs 2009, GHK 2004	50	0	0	16,063	16,063	19,275	32,125	Pounds
Home Moorings (Local Private Boats)	£3000 per boat per year. Assumes 20 long term/home moorings available in new basin. 80 % occupancy = 16 berths occupied	Gib 2001, Jacobs 2009	48000	0	0	48,000	48,000	48,000	48,000	Pounds
Trip Boat Operations to Salford Quays	Based on operation of water bus fulltime 6 months a year, weekends only 6 months. Assumes fare is £8 per head and that 5% of those visiting MOSI will participate.		33900	0	0	271,200	271,200	271,200	271,200	Pounds
	Option A shows nil return but the water bus could possibly operate from the Irwell Lock No.			see note	see note					
Paddle-sports (canoeing, rowing etc.). Opportunities limited.	Assumes visits rise as length of waterway increases - Option B = 300 visits, Option C = 500, Option D = 700 visits with benefits of £12 per visit.	British Waterways 2008	12	0	0	3,600	3,600	6,000	8,400	Pounds
Angling Activity (spend included in visitor spend) Fishing Peg Rental	No fishing in this location. But assumed angler expenditure is £5.85 per day.	British Waterways 2008, Jacobs 2009	5.85	0	0	0	0	0	0	Pounds
Sub-Total for Waterway Related				0	0	346,894	346,894	354,113	375,788	Pounds
General Land Based Visitor Expenditure	*Includes all income from walkers, cyclists and general visitors excluding boaters*									
Spend by general land-based visitors to site	Assumes 10% of visitors to MOSI will visit the New Brunswick Basin. MOSI has around 678,000 visitors per year. Assumes £6 per visit for day trippers / casual visitors and £25 per visitor for holiday makers. Ratio of Day to Holiday visits is 80 / 20.		67800	122,040	203,400	664,440	664,440	664,440	664,440	
Spend by land based visitors to tunnel air-raid shelters museum	Assumes 5% of visitors to MOSI will visit Tunnel, charge for tunnel visit of £6.50 per head. (siml to Clearwell Caves charge)		33900	na	220,350	na	220,350	0	0	
Spend by visitors to tunnel via trip boat	Assumes 5% of visitors to MOSI will take tunnel tour. Charge for tunnel tour £6 (short) to £10 (long) per head. (siml to		33900	0	0	0		203,400	305,100	
Sub-Total General Tourism & Leisure				122,040	423,750	664,440	884,790	867,840	969,540	Pounds
Health and Well-Being Benefits (expressed as potential cost savings to NHS due to presence of a waterway and associated paths, trails, etc.)	£33,400 to £340,000 per kilometre per year or £33.40 to £334 per metre. Benefit greatest in urban environments, therefore assuming higher figure.	Higher Figure Peacock et al 2005, Jacob 2009	334	16,366	16,366	173,613	173,613	237,107	385,937	
		Lower Figure	33.4	1,637	1,637	8,681	8,681	23,711	38,594	
Sub-Total Health & Well-Being	Using mean of higher and lower figures			9,001	9,001	91,147	91,147	130,409	212,265	Pounds
Sub-Total Health & Well-Being	Using higher figures			16,366	16,366	173,613	173,613	237,107	385,937	Pounds
Telecoms	Estimate based on other projects	Jacobs 2009								
Sub-Total for F/O wayleaves				0	0	0		0	15,000	Pounds

SUMMARY			Option A	Option A+	Option B	Option B+	Option C	Option D	Unit
Sub-Total For Land/Property Uplift	Not Quantified		negligible	negligible	high	high	low	low	
Sub-Total For Property Development	Not Quantified								
Sub-Total for Waterway Related			£ -	£ -	£ 346,894	£ 346,894	£ 354,113	£ 375,788	Pounds
Sub-Total General Tourism & Leisure			£ 122,040	£ 423,750	£ 664,440	£ 884,790	£ 867,840	£ 969,540	Pounds
Sub-Total Health & Well-Being			£ 16,366	£ 16,366	£ 173,613	£ 173,613	£ 237,107	£ 385,937	Pounds
Sub-Total for F/O wayleaves			£ -	£ -	£ -	£ -	£ -	£ 15,000	Pounds
Total for each option for One Year			£ 138,406	£ 440,116	£ 1,184,947	£ 1,405,297	£ 1,459,059	£ 1,746,265	
Total for each option for Five Years			£ 692,030	£ 2,200,580	£ 5,924,735	£ 7,026,485	£ 7,295,296	£ 8,731,323	
Total for each option for Ten Years			£ 1,384,060	£ 4,401,160	£ 11,849,470	£14,052,970	£ 14,590,591	£ 17,462,645	
Note no allowance for property uplift is included.									
Note no allowance for sustainable heating & cooling is included, nor is any allowance made for sustainable urban drainage or flood prevention									

EMPLOYMENT			Option A	Option A+	Option B	Option B+	Option C	Option D	Unit
Temporary Construction Jobs (person years)			4.7	9.7	44.3	49.2	137.5	338.8	Person Years
Long Term FTE Jobs in Tourism & Leisure (jobs)			4.9	17.0	40.5	49.3	48.9	53.8	FTE Jobs
Long Term FTE Jobs in general business (jobs)									