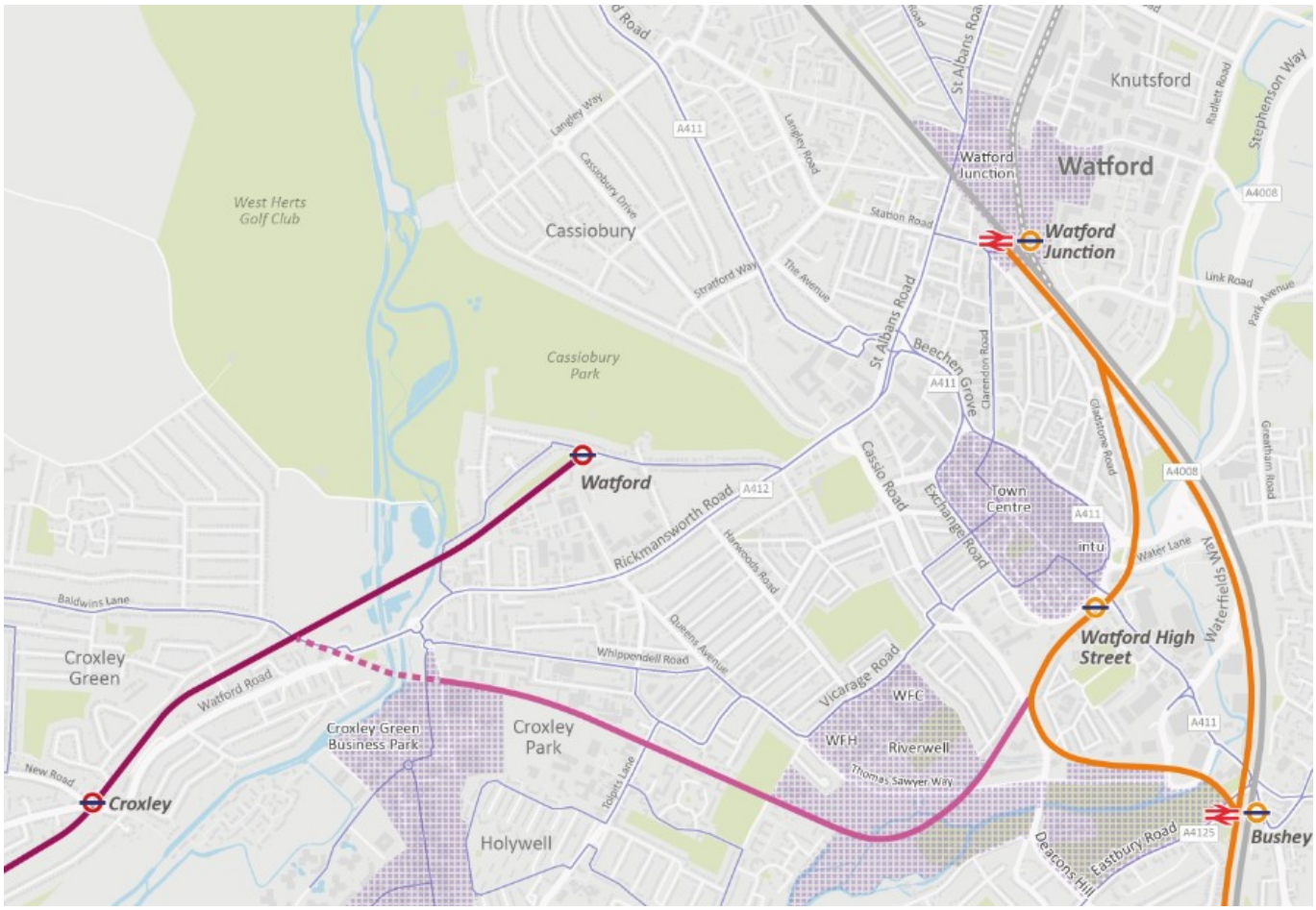
Final Report
June 2021

Metropolitan Line Extension Alternatives



Transport for London
Our ref: 23566001
Client ref: TfL 91311 / Task 155

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Metropolitan Line Extension Alternatives

Prepared by:

Steer
28-32 Upper Ground
London SE1 9PD

+44 20 7910 5000
www.steergroup.com

Prepared for:

Transport for London
5 Broadway
London
Sw1H 0BD
United Kingdom

Client ref: TfL 91311 / Task 155
Our ref: 23566001

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1 Introduction

1.1 Steer has been commissioned by Transport for London (TfL), on behalf of Watford Borough Council, Hertfordshire County Council and TfL, to identify the strategic transport needs and potential interventions in and around Watford following the cancellation of the Metropolitan Line Extension (MLX).

1.2 This report is an updated version of the original report developed in 2019, which includes Personal Rapid Transit (PRT) as an alternative to meet the transport and connectivity needs identified in the original report while making use of the Croxley Branch Line. No other material changes have been made in the report. It should be noted that the report is based on the currently adopted Local Plan from 2013. A new local plan is currently under development covering the 2018-2036 period and, whilst the number and locations of the proposed developments are subject to change with respect to the 2013 Local Plan, these are not anticipated to materially impact the conclusions of this study.

1.3 It should also be noted that, at the time of updating this report, ongoing development of Mass Rapid Transit (MRT) options in Hertfordshire is taking place; however, the emerging results of this work do not affect the findings of this report.

1.4 In line with the tasks set out in the brief, the remainder of the report is set out as follows:

- Chapter 2: Current Transport Patterns
- Chapter 3: Planned Growth
- Chapter 4: Future Transport Patterns
- Chapter 5: Transport Policy and Area-wide Interventions
- Chapter 6: Establishment of Project Objectives
- Chapter 7: Option Generation
- Chapter 8: Option Assessment
- Chapter 9: Commentary on Options and Implications
- Chapter 10: Conclusions and Next Steps

2 Current Transport Patterns

2.1 We have analysed a range of datasets to complement our understanding of Watford's transport patterns and to identify the current demand, connectivity priorities and constraints of the existing network. It should be noted that a number of these datasets and sources reflect the currently adopted Local Plan from 2013.

2.2 The following sources have been used to carry out this assessment:

- Hertfordshire COMET: Pattern of Travel Across Hertfordshire, AECOM (September 2015)
- Census 2011 Origin Destination data (Journey to Work)
- Croxley Rail Link Demand Model and Forecasting Report (September 2011)
- Watford Area Evidence Pack (June 2017)
- MOIRA data (Year to September 2018)
- TfL Oyster data
- South West Hertfordshire Growth and Transport Plan Prospectus (June 2018)
- Hertfordshire Local Transport Plan 4 (LTP4) (May 2018)
- Pitney Bowes Speed Profiles (2018)
- Watford Do-Minimum 2031 Forecasting Report, AECOM (January 2017)

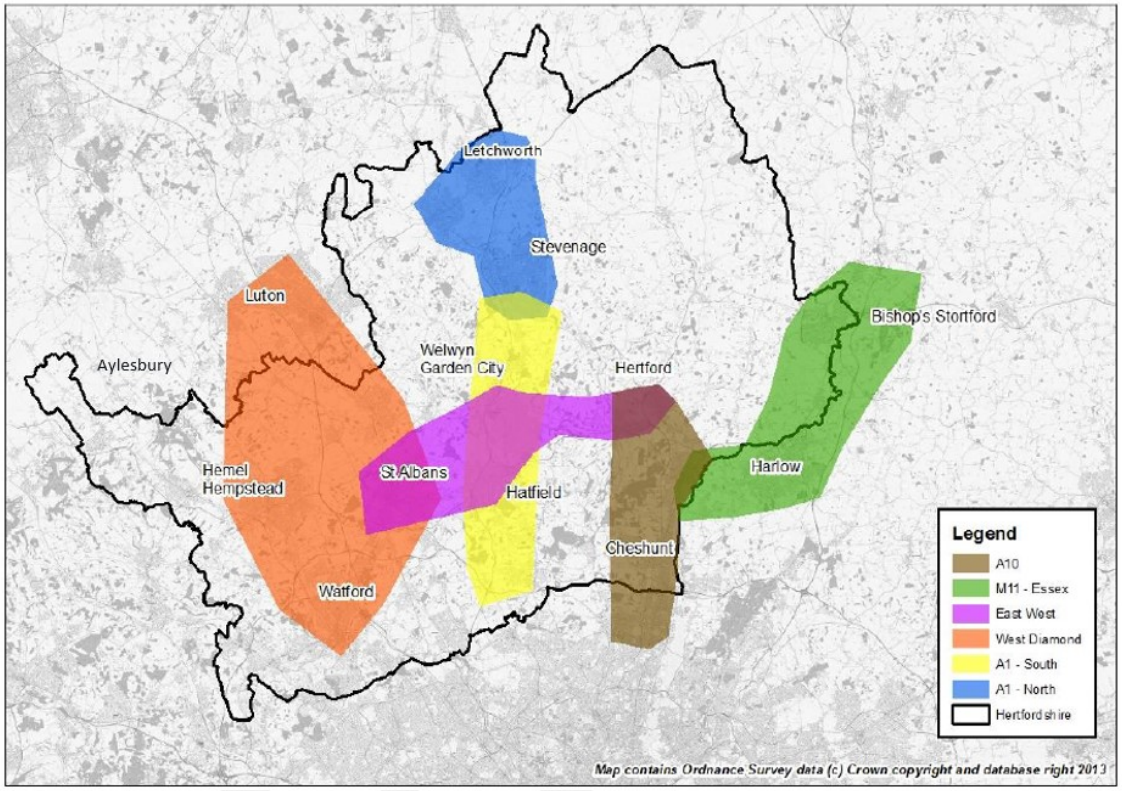
2.3 Recognising the broad geographical scope of the study, we have considered transport accessibility and connectivity more widely than simply the original Metropolitan Line Extension (MLX) corridor, considering transport patterns and constraints within the 'continuous metropolitan area' of Watford, including Bushey, Croxley and South Oxhey, plus wider accessibility constraints to Watford from southwest Hertfordshire and north-west London.

Current Journey Demand

Journeys within Hertfordshire

2.4 The Hertfordshire COMET Pattern of Travel Across Hertfordshire report identifies the main patterns of travel across Hertfordshire, to prioritise areas for further study in Growth and Transport Plans. The geographical location of these recommended areas is shown in Figure 2.1 below. The Luton – St Albans - Harpenden – Watford 'Diamond' is one prioritised area, as there are high levels of travel between these towns.

Figure 2.1: Recommended location of Growth and Transport Plans

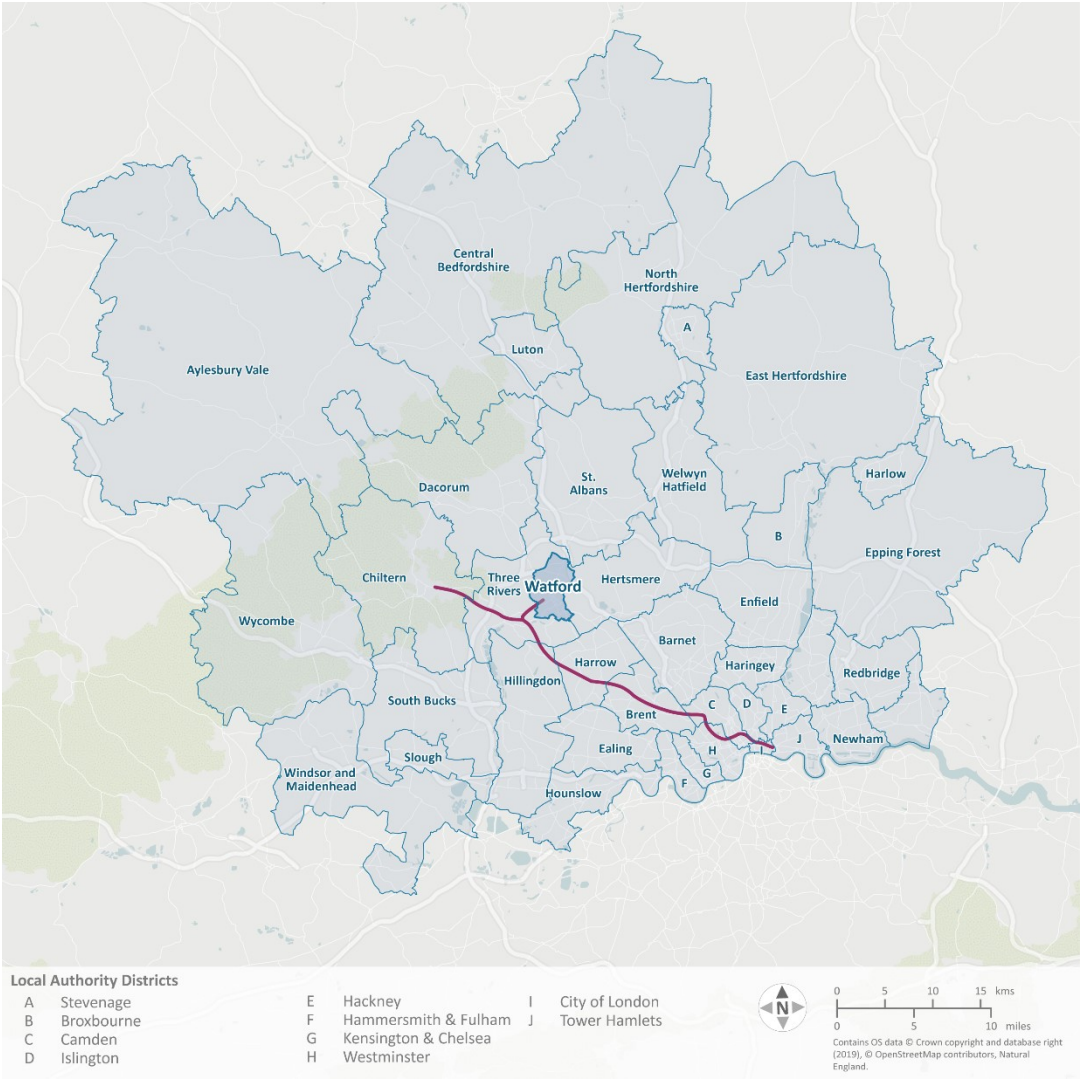


Source: Hertfordshire COMET Pattern of Travel Across Hertfordshire

Journeys into Watford

2.5 We have analysed 2011 Census Origin Destination (Journey to Work) data, to further identify commuting patterns to and from Watford and surrounding districts. This enables us to understand where the priorities for good connectivity and accessibility should be focused. The Local Authority Districts (LADs) included in this analysis are shown in Figure 2.2 below, along with the alignment of the existing Metropolitan line.

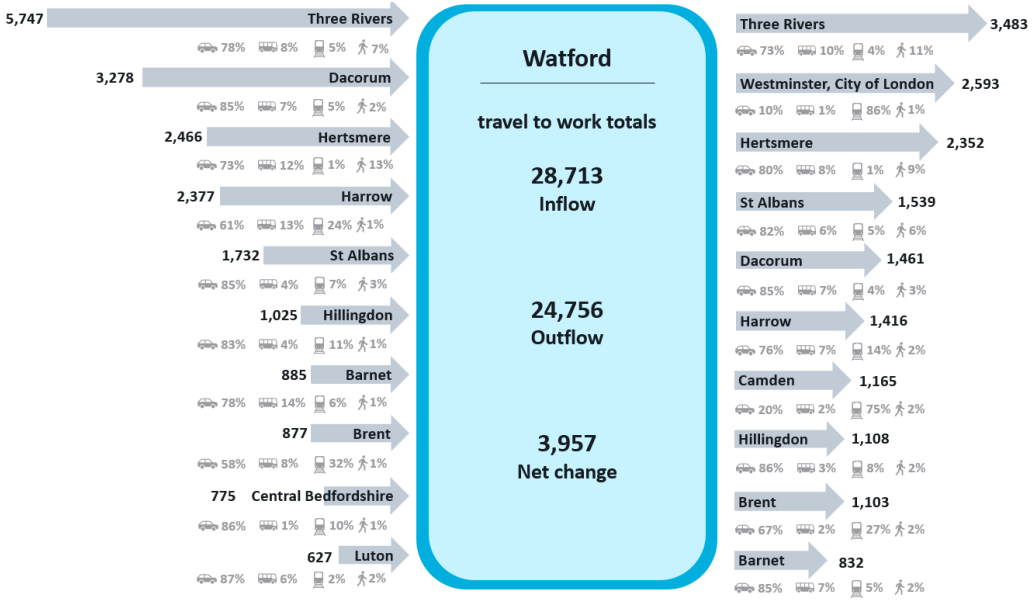
Figure 2.2: Local Authority Districts included in the Journey to Work analysis



Source: Steer

2.6 The largest flows between Watford and these LADs are shown in Figure 2.3 below, with the mode split of journeys shown below each arrow.

Figure 2.3: Journey to work analysis of Watford



Source: Steer, Journeys to Work Data

2.7 The analysis shows that Watford is a large generator and attractor of trips. Indeed, net inflows (28,713) exceed outflows (24,756), reflecting Watford's role as a major employment centre.

2.8 The analysis demonstrates that there is a high level of cross-boundary commuting with movements between medium sized urban areas. Most commutes into Watford originate from the North-West of the borough, from districts such as Three Rivers and Dacorum and the other adjacent districts of Hertsmere and St Albans. There is also high demand originating from the London boroughs to the South of Watford such as Harrow, Hillingdon, Barnet and Brent. There is also notable in-commuting from Central Bedfordshire and Luton to the north.

2.9 Car is the dominant commuting mode from all districts. Car commuting is typically around 80% or more from all districts except for Harrow and Brent, where rail (including heavy rail and underground) commuting is significant at 24% and 32% respectively. Car mode share is correspondingly lower, at around 60%. Commuting by active modes is only significant from Hertsmere, where 13% of journeys are made on foot or by bicycle.

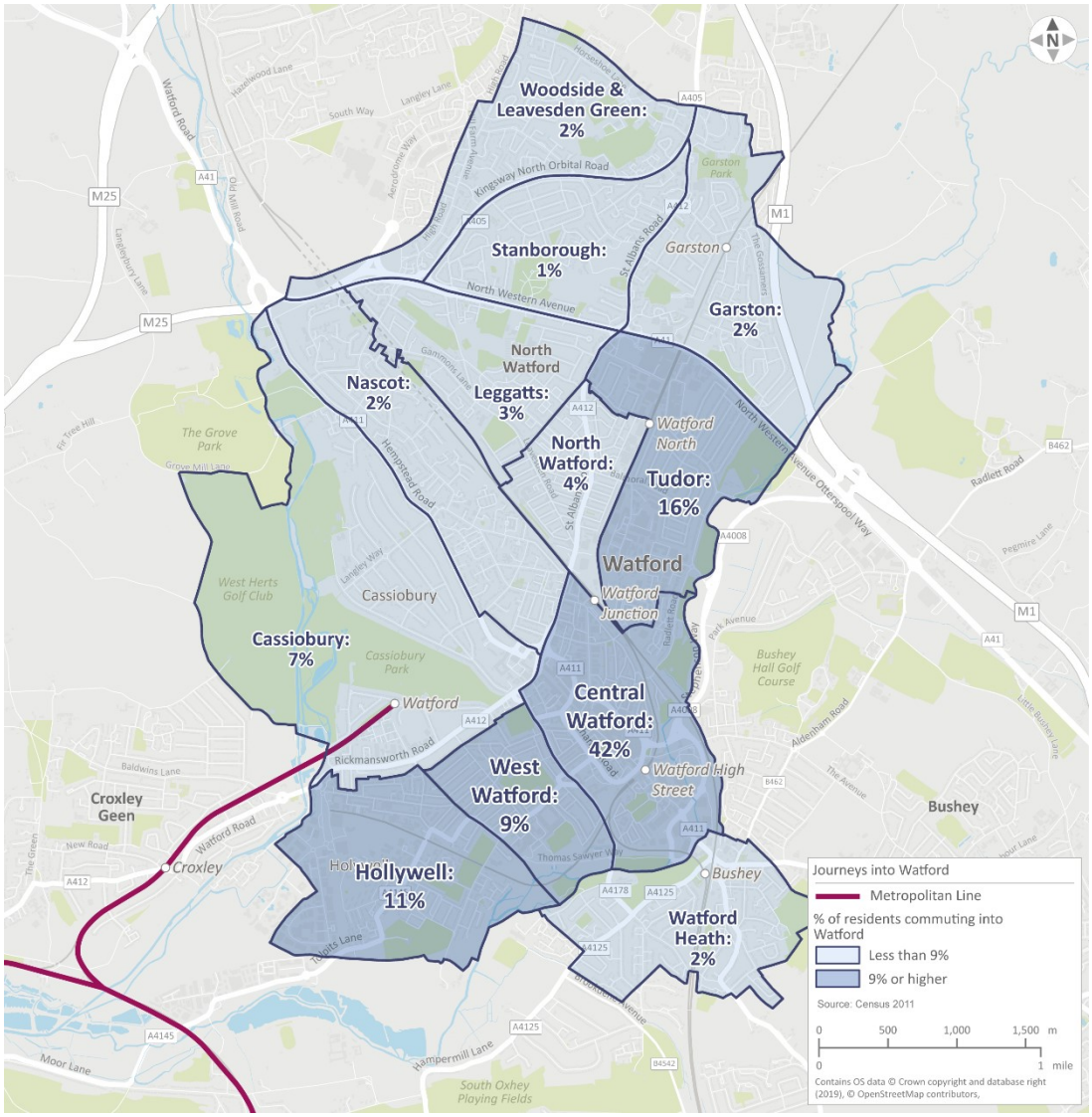
2.10 In terms of out-commuting, 43% of total journeys out of Watford are towards London with the central boroughs of Westminster and Camden accounting for roughly half of these, and the North-West London boroughs of Harrow, Hillingdon, Brent and Barnet collectively accounting for the other half. There is a net outflow of commuters travelling into London, with 10,673 outward journeys between Watford and London Boroughs compared to 7,018 of inward journeys. Journeys into central London are more likely to be taken by public transport, with 86% of journeys into Westminster/City of London and 75% of journeys into Camden made by rail. For other destinations car is the dominant mode, with the broad shares similar to that for in-commuting.

MSOA-level Analysis

2.11 We have analysed journey to work data at MSOA (Middle Super Output Area) level within Watford. Analysis of the 12 MSOAs in shows that most (78%) of in-commuting journeys to Watford serve wards on the east-west MLX axis. Of these, 42% go into Central Watford, with

Tudor (16%), Holywell (11%) and West Watford (9%) also experiencing high levels of demand. The Watford Area Evidence Pack points out that these MSOAs have a significantly higher number and density of jobs– most of the jobs are concentrated within Watford Centre, while industrial jobs are more concentrated in the Business Park (in Holywell) and North Watford employment centres (such as Tudor). The overall split between inbound journeys to Watford from surrounding districts is shown in Figure 2.4 below.

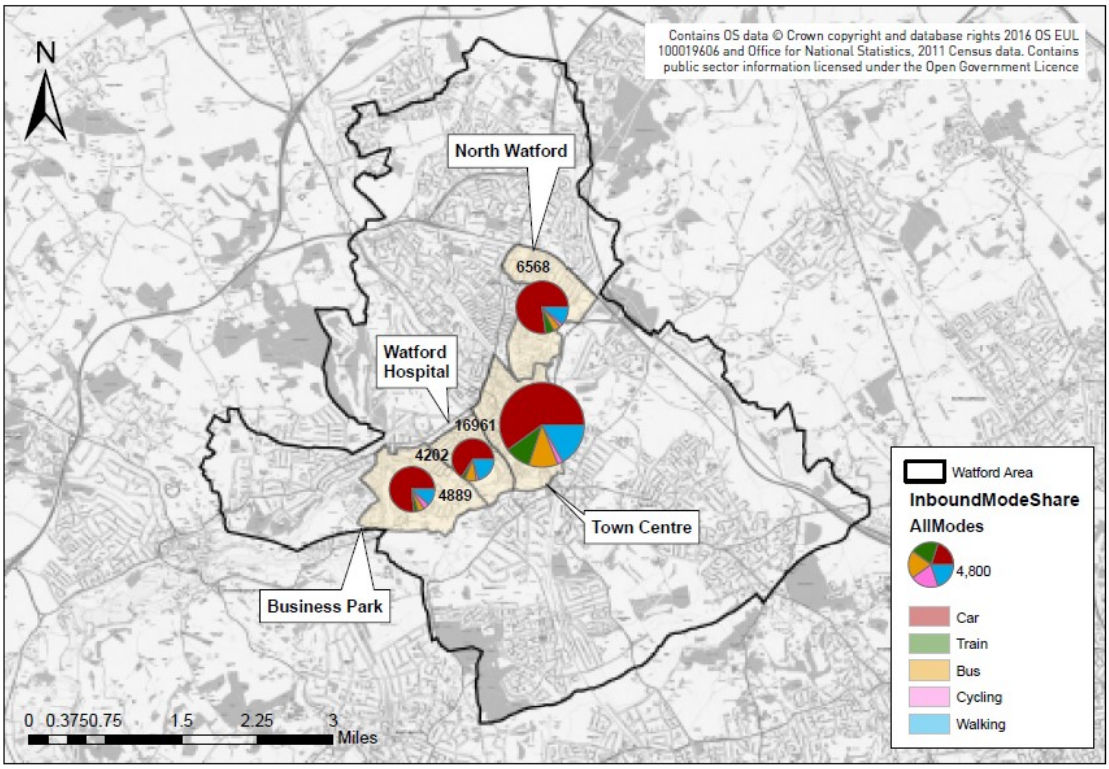
Figure 2.4: Inbound journeys from surrounding LADs into Watford MSOAs



Source: Steer, Journeys to Work Data

2.12 The mode share for inbound trips into these four high demand areas is shown in Figure 2.5 below. Most trips are taken by car (an average of 61%), though the car mode share to both Holywell (Croxley and Watford Business Parks) and West Watford (Watford Hospital) is significantly higher than for Central Watford.

Figure 2.5: Mode share for inbound trips to employment areas, total trips

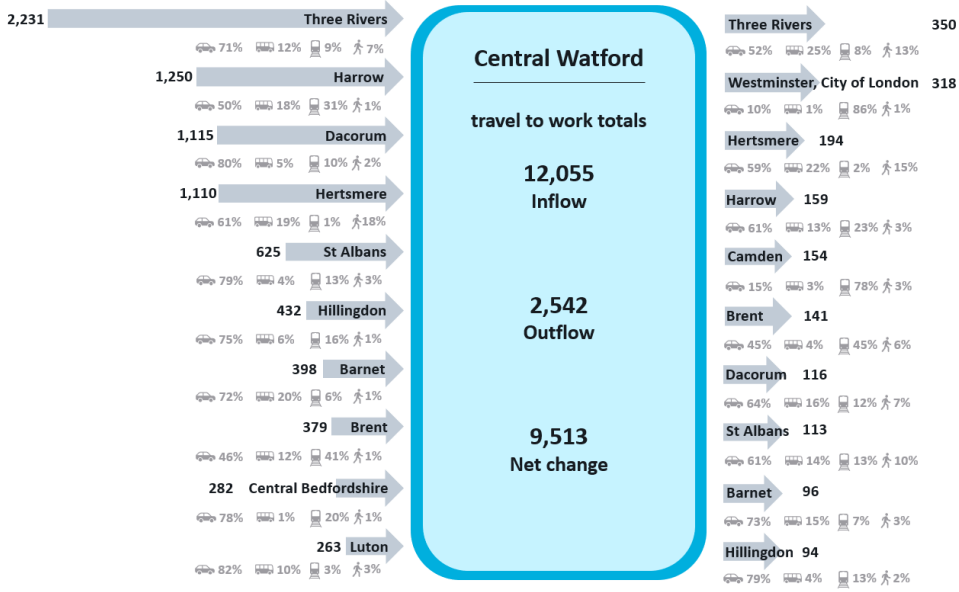


Source: Watford Area Evidence Pack

2.13 Maps of the specific journey to work flows (inbound and outbound) for these four MSOAs are shown in **Appendix A**. There is a similar pattern to that seen in the overall borough, with most inward journeys coming from the immediate surrounding boroughs and high outward flows towards London.

2.14 Central Watford, which has the highest number of inflow journeys, has journeys originating from a wider distance. A breakdown of journey to work patterns for Central Watford is shown in Figure 2.6 below (excluding trips from other areas in Watford). The distribution of commuting is similar to that of Watford as a whole (as per Figure 2.3), though the public transport mode shares are typically greater reflecting the much better public transport accessibility of central Watford compared to the borough overall.

Figure 2.6: Journey to work analysis of Central Watford



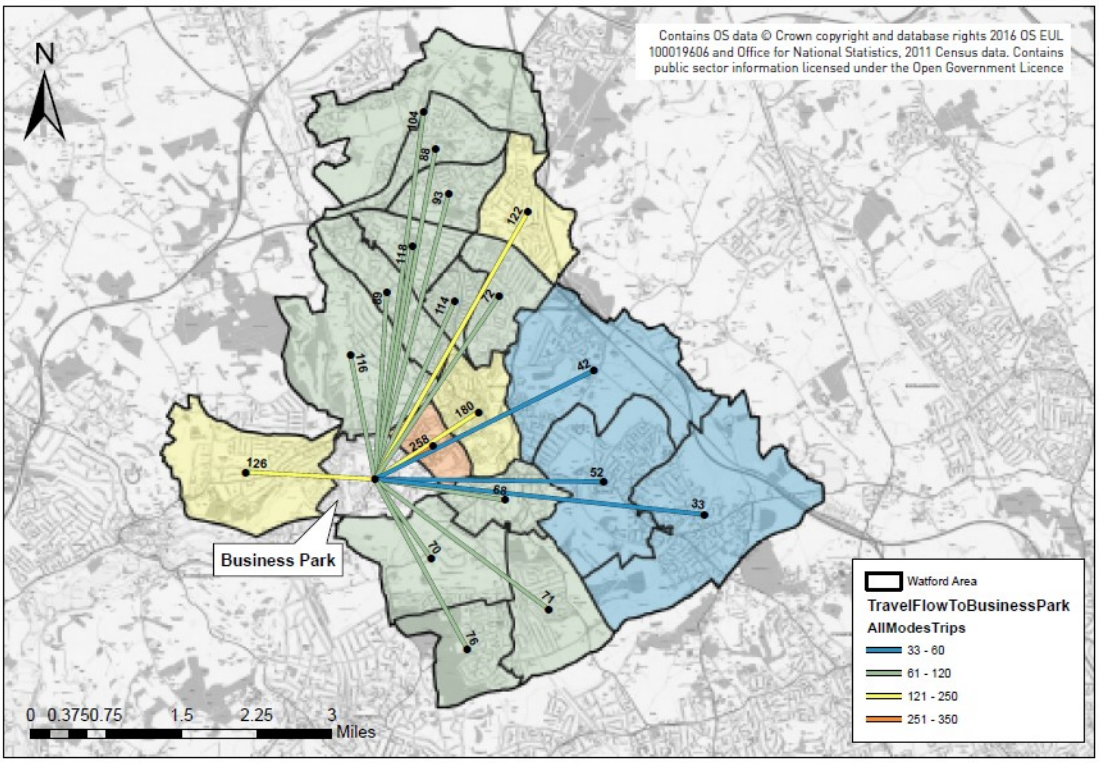
Source: Steer, Journeys to Work Data

Journeys within Watford

2.15 Journey to work flows between the 12 MSOAs in Watford are shown in **Appendix C**. This analysis shows that most of the journeys into Central Watford originate from West Watford and Holywell, which are both areas on the original MLX alignment corridor.

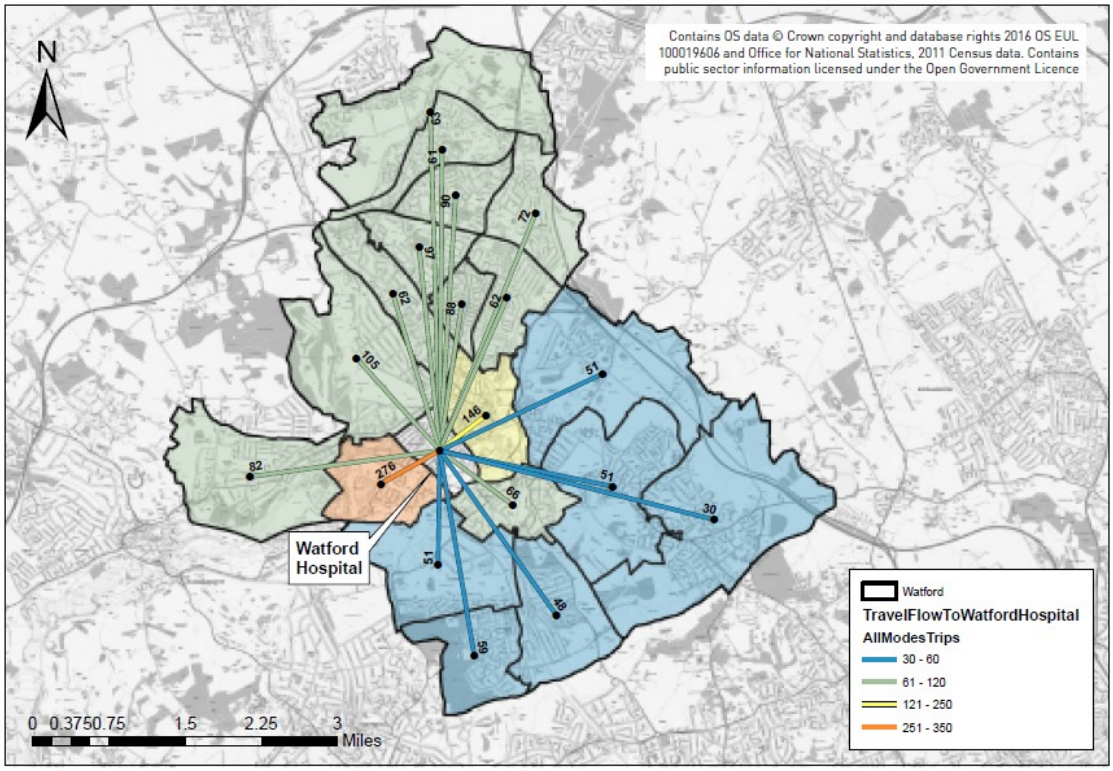
2.16 The Journey to Work flows for the four 'high demand' areas along the former MLX axis identified in Figure 2.4 are shown in the maps below (Figure 2.7 to Figure 2.10).

Figure 2.7: Watford Commuting trips to Holywell (location of the Business Park)



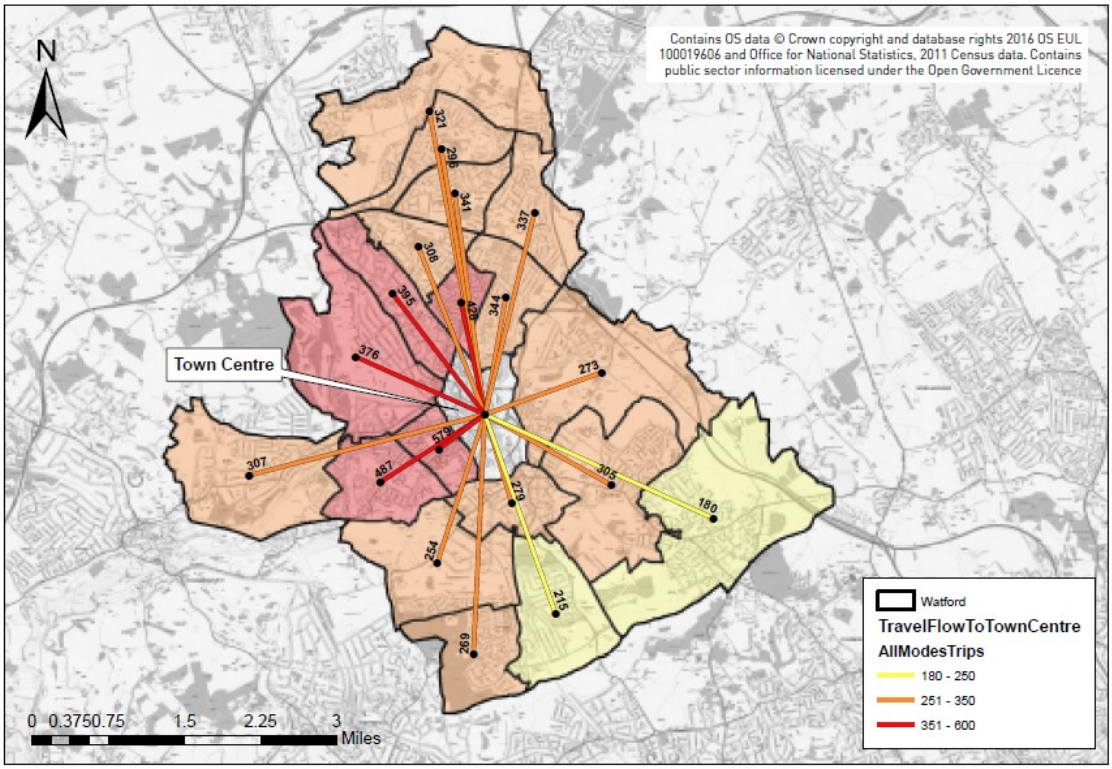
Source: Watford Area Evidence Pack

Figure 2.8: Watford Commuting trips to West Watford (location of Watford Hospital)



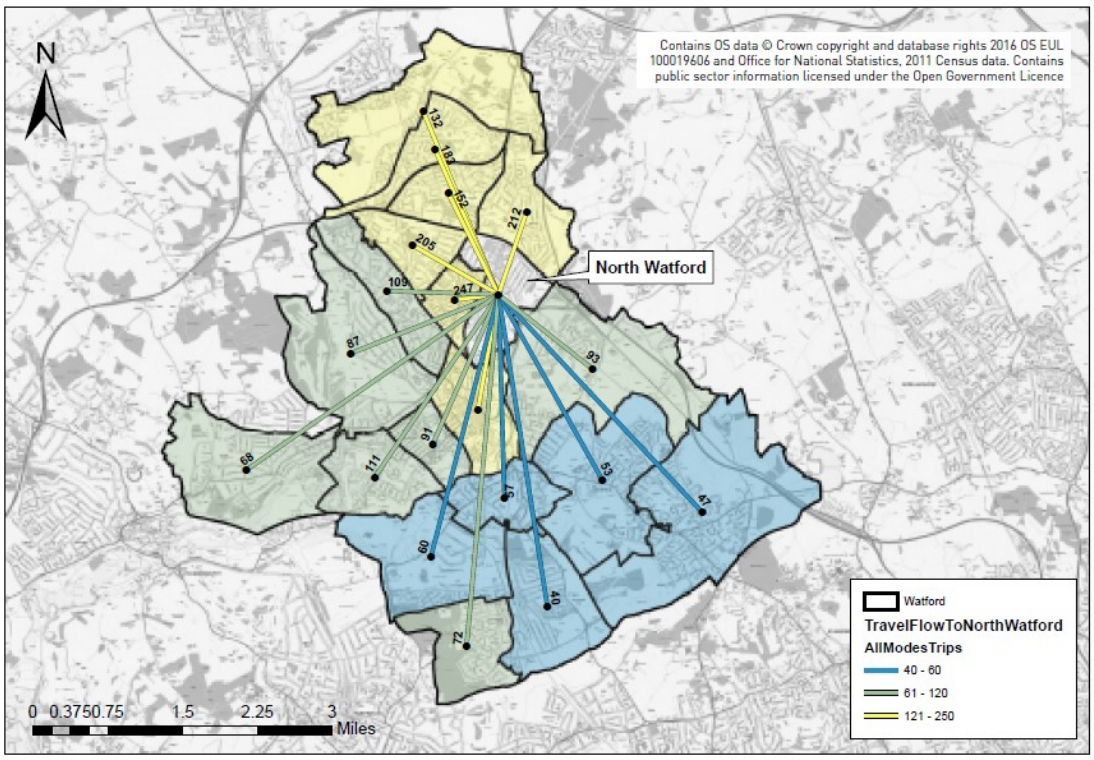
Source: Watford Area Evidence Pack

Figure 2.9: Watford Commuting trips to Central Watford (location of the Town Centre)



Source: Watford Area Evidence Pack

Figure 2.10: Watford Commuting trips to Tudor



Source: Watford Area Evidence Pack

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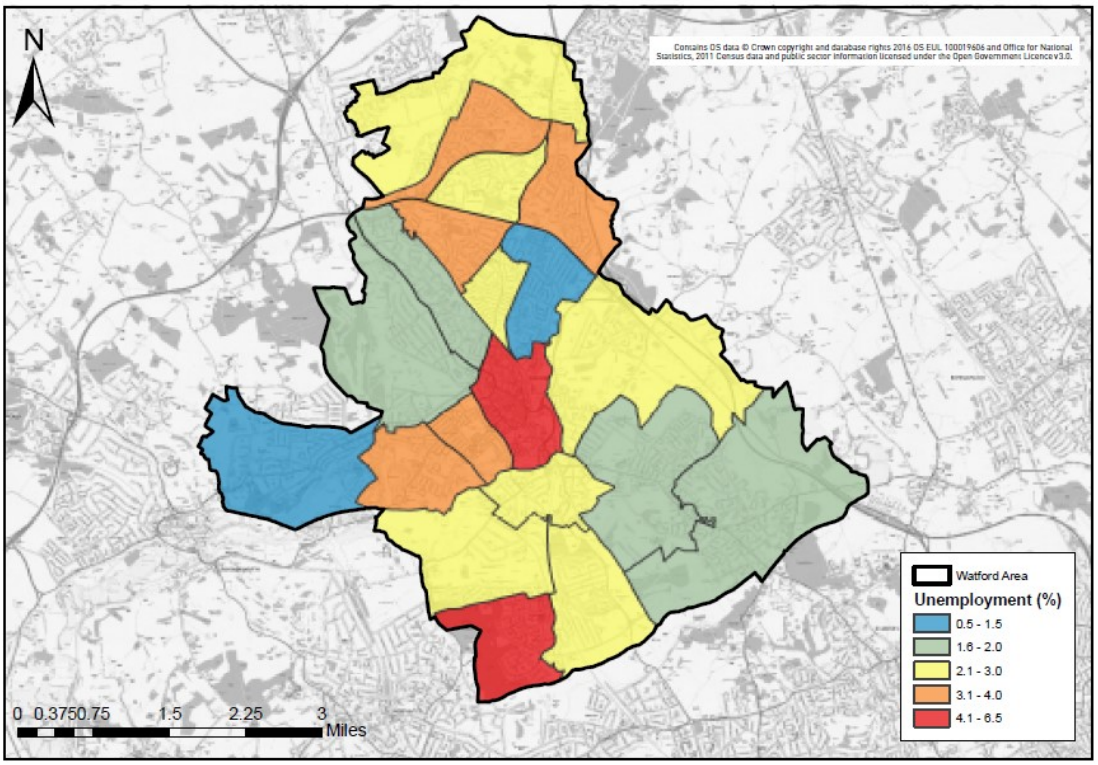
2.17 There is currently a high number of journeys made between the three 'core' areas (Central Watford, West Watford and Holywell). There is currently less demand for journeys from the North of the borough to areas in the South (such as West Watford and Holywell), but as there are several housing and employment developments planned in these areas we would expect these journeys to increase.

2.18 The demand for movements between these core areas is supported by the estimated demand the former MLX scheme. The Croxley Rail Link Demand Model and Forecasting Report estimated demand profiles for the forecast year 2016, as shown in **Appendix B**. These illustrate that there are significant levels of local trips, particularly in the AM peak with high numbers of southbound alightings at Watford High Street and Watford Hospital, and substantial boardings at Ascot Road, as well as significant demand from Watford Junction.It should be noted that demand profiles might have changed since the preparation of the MLX scheme business case, but this should be an indication of potential attractors and producers of demand along the former Croxley Branch corridor.

Socio-demographic Context

2.19 There are high levels of unemployment and deprivation in west Watford, as shown in Figure 2.11 and Figure 2.12 below. Unemployment and deprivation are highest in South-West Watford, where there is also a high rate of older people in deprivation and individuals with a long-term illness or disability. This increases the need for connectivity to the west of Watford, as it presents the opportunity to increase accessibility to economic opportunities for deprived individuals and communities.

Figure 2.11: Unemployment rates in Watford (% of working age population claiming out of work benefit)



Source: Watford Area Evidence Pack

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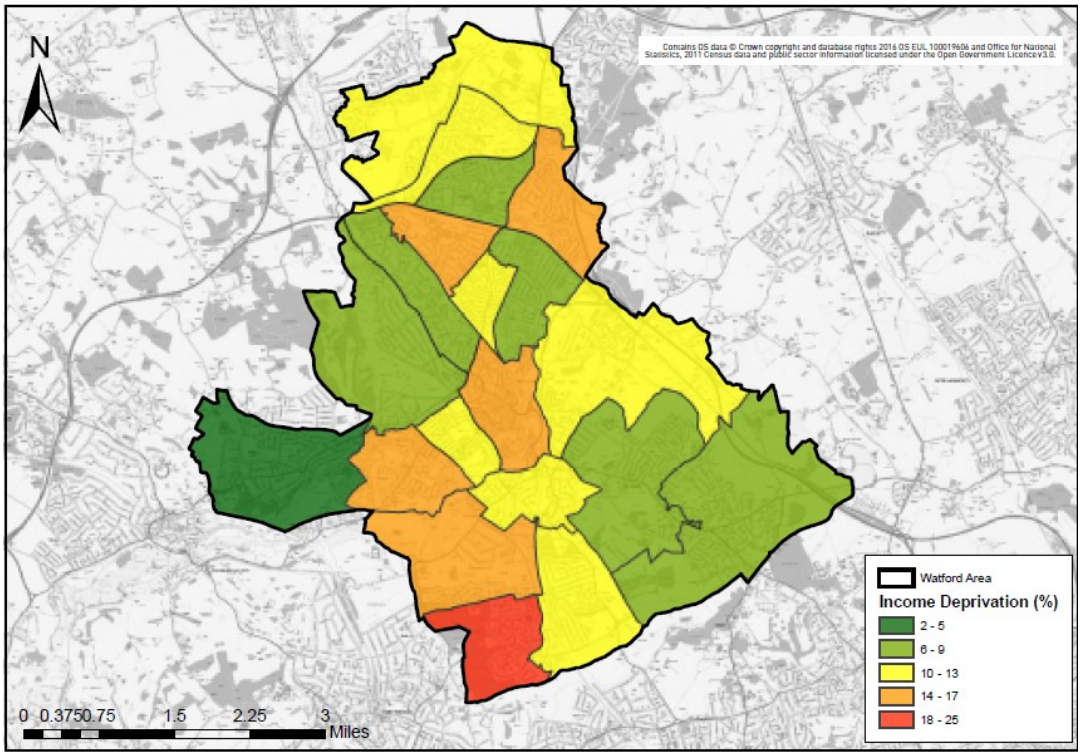
Figure 2.12: Income deprivation in Watford (% of population living in low income families reliance on means tested benefits)



Source: Watford Area Evidence Pack

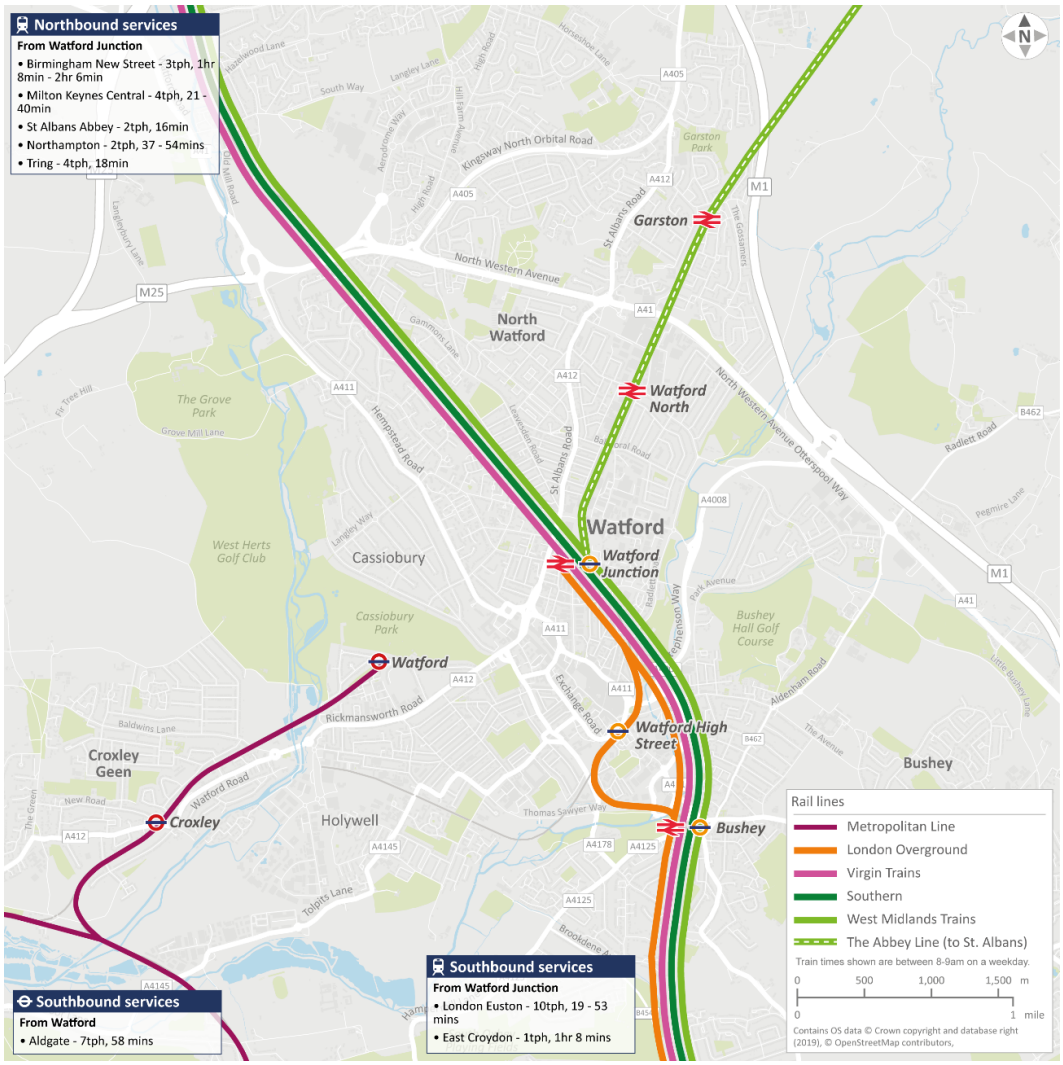
Current Transport Offer

Rail and Underground Network

2.20 The rail and tube network and station termini within Watford are shown in Figure 2.13 below. There is a good provision of rail connectivity North-South across the borough, with regular Northbound services to the rest of Hertfordshire and further afield from Watford Junction.

2.21 The Abbey Line provides connectivity for the North of the borough, running from Watford Junction through to St Albans Abbey and passing through town and countryside in Hertfordshire. The Abbey line is a semi-rural line and runs on a single-track operation, meaning that service frequencies are lower and do not operate on a clockface timetable (the service runs at asymmetric times of every 45 minutes until 10pm).

Figure 2.13: Rail provision within Watford



Source: Steer

Rail Demand

2.22 Estimates of Station Usages data from the Office of Rail and Road[1] are summarised in Table 2.1.

Table 2.1 Rail Station Usage

Station	Annual Usage (millions, 2017/18)
Watford Junction	8.3m
Watford High Street	1.4m
Bushey	1.5m
Watford North	c0.1m
Garston	<0.1m

Source: Office of Rail and Road Station Usage (2017/18)

[1] https://orr.gov.uk/statistics/published-stats/station-usage-estimates

2.23 This shows that Watford Junction is the predominant station with over 8m annual rail users (reflecting its service level to London), with Watford High Street and Bushey each attracting around 1.5m users per annum. Rail demand is significantly lower along the Abbey line, with just over 100,000 annual passengers at Watford North and 80,000 at Garston. There is significant underutilisation along the length of the Abbey Line.

2.24 London Underground station entry and exit figures from Transport for London[2] are summarised in Table 2.2.

Table 2.2: Entry and exits - London Underground stations

Station	Annual Usage (millions, 2017/18)
Watford	1.9m
Croxley	1.2m

Source: Transport for London Annual Entries and Exits (2017)

2.25 This shows that there is a high demand for London Underground services, with the two stations experiencing similar levels of demand to Watford High Street and Bushey and substantially more than stations along the length of the Abbey Line.

Rail Flows

2.26 The top five bidirectional flows for Watford Junction, Watford High Street and Bushey are shown in Table 2.3 to Table 2.5 below, based on MOIRA data supplied by Transport for London. The figures below include the journeys in both directions for each origin-destination pair.

Table 2.3: Top rail flows for Watford Junction station

Station	Annual number of passengers
London Terminals	4,269,239
Harrow & Wealdstone	363,960
Wembley Central	246,358
Queens Park London	179,281
Hemel Hempstead	171,664

Table 2.4: Top rail flows for Watford High Street station

Station	Annual number of passengers
Carpenders Park	226,995
London Terminals	162,490
Hatch End	147,592
Harrow & Wealdstone	133,765
Wembley Central	92,380

[2] https://data.london.gov.uk/dataset/london-underground-performance-reports

Table 2.5: Top rail flows for Bushey station

Station	Annual number of passengers
London Terminals	946,834
Carpenders Park	73,725
Harrow & Wealdstone	52,185
Queens Park London	43,641
Willesden Junction	42,175

Source: MOIRA, sourced from Transport for London (TfL)

2.27 This shows that there is high demand for services from/to London into the three central stations. There is also high demand from the South along the Overground alignment, from areas such as Carpenders Park and Hatch End into Watford High Street.

Bus network

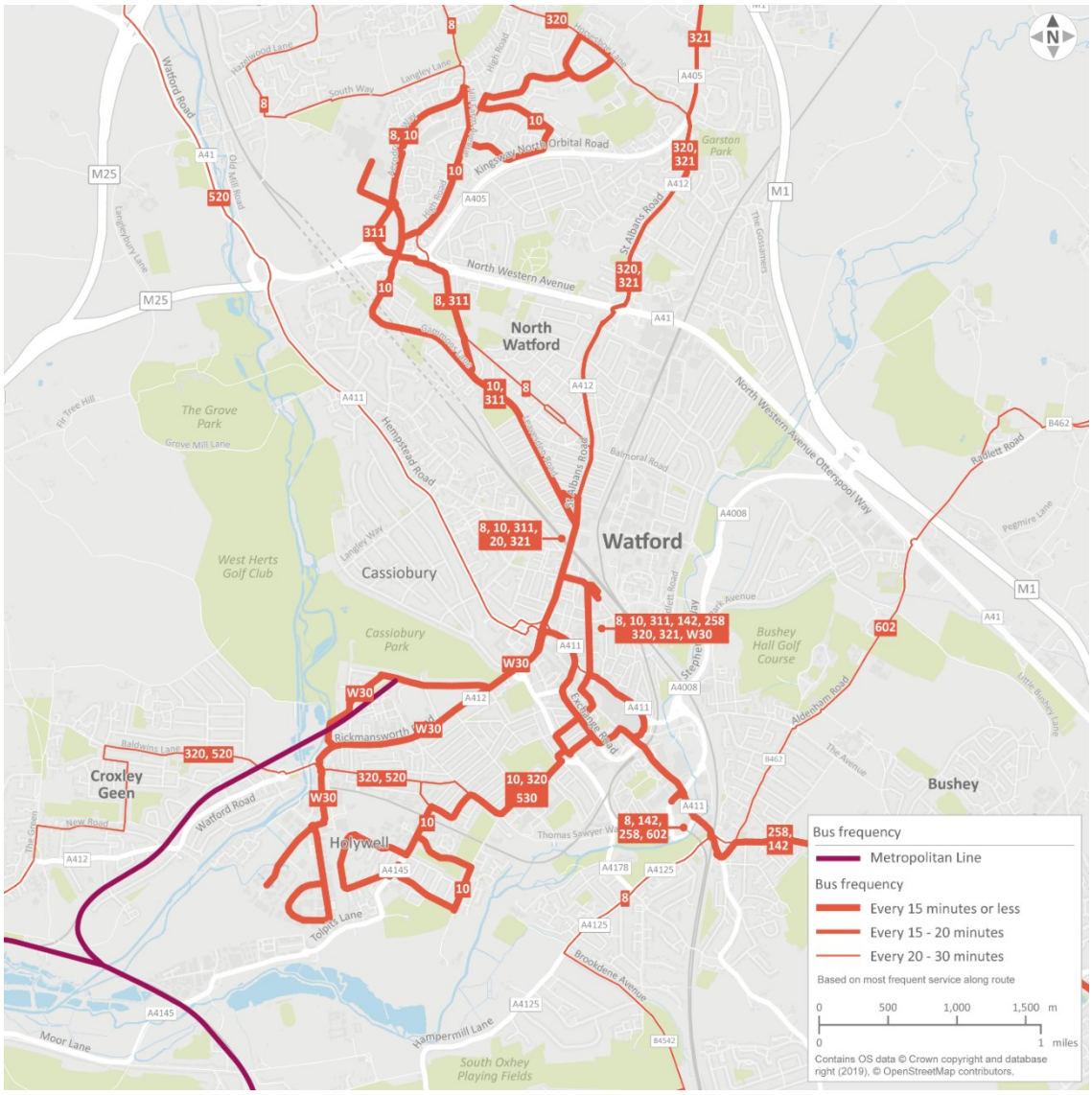
2.28 Bus services which have a frequency of at least every 30 minutes are shown in Figure 2.14 below. Bus services operate in a deregulated market, with around 95% of them operating on a commercial basis. This means that operators decide where to run their services and with which frequency and, as a consequence, change their routes to attract passengers. HCC contracted services only account for the remaining 5% and are significantly constrained by funding availability. HCC is working with operators to introduce an Enhanced Partnership to make routes more attractive, therefore increasing patronage which should lead to operators being able to invest and improve these routes.

2.29 HCC's influence over the bus network is through dialogue with operators through the Intalink Partnership. An Enhanced Partnership arrangement with operators would provide greater powers in relation to reliability, punctuality and vehicle standards as well as taking on some of the powers of the Traffic Commissioner in relation to registration of routes and enforcement. We are one of the few authorities to be doing this.

2.30 These are the main bus routes in the scope area:

- W30 is primarily a commuter route, linking the business parks to the town centre and rail station.
- Routes 320, 520 and 10 serve the hospital, football stadium and High Street. Routes 320 and 520 call at bus stops in Whippendell, Rd which would be within 400m of some of the business park area. Route 10 serves the Holywell estate and is within 400m of some of the southern part of Watford business park.
- The main corridor northwest of Watford is Hempstead Road, with route 319, and routes W18 and W20 east of Watford. These no longer operate commercially due to declining demand.
- Route 10 connects the town centre and Holywell Estate, with a high service frequency. The operator has been approached about an extension in the past but this is not feasible with the current timetable.
- The issue of lack of connectivity from Tolpits Lane/Wolsey Business Park has been identified as part of the GTP. However, any new bus route from Moor Park would require additional funding.

Figure 2.14: Bus network within Watford



Source: Steer

Road network

2.31 Watford's road network includes two intersecting motorways (M1 and M25), a number of A roads and a densely developed network of more minor roads with connections to North London. The major East-West routes include the A412 (from Rickmansworth to Watford) and the A411 (to Bushey). The major North-South routes include the A4008/M1 (for Hemel Hempstead and the North), A411/A41 (for Hemel Hempstead and Aylesbury), and A412/A405 (for St Albans).

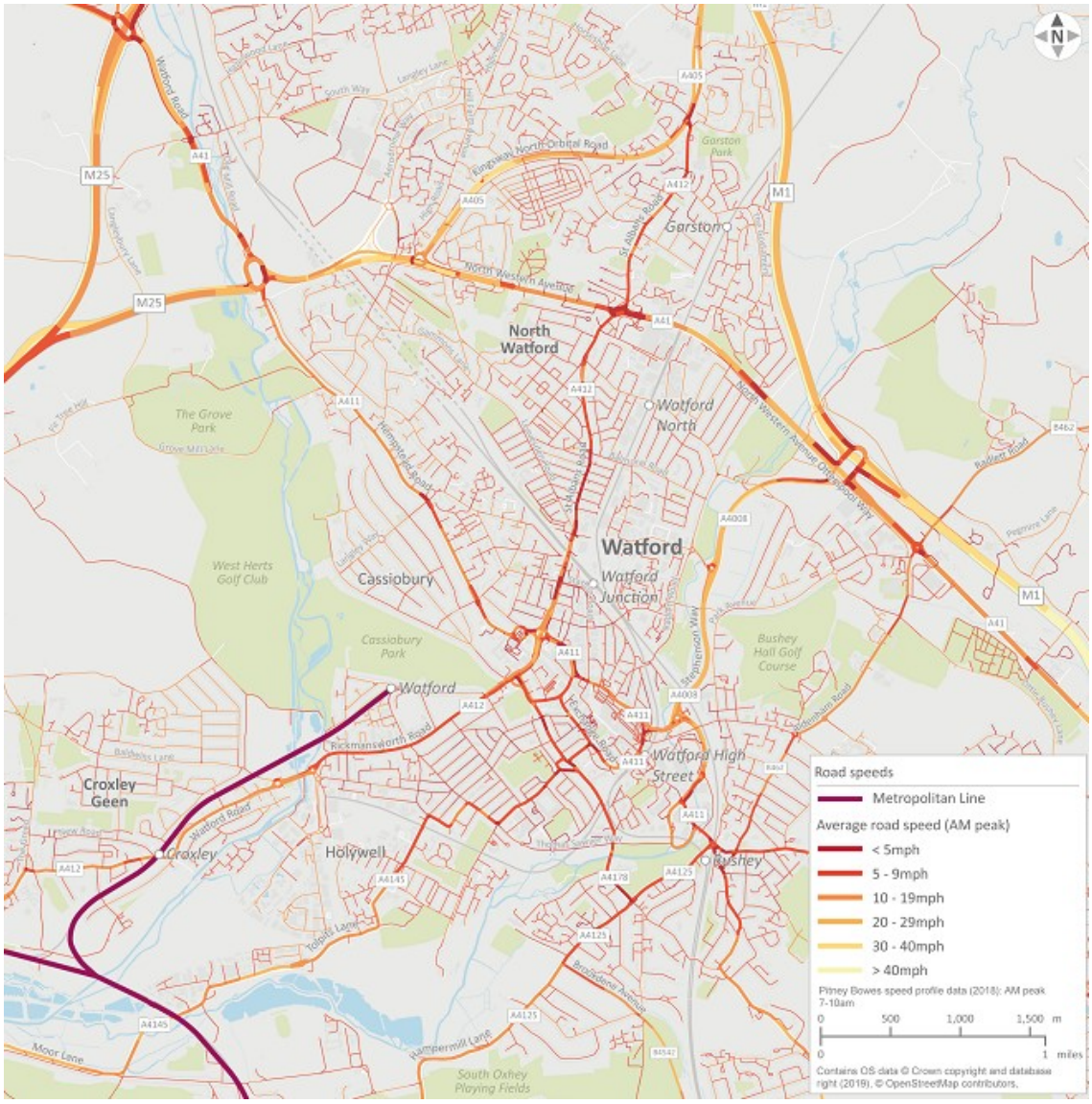
2.32 Analysis of average road speeds in Watford is shown in Figure 2.15. There are high levels of congestion throughout Watford. Strategic routes that connect Watford to the wider 'continuous metropolitan area' are highly congested. The M25 and M1, which connect Watford to boroughs such as Three Rivers and Dacorum, experience particularly slow average road speeds. This is in line with the high level of cross-boundary commuting that takes place by car between Watford and boroughs to the North-West.

2.33 Important roads within Watford are also highly congested, such as the A411 ring road, which contains larges sections with average speeds of below 10 miles per hour (in the AM peak).

2.34 Road connectivity is particularly poor along the Watford to Croxley corridor, where there are fewer Major Road Network (MRN) routes and congestion on the A-roads. This congestion is exacerbated by the lack of direct access to the Watford and Croxley Business Parks. Most cars use the circular route (A412 and A4145) to access the high concentration of industrial jobs at the Business Park, increasing the flow and congestion on these roads. This issue is likely to intensify with an increase in the number of new developments planned for the west of Watford (such as in the Watford Western Gateway).

2.35 Road congestion also affects bus journey times and reliability. Speeds are slow along Vicarage Road, the ring road and Clarendon Road, which together comprise the main bus routing between Ascot Road and Watford Junction.

Figure 2.15: Congestion levels in the AM Peak



Source: Steer, TrafficMaster Data

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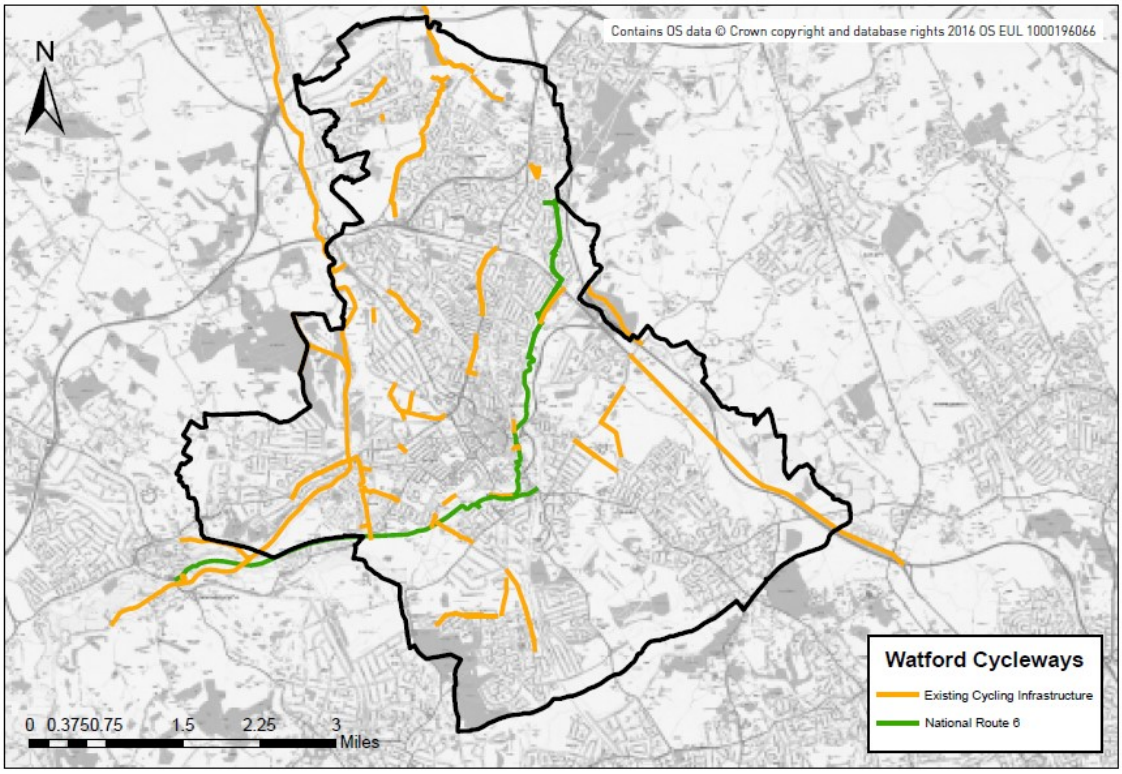
Cycleways

2.36 Figure 2.16 below shows some of the existing cycling infrastructure in the Watford area. There is some cycling provision throughout Watford including the National Route 6, which passes through Watford and connects to Uxbridge in the south and Sheffield in the far north. However, there is a lack of cycle friendly routes connecting the east and west of Watford.

Figure 2.16: Cycleway provision in the Watford area



Source: Watford Area Evidence Pack

Current Transport Challenges and Constraints

2.37 The evidence presented in this section points to a number of transport challenges and constraints across the areas as a whole and more specific issues in the broad east-west corridor between Croxley and Watford. These have been summarised in Table 2.6 below.

2.38 These challenges and constraints reflect those identified in the South West Hertfordshire Growth and Transport Plan Prospectus (June 2018) and Hertfordshire LTP4 (May 2018).

Table 2.6 Key Challenged and Issues

Key Challenges	Issues (area-wide)	Issues (east-west corridor)
• High levels of cross-boundary commuting and complicated movement patterns due to the high number of medium-sized towns. • Limited accessibility for non-car modes • Poor east-west connections – car and public transport	• Complex patterns of demand • Lack of viable public transport options; for many journeys car is the dominant mode for the majority of movements • Congestion, unreliability and poor network resilience on parts of the strategic road network • Highway network constraints also affect the • attractiveness of urban and inter-urban bus options • Rail service and station crowding at Watford Junction	• Corridor is the main focus of employment and employment trips within the borough • More limited highway route options • High levels of congestion on key radials of Vicarage Road and Rickmansworth Road, affecting both highway and bus • Bus operated in a deregulated market and decide routes and frequencies. HCC is working with operators on an Enhanced Partnership to make routes more attractive. • Variable coverage of bus network, and circuitous routing of some services • Poor rail-based accessibility, as Metropolitan Line runs to the north of the corridor, Overground serves Watford High Street and Watford Junction, but no through connectivity.

2.39 These issues would, in the absence of interventions, become exacerbated as further growth across the wider area, and employment growth targeted towards the Croxley – Watford Junction corridor, will increase demand and further compromise network performance.

West and Central Watford Challenges, Constraints and Opportunities

2.40 We have identified the following key constraints and opportunities relating to Watford's infrastructure:

Ring Road (A411)

2.41 The ring road serves as a one-way system circling around Watford town centre, with grade separation used on three occasions to separate the traffic from pedestrians and cyclists. There are high levels of congestion on the ring road, with a number of bus services using the route.

2.42 As part of Package 7 of the South West Hertfordshire GTP, significant improvements to the Ring Road are proposed. This includes multi-modal movement, access and permeability improvements as well as enhancements to improve cycle and pedestrian facilities and the introduction of a 20mph speed limit on sections adjacent to gateway junctions. The truncation of the Ring Road has been previously put forward as an idea but is no longer included in the GTP.

2.43 There are numerous car park entrances positioned on the outside lane and road space is shared with buses, as shown in Figure 2.17 below. This has been identified as a constraint to the option of converting the road into a two-way system.

Figure 2.17: Watford's Ring Road (A411)

Source: Google Maps

2.44 Vehicles use the ring road to travel from one side of town to the other, with limited alternatives – the A41 is on the eastern side of town and the A4178 skirts the western edge of the town centre and is partly subject to a one-way system. This leads to high levels of congestion and barriers for sustainable modes of transport to travel between the town centre and the rest of Watford.

2.45 The bridge on Exchange Road that cuts over the High Street also decreases the ambience of the town centre. Package 7 of the South West Hertfordshire GTP includes the development of a new bus- and cycle-only link bridge at Exchange Road.

Rickmansworth Road (A412)

2.46 Rickmansworth Road runs along the north-west of the ring road and includes a grade-separated bridge across Watford's High Street. The limited severance of the ring road is exacerbated here, due to the lack of pedestrian and cyclist crossings from areas such as Cassiobury.

2.47 Congestion and a lack of resilience is also an issue; when roadworks took place on the road earlier this year, traffic became gridlocked from the roundabout near Watford Library at the top end of the Parade. The congestion had a knock-on effect throughout Watford, creating delays coming off the ring road past and in the other direction, queues stretching back to Croxley Green.

2.48 The W30 bus route runs down Rickmansworth Road, connecting Holywell in the west to Watford town centre via a circular route. The high number of car journeys made along Rickmansworth Road impacts bus journey times between the west and the town centre of Watford.

Clarendon Road

2.49 Clarendon Road provides a route to Watford Junction station, which serves over 8.1 million passengers per year and is the busiest rail station in Hertfordshire. The road is also a key bus corridor for wider Watford, serving eight different bus routes with frequencies between every 15 to 30 minutes.

2.50 Clarendon Road is also home to many businesses, including large corporations such as KPMG and TJX Europe. There are plans to intensify employment space along the road, with Watford Borough Council granting permission for a 11-storey building of new office space in February 2019.

2.51 However, the road is narrow with one lane per direction, a lot of on-street parking and a 20mph speed limit (as shown in Figure 2.18 below). This limits, but not fully precludes, the potential to use the road for alternative public transport provision, such as segregated busways.

Figure 2.18: Clarendon Road

Source: Google Maps

2.52 Clarendon Road is currently undergoing a major transformation project that provides the opportunity to improve these constraints. The project will significantly improve the Beechen Grove junction and surrounding area for pedestrians and cyclists as well as the overall look of one of the town's most well-used thoroughfares.

2.53 The scheme means that the road will remain one lane per direction, but with reduced width (6.2m). This is the minimum width that enables buses to operate – as Clarendon Road is a key bus corridor, any further plans should consider this when taking into account efficient bus operation.

Croxley rail link

2.54 The original Metropolitan Line Extension (MLX) would have included the use of the former Croxley Branch Line, which is currently owned by Network Rail under the London and North Western Railway Act 1907. The MLX would have involved the construction of a viaduct over the Grand Union Canal, River Gade and A412 road. The need to build a viaduct to connect the line to the proposed Cassiobridge and Watford Vicarage Road stations is a constraint, as it was a key

cause of the scheme's unaffordability, as well as the signalling costs associated with the compatibility between the underground and rail systems.

2.55 There is an opportunity to include the disused alignment in alternative options, which will be considered in this study.

Vicarage Road corridor

2.56 Vicarage Road is a key bus corridor, serving three different bus routes that have a frequency of 30 minutes or less. The corridor provides connectivity between Watford town centre and the west of Watford, including key locations such as Vicarage Road Stadium, Watford General Hospital and future development sites such as Western Gateway.

2.57 As shown in Figure 2.19, Vicarage road is narrow with one lane per direction and sharp turns. Many sections of the road are also shared with on-street parking, further creating the potential for road conflict and congestion.

Figure 2.19: Vicarage Road

Source: Google Maps

Thomas Sawyer Way

2.58 Thomas Sawyer Way opened in November 2016 as the main access road in and out of Watford General Hospital, with the previous access route via Vicarage Road now for dropping off and disabled parking only. The new route created an opportunity to speed up journey times for emergency vehicle and improve the flow of traffic on the roads surrounding the hospital. Part of the road is only for the use of ambulances and buses.

3 Planned Growth

3.1 As part of assessing Watford's transport needs, we have carried out a desktop assessment of local and regional planning policy, to understand the geography of future housing and employment growth. This has been mapped graphically to better understand how future growth maps to the regions' transport infrastructure and key constraints.

3.2 This exercise has focused on the Watford 'continuous urban area' (as defined in Chapter 2), and the specific development opportunities at Ascot Road, Watford Riverwell, Watford Junction and the Croxley and Watford Business Parks. We have also considered, at a more outline level, growth within the wider region that could impact on travel demand in Watford.

3.3 The following sources have been used to carry out this assessment:

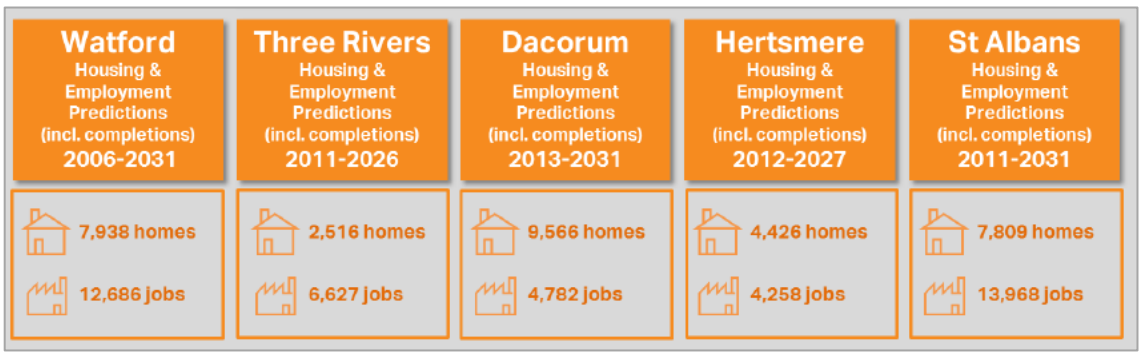
- Watford's Local Plan (Adopted 30 January 2013)
- Watford Area Evidence Pack
- South West Hertfordshire Growth and Transport Plan Prospectus (GTPP) (June 2018)
- New Watford Local Plan Consultation (September-October 2018)

3.4 A new local plan is currently under development covering the 2018-2036 period and, whilst the number and locations of the proposed developments are subject to change with respect to the 2013 Local Plan, these are not anticipated to materially impact the conclusions of this study.

Overall Regional Growth

3.5 The South West Hertfordshire Growth and Transport Plan summarises housing and employment predictions across the region, based on adopted Local Plans. It is estimated that over 32,000 new homes will be built and over 42,000 new jobs could be created by 2031. A breakdown by district is provided in Figure 3.1 below.

Figure 3.1: South West Hertfordshire Growth Predictions



Source: South West Hertfordshire Growth and Transport Plan Prospectus (June 2018)

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Watford Growth

3.6 The Watford Area Evidence Pack reports that Watford's employment growth rate (16%) will be double that of the UK overall (8%) between 2016 and 2031. Watford's adopted Local Plan outlines plans for a *minimum* number of 6,500 new homes (compared to the predicted 7,938 above) between 2006 and 2031, to provide for this increasing population. This is an average of 260 per year, with nearly 2,500 of these having been built by 2012. As a minimum 7,000 additional jobs are also planned, to accompany the population growth and to maintain Watford's role as a regional centre.

Development Requirements

3.7 South West Hertfordshire area Local Authorities are expecting substantially higher housing targets for the next set of Local Plans, following changes proposed by the government around housing needs calculated using a standard methodology for the whole country. The government's revised National Planning Policy Framework[3] released in July 2018 indicates that about 770 new homes per year will be needed in Watford, which is regarded as a minimum. This is an increase of 510 per year from the adopted Local Plan. The New Watford Local Plan Consultation reports that this is a considerable challenge with the amount of available land within the town, highlighting the need to explore the different ways new housing can be delivered in the borough.

3.8 In 2018 the local planning authorities of Dacorum Borough Council, Three Rivers District Council, St Albans City and District Council, Hertsmere Borough Council and Watford Borough Council commenced work on a Joint Strategic Plan for the South West Hertfordshire area. This plan will identify longer term strategic growth requirements for the whole area and will help to inform each authority's next Local Plan.

Location of Key Planned Developments - Special Policy Areas (SPAs)

3.9 Watford's adopted Local Plan identifies Special Policy Areas (SPAs), for which more location specific policies are useful. The location of the SPAs is shown in **Appendix E**. This map also shows Greenbelt areas in Watford, where development is prohibited.

3.10 Most additional development and employment will be focused on the SPA locations which have good access to public transport and local facilities and are most able to accommodate development without serious harm to character or amenity. These locations and their corresponding developments[4] are:

- **Town Centre SPA:** The town centre is the focus for shopping, leisure and cultural activities, with office uses focused along Clarendon Road. Some residential use is also appropriate. The council expects around half of all additional jobs to be provided within the wider town centre (in the order of 3,300 to 4,200 jobs).
- **Watford Junction SPA:** a mixed-use scheme that when complete, will create 75,000 sqm of commercial space, 6,000 sqm of retail, just under 3,000 dwellings, two primary schools and

[3] Source: **National Planning Policy Framework**, (Ministry of Housing, Communities & Local Government, July 2018).

[4] As the current Local Plan was adopted in 2013, most of the identified homes and jobs identified above have already or in the process of being developed.

a range of community uses. The council expects this SPA to provide in the order of 1,350 to 2,350 jobs.

- **Health Campus SPA:** a mixed-use scheme including a new hospital, at least 500 new homes, employment space, local shops and a primary school, on a site including the current Watford General Hospital. The council expects the Health Campus to provide in the order of 1,000 to 1,900 new jobs.
- **Western Gateway SPA:** an area focused on Watford Business Park, an underperforming employment area in need of upgrading. Additional employment will be provided, with a wider mix of uses including a supermarket, a primary school and 300 homes. The council expects this SPA to provide in the order of 700 to 2,000 additional jobs in the business park with an additional 150 retail jobs at Ascot Road.

3.11 The adopted Local Plan states that higher density homes will be delivered in the town centre, at the Watford Junction and Health Campus SPAs. In the rest of the borough, the focus will be on low to medium density residential development. There are also the following SPAs, which Watford's Adopted Plan reports are not necessarily suitable for significant development:

- **Lower High Street SPA:** An existing retail and mixed-used area in need of physical and environmental improvements suitable for a variety of land uses.
- **Dome Roundabout SPA:** An existing out-of-town retail area in need of physical and environmental improvements and diversification of land uses, which could include some residential use.

Status of Developments

3.12 Since the adoption of Watford's Local Plan in 2013, progress has been made in these SPAs with significant developments either underway or confirmed. The South West Hertfordshire GTPP reports on the location of key development sites. Those which have progressed are shown in Figure 3.3, with the detail of each scheme provided below.

Watford Western Gateway (comprising Watford & Croxley Business Parks)

3.13 There is a masterplan for the Western Gateway area which will support the delivery of approximately 1,000 new homes along with retail and employment opportunities. Two housing schemes, Ascot Road and adjacent to Tolpits Lane, have already been granted planning permission which will deliver over 500 new homes across the two sites.

3.14 The area includes the Watford and Croxley Business Parks. £13 million has been earmarked for the redevelopment of Watford Business Park, with a significant portion of the 26-hectare site having been bought by the council already (five out of six leaseholds). The first phase of the scheme is planned for construction in 2020 and will see improvements to buildings, a new entrance to manage traffic and increased employment capacity which could create 1,500 jobs.

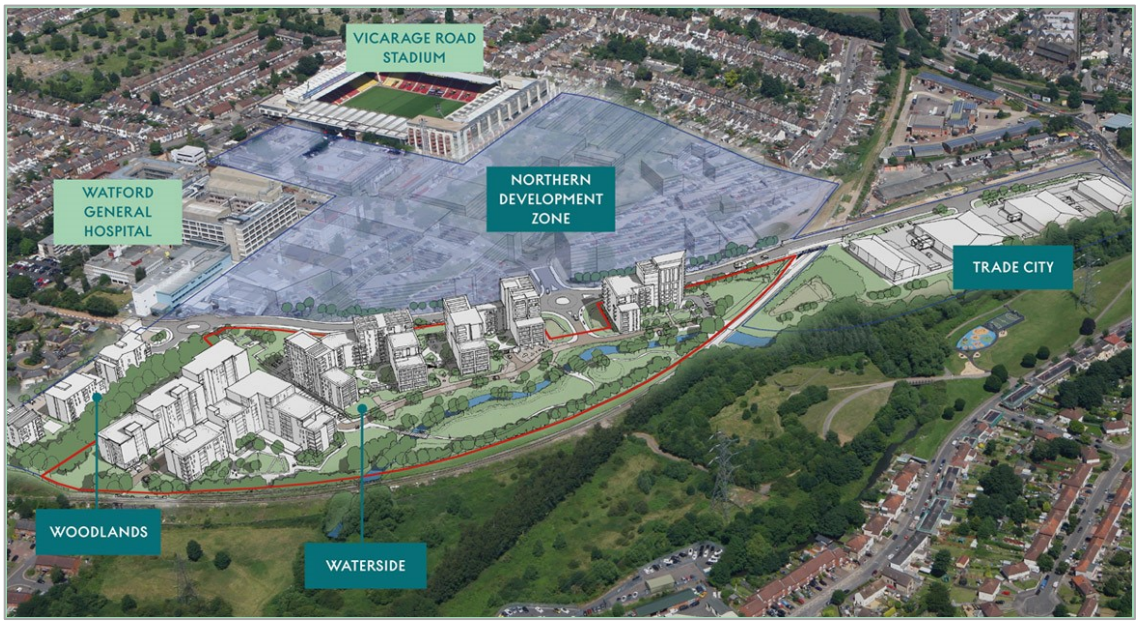
3.15 Watford Borough Council acquired the leasehold for Croxley Business Park in January 2019. There is a significant development programme underway, including community amenities (such as an event space) which are due for completion in 2019. 'Building 1' is due for completion in 2020 and will provide 85,000 sq. ft of office space. 'The Campus' has been granted outline planning permission, and will include four new office buildings offering 350,000 sq. ft of office space.

Watford Riverwell (formerly known as Watford Health Campus)

3.16 Watford Riverwell is transforming 58 hectares of former industrial land to the south of Watford General Hospital and Watford Football Club into a thriving new community (as shown in Figure 3.2). The improvement of the acute health facilities of Watford Hospital is a key development objective. There will be a mix of education, leisure and retail uses, with employment and residential uses to the south of the site.

3.17 Construction started on the first phase of Watford Riverwell at Woodlands in January 2018 and the first new homes will be completed and occupied in 2019. Full planning permission was granted by the council for Waterside in July 2018 and in 2019 further plans are expected to be brought forward for the Northern Zones.

Figure 3.2: Watford Riverwell development



Source: http://riverwell-regeneration.com/our-plans/

Watford Junction

3.18 There is a £1.6 billion regeneration masterplan to transform 19 hectares of land around Watford Junction, including improved transport links, the regeneration of unused land and new jobs and homes. When complete, the masterplan will create 75,000 sqm of commercial space, 6,000 sqm of retail, just under 3,000 dwellings, two primary schools and a range of community uses. Included in the plan is a proposal for a new passenger bridge that links the station to the Watford Junction redevelopment area.

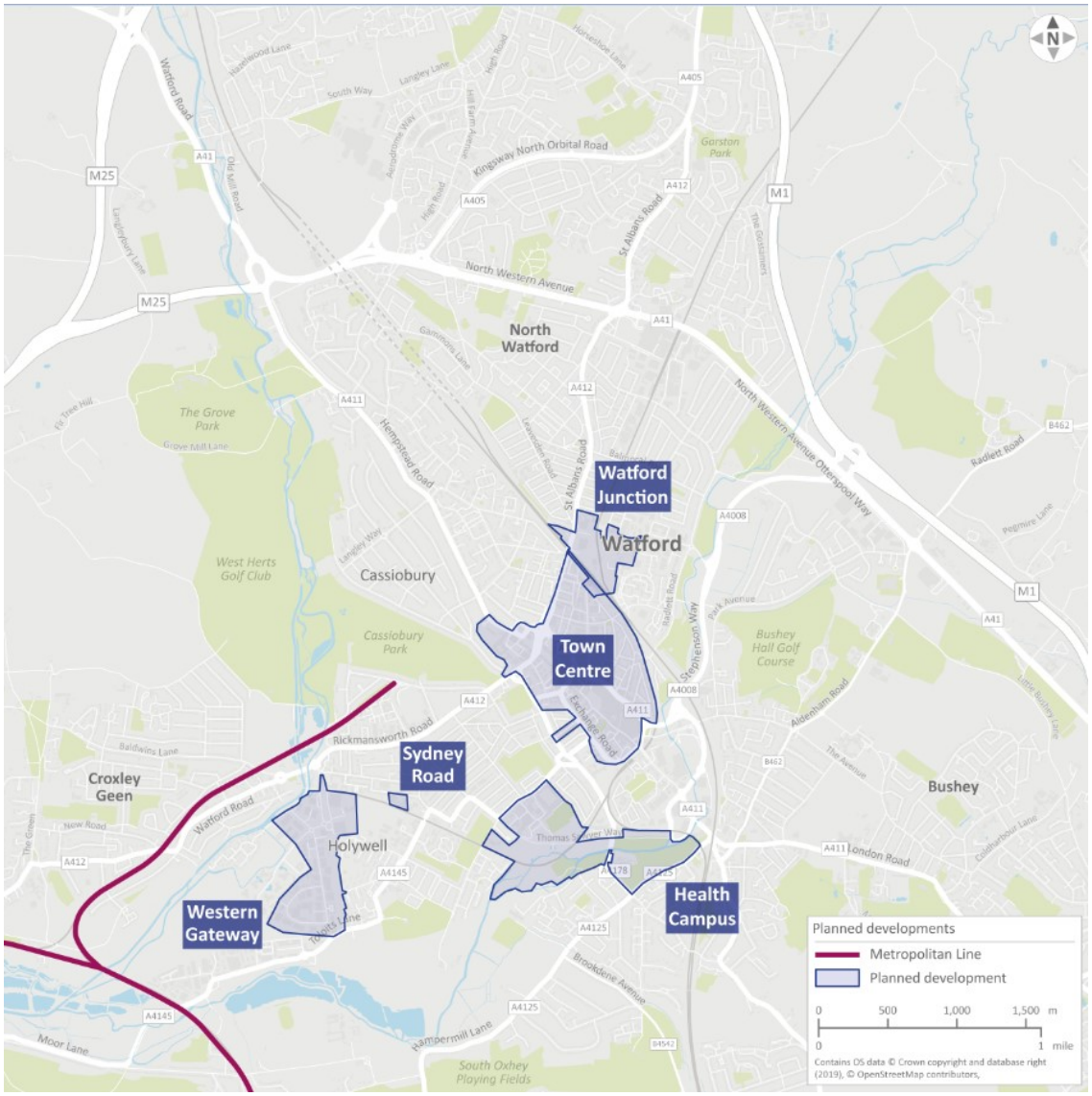
3.19 Watford Borough Council granted planning consent for the first phase of the plan on St Albans Road in July 2018. Homes England provided their support of the scheme (in principle) in December 2018.

Other key developments

3.20 Applications to redevelop Sydney Road were approved in October 2018. A £85 million scheme will convert the Watford Laundry Factory site into 227 apartments – alongside a separate Sydney Road development of 278 homes. Alongside the apartments will be a commercial facility, piazzas, 160 parking spaces, and green spaces.

3.21 The area surrounding Lower High Street has also been highlighted as a potential area for mixed-use developments in Watford Borough Council's upcoming Local Plan.

Figure 3.3: Location of key planned developments



Source: Steer

4 Future Transport Patterns

4.1 Based on the current transport patterns and planned growth identified in the adopted Local Plan (2013), we have used a qualitative approach to assess potential future transport patterns, and the extent to which the existing transport network can support future demand. We have considered the scale and location of future developments, as well as wider background changes in demand.

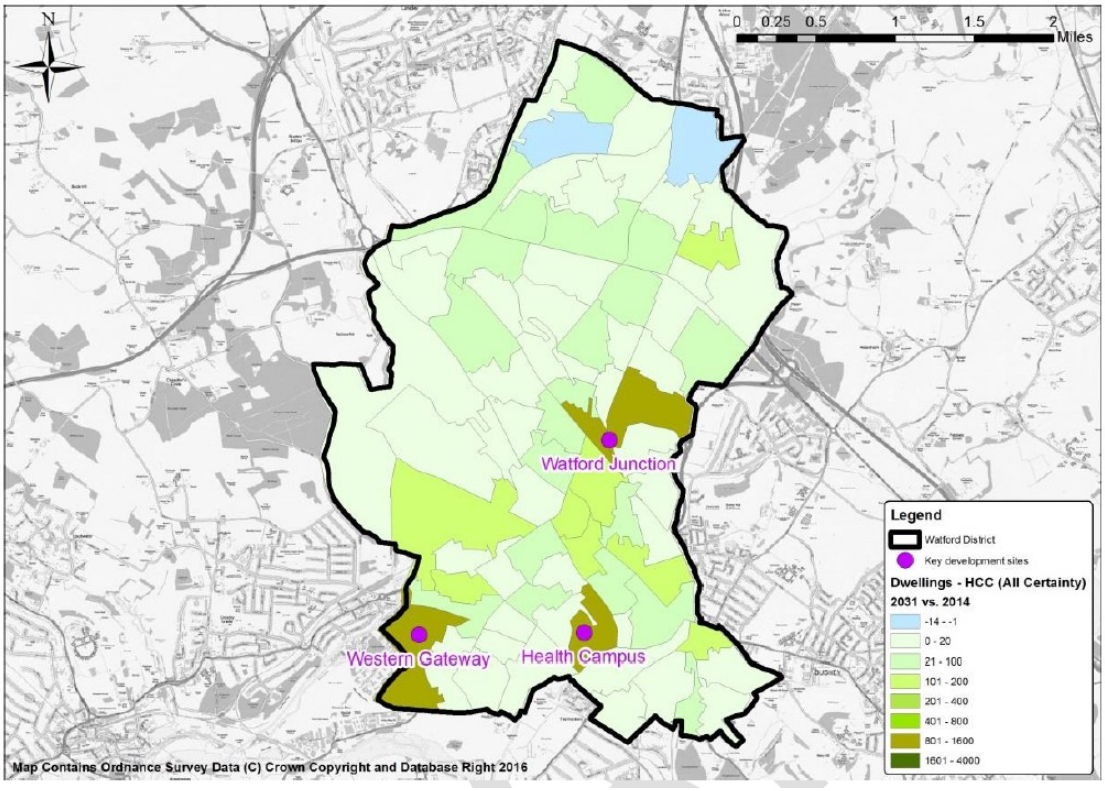
4.2 The implications of this growth on travel demand has helped us to identify future transport constraints and 'pinch points', which any transport intervention should seek to address.

Planned population and employment growth

4.3 Significant growth in housing and jobs is proposed for Watford borough, with employment up by 15% in 2031 and population rising by 16% in that time. The government has indicated that a minimum of 770 new homes per year will be needed. This growth is also expected in wider region areas such as Three Rivers, resulting in a higher number of commutes into Watford. This growth will put additional pressure of the current infrastructure, which is already experiencing high levels of demand.

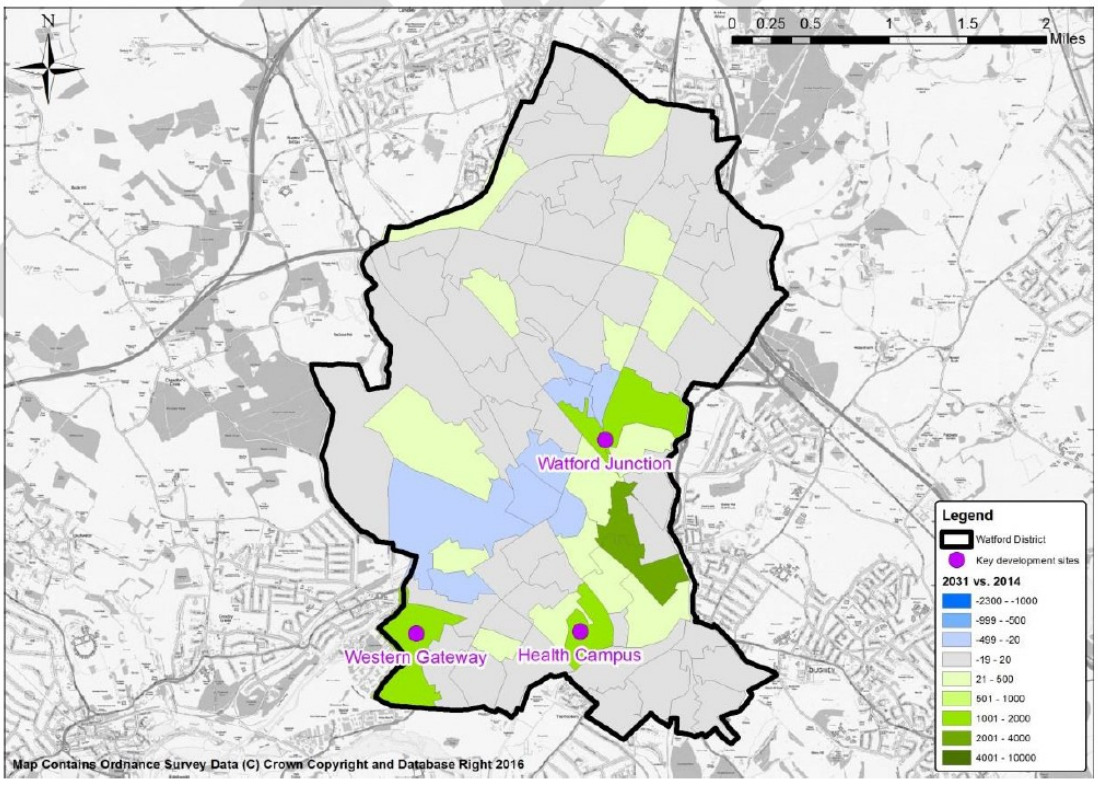
4.4 This growth has been represented in Hertfordshire County Council's countywide strategic multi-modal transport model (COMET). The model has been used to define a 2031 Watford Do-Minimum scenario (WDM). The model considers Local Plan data provided by HCC, as well as NTEM v7 data for growth outside of Hertfordshire. Based on this data, the planned change in the number of jobs and dwellings between 2014 and 2031 is shown in Figure 4.1 and Figure 4.2 below.

Figure 4.1: Change in number of dwellings (2014 vs 2031)



Source: Watford Do-Minimum 2031 Forecasting Report, AECOM (January 2017)

Figure 4.2: Change in number of jobs (2014 vs 2031)



Source: Watford Do-Minimum 2031 Forecasting Report, AECOM (January 2017)

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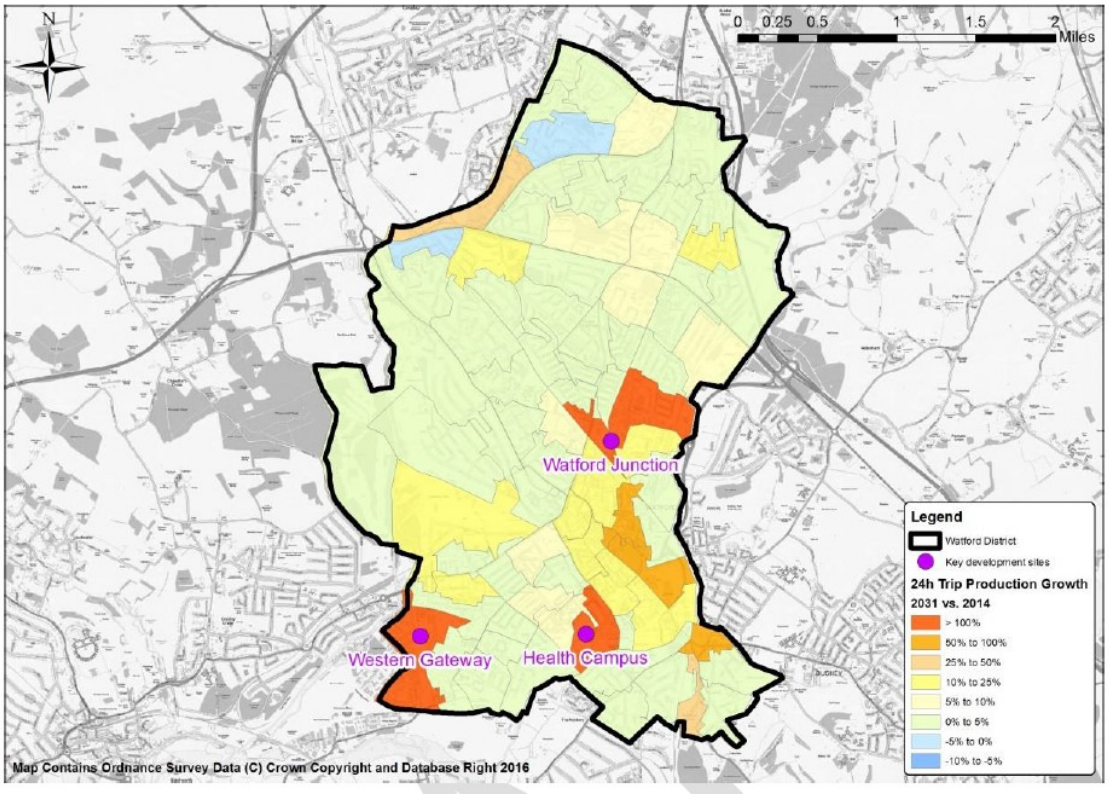
4.5 The estimated change in production trip ends as a result of this growth is shown in Figure 4.3 below.

Figure 4.3: WDM 2031 vs. Base Year 2014 change in production trip ends



Source: Watford Do-Minimum 2031 Forecasting Report, AECOM (January 2017)

4.6 The main changes in terms of planned growth and trip production are concentrated around three of the key development sites identified in Chapter 3: Watford Junction, Western Gateway and Watford Riverwell (formerly known as Watford Health Campus). Two of these are in the west of Watford, which already experiences high levels of demand with most existing journeys into Central Watford originate from the west from areas such as Holywell.

4.7 The current transport offer for these movements is limited, with no rail offer between the Overground and Metropolitan line, a relatively unattractive bus offer compared to the car and high levels of road congestion. The expected growth in production trip ends further demonstrates the need for intervention to alleviate congestion and to provide connectivity to new development sites.

Impact on network performance

4.8 The WDM 2031 model predicts that traffic flows and journey times on the roads that provide connectivity to west Watford will worsen if no intervention takes place. In a Do-Minimum scenario, the planned developments will worsen network performance, with AM inbound (to Watford) peak journey times forecast to double (as shown in Figure 4.4).

Figure 4.4: Traffic flows (WDM 2031, PCUs) and journey time differences (2031 vs 2014, mm:ss), A412 Rickmansworth road

Source: Watford Do-Minimum 2031 Forecasting Report, AECOM (January 2017)

Impact on bus services

4.9 This growth will also put pressure on the existing bus network. There are currently services between the centre and west of Watford, running down Vicarage Road and into Holywell, but are relatively unattractive compared to the car. Additionally, a large majority of the bus services within Watford are run on narrow streets with one lane per direction and high levels of on-street parking, such as along the Vicarage Road corridor.

4.10 Increased congestion along the corridors where these services operate would make them less attractive and therefore exacerbate the current disincentive to a mode shift to public transport (which is reflected by the fact that only 6% of commutes within Watford are by bus).

4.11 HCC is in the process of developing an Enhanced Partnership arrangement with operators which will provide greater powers in relation to reliability, punctuality and vehicle standards as well as taking on some of the powers of the Traffic Commissioner in relation to registration of routes and enforcement.

Future transport priorities

4.12 As well as the future constraints and problems outlined above, the development of the transport objectives should consider the following transport priorities.

Encouragement of sustainable modes

4.13 A high proportion of journeys into Watford are made by car, particularly journeys originating from the North-West, such as Three Rivers and Dacorum. Car is also the predominant mode of transport for journeys within Watford, making up 49% of commuting trips.

4.14 As a result, there is a high level of congestion on the radial routes in Watford (such as the M25 and M1) and within the town centre, particularly on the Ring Road where delays can trigger congestion throughout the wider borough. The predominance of car creates severance for pedestrians, discourages cyclists and negatively impacts the public realm, such as the bridge at Exchange Road and Rickmansworth Road bridge.

4.15 This congestion can be partially alleviated through the encouragement of more sustainable modes. This point is highlighted in the Hertfordshire Local Transport Plan 4 (LTP4) which reports that addressing future travel demand will require significantly strong support for walking, cycling, passenger transport, and traffic demand management measures where appropriate.

Rail connectivity

4.16 There is a high demand for journeys into Watford Junction, with over four million annual passengers per year (over half) originating from London Terminals. The Hertfordshire LTP4 highlights that rail travel between the region and London will continue to grow in the future so sufficient capacity and service levels are essential. Increasing service levels and connectivity to other destinations is also important, as well as enabling rail to serve local interurban travel needs better.

5 Transport Policy and Area-wide Interventions

5.1 We have summarised the key themes across local and regional transport and planning policy, to understand the key enablers and barriers to the delivery of a scheme. We have also considered the existing and proposed transport schemes, to understand the extent to which they can address the transport priorities and constraints identified in the tasks above.

5.2 The following sources have been used to carry out the assessment:

- Hertfordshire Local Transport Plan 4 (LTP4) (May 2018)
- Hertfordshire COMET: Pattern of Travel across Hertfordshire, AECOM (September 2015)
- Draft A414 Corridor Strategy, Annex 15: Mass Rapid Transit – Vision and Options (December 2018)
- South West Hertfordshire Growth and Transport Plan Prospectus (GTP) (June 2018)

Area-wide policies

5.3 The Hertfordshire LTP4 outlines the following policies:

- **Transport User Hierarchy**: Support the creation of built environments that encourage greater and safer use of sustainable transport modes.
- **Influencing land use planning:** Encourage the location of new development in areas served by, or with the potential to be served by, high quality passenger transport facilities so they can form a real alternative to the car, and where key services can be accessed by walking and cycling.
- **Travel plans and behaviour change:** Encourage the widespread adoption of travel plans. The application of personalised travel planning techniques, marketing and other behavioural change initiatives will be considered when delivering physical transport improvements to maximise the potential to achieve modal shift.
- **Demand management:** Consider greater traffic demand management to be essential in the county's urban areas in the next five years to achieve modal shift and improve sustainable travel provision. This can only currently be achieved efficiently and effectively through parking restriction and charging applied to on-street, off-street and potentially at workplace parking.
- **Development management:** Work with development promoters and the district and borough councils to ensure that new developments adequately consider transport needs.
- **Accessibility:** The county council will seek to increase the ease with which people, particularly disadvantaged groups, can access key services.

5.4 AECOM developed a report based on the development of the COMET model, using the various data sources used to inform the model to provide an understanding on the current travel patterns across Hertfordshire. This work has highlighted some key issues for which the following policies are highlighted for consideration:

- The **location of both residential and employment sites** must consider the level of accessibility by public transport.
- Need to review the availability of **parking in town centres and at employment sites**. This could include investigating the potential of implementing a workplace parking levy.
- **Collaborate with neighbouring authorities** identified as having significant travel interactions with Hertfordshire to identify mutually beneficial options for accommodating these trips.
- Potential to review whether there is **un-tapped demand along Hertfordshire's rail corridors** for trips not going into London. This may be due to over-crowding or even high fare prices for non-London trips
- Opportunity to **implement new bus services** where demand is high but current public transport provision is limited.

5.5 In addition, it is recommended that options to develop an **integrated rapid transit system** providing good inter-urban and intra-urban connectivity are investigated. This could include expanding rail corridors or exploring potential tram, train or bus rapid transit options to better serve town centres and employment sites.

Summary of area-wide policies

5.6 The following themes are common across the area-wide polices:

- Modal shift away from car
- Use of sustainable modes
- Supporting developments

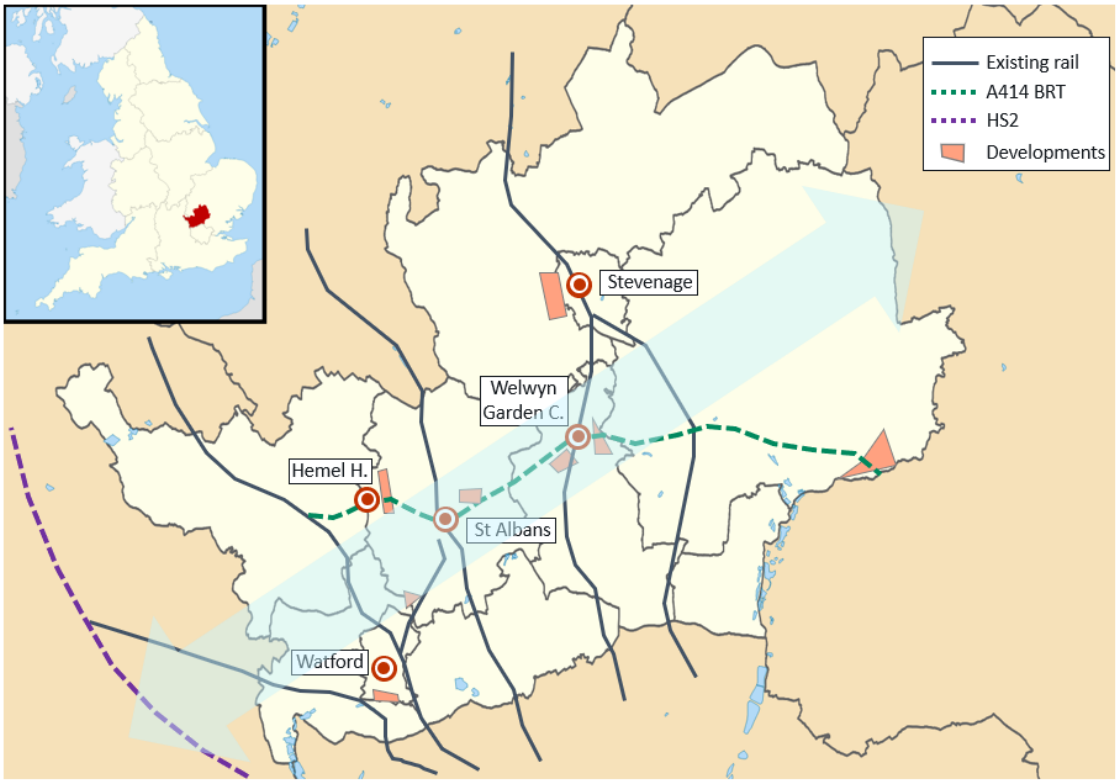
5.7 We have considered the importance of these themes when establishing the project objectives (Chapter 6) and during the generation of the scheme options.

Area-wide interventions

5.8 The major planned and proposed transport interventions of relevance to the study area are shown in Figure 5.1 below. These include:

- **A414 Mass Rapid Transit (MRT) System**: A passenger transport link offering greater speeds and reliability than traditional bus services, linking Hemel Hempstead Rail Station in the west to Welwyn Garden City in the east, with potential future extensions to Hertford and Harlow. A bus-based MRT is considered to be the most suitable option. The exact route alignment needs to be examined in more detail as part of a feasibility study.
- **HS2**: A high-speed railway under construction which, when completed, will directly connect London, Birmingham, the East Midlands, Leeds and Manchester. The connection between London and Birmingham is set to open in 2026. Though HS2 would not serve Watford it is expected that the freeing up of capacity on the WCML would support an increase in service levels between Watford and London. Hertfordshire County Council have set out their aspirations for West Coast Main Line rail services in Hertfordshire following the opening in HS2, including improved intercity services (particularly to Manchester and Liverpool), capacity increases on local services and the extension of West London line services to Gatwick Airport.

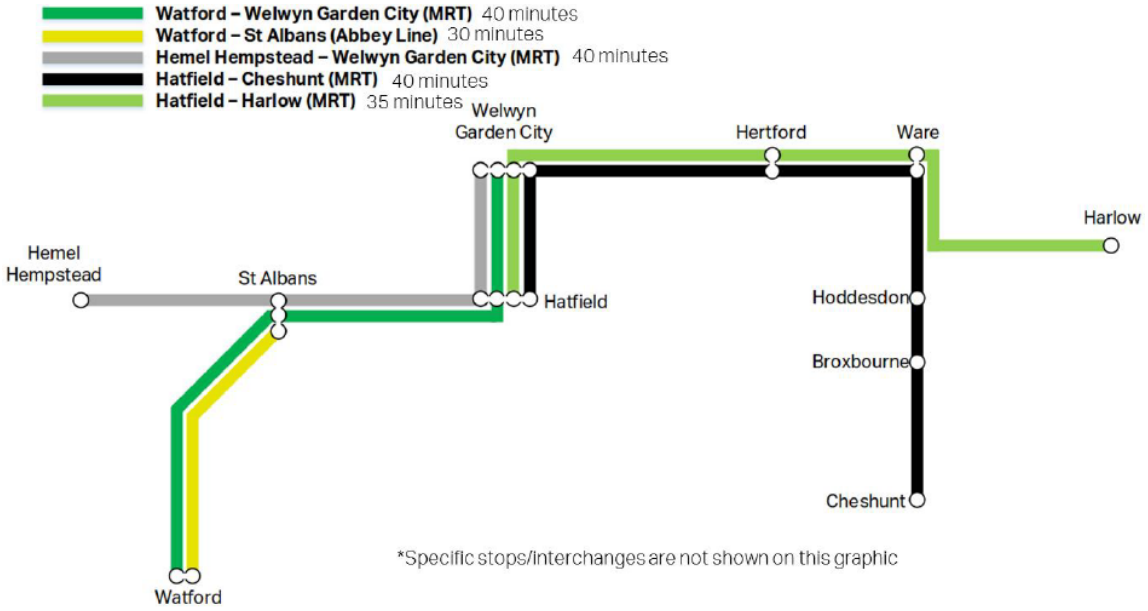
Figure 5.1: Current and planned transport and housing offer in Hertfordshire



Source: Steer

5.9 The Draft A414 Strategy sets out the high-level vision and potential options for an MRT system across Hertfordshire. The proposed route alignment includes a connection between Watford and St Albans, with the potential service configuration shown in Figure 5.2 below.

Figure 5.2: Potential service configuration of the A414 MRT system



Source: Draft A414 Corridor Strategy, Annex 15: Mass Rapid Transit – Vision and Options (December 2018)

5.10 The position of HCC is that it supports the continued use of the Abbey Line as a heavy rail operation, whilst seeking improvements that would increase service frequencies. HCC would consider longer-term options if these were to enhance connectivity for the line.

Watford interventions

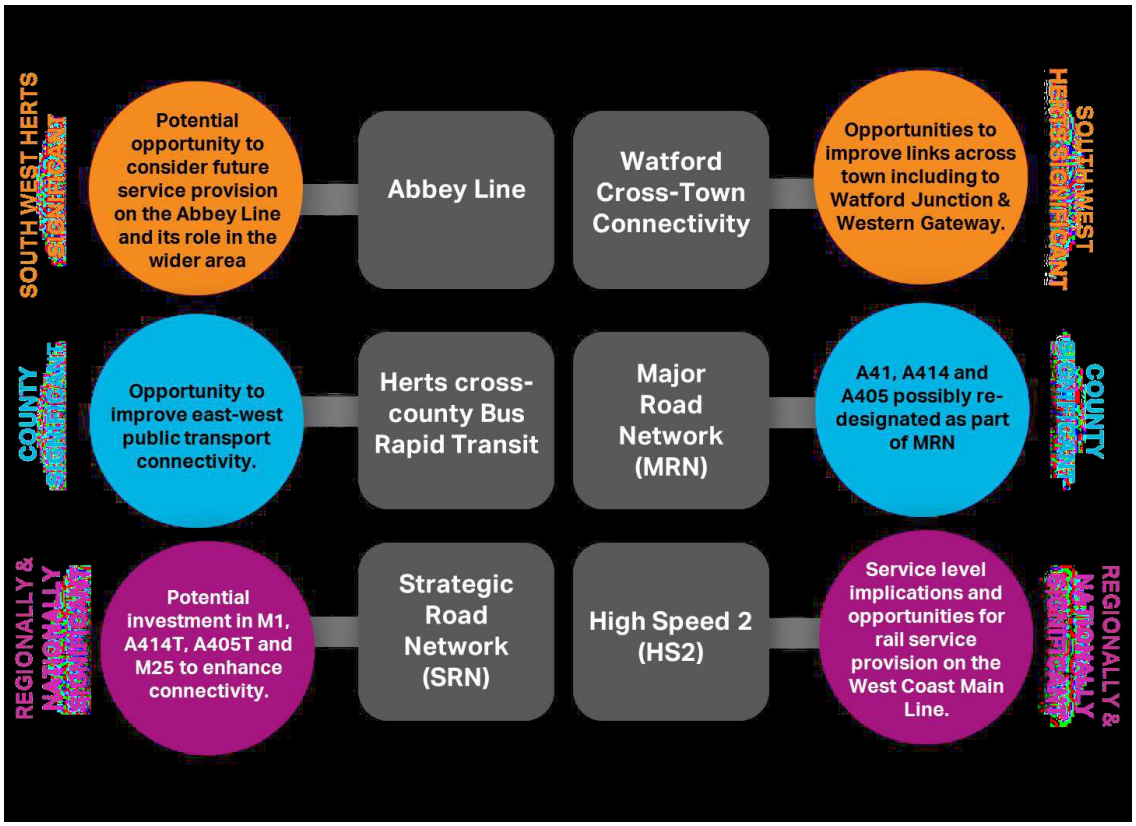
5.11 There are also existing and proposed transport schemes within Watford, including:

- **Clarendon Road**: Clarendon Road is currently undergoing a major transformation project that will significantly improve the Beechen Grove junction and surrounding area for pedestrians and cyclists as well as the overall look of one of the town's most well-used thoroughfares.
- **Watford Ring Road**: As part of Package 7 of the South West Hertfordshire GTP, significant improvements to the Ring Road are proposed. This includes multi-modal movement, access and permeability improvements as well as enhancements to improve cycle and pedestrian facilities, the introduction of a 20mph speed limit on sections adjacent to gateway junctions and the development of a new bus- and cycle-only link bridge at Colonial Way. The truncation of the Ring Road has been previously put forward as an idea but is no longer included in the GTP.
- **Watford Cross-Town Connectivity:** The South West Hertfordshire Prospectus identifies that non-car connectivity across Watford is a priority and further work will be undertaken to understand how to achieve this. One objective will be to provide a viable alternative to private car-based travel on the congested A412 route and provide improved connections into Watford Junction, the Western Gateway and Riverwell.

South West Hertfordshire Growth and Transport Plan Prospectus

5.12 The South West Hertfordshire Growth and Transport Plan Prospectus also sets out proposed package interventions. The prospectus identifies larger, strategic interventions with Hertfordshire-wide or national significance which could have a bearing on the proposals put forward in the GTPP. A summary of these interventions is shown in Figure 5.3 below.

Figure 5.3: Strategic interventions and corridors in Hertfordshire



Source: South West Hertfordshire Growth and Transport Plan Prospectus

Watford Western Gateway Package 5

5.13 The proposed package of measures consists of:

- A new southern access into the Watford Western Gateway business parks area for cyclists and buses only, and enhancements of the Ebury Way for walking and cycling.
- Making use of the disused railway alignment in West Watford to enable sustainable and mass transit transport opportunities, informed by a study of options
- The introduction of a new bus- and cycle-only link across the River Colne linking South Oxhey and the Business Parks area.
- Enhanced cycleways and facilities linking the Western Gateway area to Watford Junction.

Watford Central Package

5.14 The proposed package of measures consists of:

- Significant public realm enhancements and improvements to movement and permeability for sustainable modes on Watford Ring Road.
- Improved walking and cycling environment on routes to Watford Junction Station and a new foot, cycle and bus link bridge at Colonial Way.
- The introduction of slips at M1 Junction 4 to allow all movements between the M1 and A41, alongside a Park and Ride facility at M1 Junction 5.

Summary of interventions

5.15 Transformational schemes such as HS2 will improve connectivity between Hertfordshire and the rest of the UK, as well as freeing up capacity for services between Watford and London. However, improvements to journeys within Watford and to and from surrounding districts are required to address the existing and future challenges set out in previous chapters.

5.16 A A414 Mass Rapid Transit System could improve connectivity between Watford and St Albans (and the wider Hertfordshire region), relieving road congestion and encouraging modal shift away from car (which is currently the dominant mode of transport). However, the alignment of the system is not yet confirmed and would not directly address the challenge of improving connectivity to the west of Watford.

5.17 Proposed schemes within Watford address some of the most congested roads (Clarendon Road and the Watford Ring Road). However, these do not address other connectivity challenges across the area, encouragement of sustainable modes, and enabling rail to serve local interurban travel needs better.

6 Establishment of Project Objectives

6.1 The establishment of project objectives has been informed by the identification of specific problems and constraints in the transport network, and a review of priorities and objectives set out in the South West Hertfordshire Growth and Transport Plan Prospectus (June 2018).

6.2 We have also considered the aspirations set out in the MLX Statement of Case to assess how these map onto those within the Prospectus.

6.3 We have developed, from the above, objectives, priorities and supporting assessment metrics that support the assessment of MLX alternatives. These have been agreed with Watford Borough Council, Hertfordshire County Council and Transport for London.

South West Hertfordshire Growth and Transport Plan Prospectus – Key Aims and Priorities

6.4 The South West Hertfordshire Growth and Transport Plan Prospectus sets out specific aims for Watford Centre, Western Gateway and the strategic (former MLX) corridor. We have used these aims and objectives to inform the development of objectives for this study. The proposed interventions set out in the Prospectus are presented in Chapter 5.

Strategic Interventions and Corridors

6.5 The prospectus identifies larger, strategic interventions with Hertfordshire-wide or national significance which could have a bearing on the proposals put forward in the GTPP. Included within these interventions is the Watford Cross-Town Connectivity study. The objectives of this intervention are highlighted in the quote below:

> HCC has been developing a major scheme to extend the London Underground Metropolitan Line to Watford Junction. There is now uncertainty around this scheme proceeding. However, **non-car connectivity across Watford remains a significant priority** and therefore further work will be undertaken to understand how this outcome can best be achieved. One objective will **be to provide a viable alternative to private car-based travel on the congested A412 route** and **provide improved connections into Watford Junction, the Western Gateway and Riverwell**. HCC will work with partners to safeguard the disused railway corridor to ensure it remains available as a future sustainable transport route.

6.6 The overarching aim of the Watford Western Gateway (Package 5) is:

> To **improve access to Watford Western Gateway business park through the enhancement of sustainable transport links**.

6.7 The overarching aim of the Watford Central Package (Package 7) is:

To **reduce traffic congestion** in Watford town centre **by enhancing infrastructure which benefits journeys made on foot, by bicycle and by bus**, and provide **new route options for traffic which avoid busy urban roads.**

MLX Statement of Case – Aims

6.8 The Statement of Case for the Metropolitan Line Extension set out a series of transport problems and opportunities, which were used to define objectives to allow the comparison of alternative options for intervention. These objectives were consolidated into three aims, as set out below:

- to **enhance sustainable links to**, and between, residents and employment, business, education, health and leisure opportunities within Watford and across Hertfordshire, and to key external attractors in London and the national rail network, reinforcing Watford's role as a key transport hub;
- to **improve local connectivity** within Watford between current and potential employees, the town centre and the key development areas of Watford Junction, Watford Business Park / Ascot Road and the Health Campus providing a catalyst for both economic and housing development; and
- to **provide a sustainable and value-for-money alternative** to car travel, with inherently lower environmental impacts per trip including noise and greenhouse gas emissions.

Mapping of Aims, Objectives and Priorities from Existing Sources

6.9 The mapping of aims, objectives and priorities is summarised in Table 6.1.

Table 6.1: Objectives Mapping

Source of Objective (SWHGTP)	**Aim** (SWHGTP)	**Proposed priorities** (SWHGTP)	**Specific measures** (SWHGTP)	**Mapping to MLX Objective (from MLX SoC)**
Strategic Intervention (MLX successor)	**non-car connectivity** across Watford remains a significant priority		• to provide a viable alternative to private car-based travel on the congested A412 (Rickmansworth Road) route and • provide improved connections into Watford Junction, the Western Gateway and Riverwell	to **enhance sustainable links to**, and between…Watford and across Hertfordshire, and to key external attractors in London and the national rail network, reinforcing Watford's role as a key transport hub
Watford Western Gateway	**improve access to Watford Western Gateway business park**	• enhancement of sustainable transport links	• A new southern access into Watford Western Gateway Business Parks area for cyclists and buses only. • The introduction of a new bus- and cycle-only link across the River Colne linking South Oxhey and the Business Parks Area. • Enhanced cycleways and facilities from the area around the edge of Watford town centre to Watford Junction. • Making use of the disused railway alignment in West Watford to enable sustainable and mass transit transport opportunities	

Source of Objective (SWHGTP)	**Aim** (SWHGTP)	**Proposed priorities** (SWHGTP)	**Specific measures** (SWHGTP)	**Mapping to MLX Objective (from MLX SoC)**
Watford Central Package	**reduce traffic congestion** in Watford town centre	• by enhancing infrastructure which benefits journeys made on foot, by bicycle and by bus • provide new route options for traffic which avoid busy urban roads	• Significant public realm enhancements on Watford Ring Road. • Truncation of the Watford Ring Road and a new bus- and cycle-only link bridge at Colonial Way. • The introduction of slips at M1 Junction 4 to allow all movements between the M1 and A41, alongside a Park and Ride facility at M1 Junction 5.	to **improve local connectivity** within Watford between current and potential employees, the town centre and the key development areas of Watford Junction, Watford Business Park / Ascot Road and the Health Campus providing a catalyst for both economic and housing development

Hertfordshire County Council Rail Strategy

6.10 The objectives outlined in Table 6.1 also align with those set out in the HCC Rail Strategy. The strategy sets out a high-level strategic approach for the railway in Hertfordshire, including the following four rail development objectives:

- to **support competitiveness**, the Strategy includes improvements in links to the rest of the country to maximise benefits from the agglomeration effect that better transport connections between centres can bring;
- to **support economic growth**, the Strategy comprises a number of interventions that improve the rail service for commuting trips from/into Hertfordshire;
- to **address sustainability**, the Strategy proposes improvements to encourage modal shift, including for east-west orbital and long-distance movements as more sustainable alternatives to travel by private car and air respectively; and
- to **support population growth**, the Strategy includes recommendations for the development of strategic transport hubs around key stations.

6.11 Aspirations for Watford include improving connectivity between Watford Junction and important long-distance destinations to the north (including Manchester and Liverpool), and developing the longer-term redevelopment of Watford Junction into a major interchange hub

Establishment of Project Objectives and an Assessment Framework

6.12 Existing documentation policies comprise a combination of outcomes, objectives and measures, which to not lend themselves to being used directly as project objectives for this study. We have therefore sought to distil these into a set of clear aims and supporting objectives that capture the essence of existing policies but provide a clearer framework for the development and assessment of options.

6.13 We have developed three 'aims' that reflect these objectives. Within each theme a number of supporting objectives have been developed, along with proposed supporting assessment measures to support the assessment of MLX alternatives.

6.14 The three aims are:

- Enhance Strategic Connectivity
- Enhance Local Connectivity
- Support accessibility to, and improvement of, Watford Town Centre

6.15 These proposed aims and supporting objectives are set out in Table 6.2.

Table 6.2: Proposed Aims and Objectives for MLX Alternatives Project

Aim	Objective	Measures
Enhance Strategic Connectivity	Sustainable connectivity to London	Improved direct connectivity to London
		Improved access via interchange via Watford Junction, Watford High Street or Metropolitan Line
	Sustainable connectivity to other cities (such as Manchester and Liverpool)	Improved access via interchange
	Sustainable connectivity to the West (Rickmansworth / Amersham / Aylesbury)	Improved direct connectivity
		Improved access via interchange
	Sustainable connectivity across Hertfordshire (St. Albans etc.)	Improved direct connectivity
		Improved access via interchange
	Develop Watford Junction as a rail interchange hub	Improved access to other locations from Watford Junction
Enhance Local Connectivity	Public transport connectivity from Watford and Croxley Business Parks	To Watford Town Centre
		To Watford Junction
	Public transport connectivity from Riverwell / Hospital	To Watford Town Centre
		To Watford Junction
	Cycle connectivity from Watford Business Parks	To Watford Town Centre
		To Watford Junction
	Cycle connectivity from Riverwell / Hospital	To Watford Town Centre
		To Watford Junction
Support accessibility to, and improvement of, Watford Town Centre	Improve journeys by foot	New pedestrian routes / opportunities
		Enhanced pedestrian routes / opportunities
		Quality of pedestrian journeys
	Improve journeys by cycle	New cycle routes / opportunities
		Quality of cycle journeys
	Improve journeys by bus	New bus routes / services
		Improved existing routes
		Bus priority / enhanced partnership
	Reduce Traffic Congestion	Impact on traffic volumes and network

7 Option Generation

Introduction

7.1 Phase 2 of this study concentrates on the identification of a range of options that meet the project objectives identified in Phase 1, which have been agreed by Watford Borough Council, Hertfordshire County Council and Transport for London.

7.2 This Chapter describes our approach to generate the long-list of options, which are then assessed in the following Chapter.

Option Generation

7.3 We identified a range of options that offer the potential to meet the project objectives set out in Chapter 6, Establishment of Project Objectives, of this report. The options generation process and the rationale for the development of the options is described below:

Option Generation Process

7.4 The option generation process comprised a combination of:

- The identification of **options that have been previously identified**, such as those considered as alternatives to the MLX project[5], and those identified in the South West Hertfordshire Transport and Growth Prospectus.
- **New infrastructure-led options that support passenger-transit services** developed by Steer. The development of these were framed by the need to deliver the strategic and local connectivity requirements, and the disused Croxley Branch Line could be utilised to support this requirement. Within this category a range of modal options were considered.
- Consideration of **non-passenger transit options** that could either contribute towards scheme objectives in their own right, or that could potentially complement some of the options above. These options have also been informed by the priorities and measures developed by WBC and HCC, such as cycling and walking and demand responsive transport.
- **Stakeholder consultation and input**. Options were put forward by stakeholders through the course of the study. An Options Workshop was held where Steer identified the range of options it proposed for consideration, and invited stakeholders to propose any additional options (or option variants) at the meeting or via follow-up suggestions. This resulted in the inclusion of a couple of further options.
- Options promoted by **private sector parties**, such as the option to deliver a Personal Rapid Transit system along the corridor, which was originally proposed to local stakeholders by a private provider.

[5] As part the development of the MLX a range of options were considered, which are presented in the MLX Statement of Case document:
http://www.croxleyraillink.com/media/31013/app1%20-%20statement%20of%20case.pdf

Identification of Infrastructure and Route Options

7.5 The identification of new infrastructure-led options required a fresh consideration of MLX alternatives in the context of the strategic and local connectivity requirements reflected in the scheme objectives. The strategic connectivity requirements necessitated consideration of options both within the Croxley Branch Line corridor, but also how these could connect with other existing, planned or proposed interventions serving the east (towards St. Albans), south (London) and west (Rickmansworth).

7.6 To support this, two stages of option development were undertaken looking at geographical coverage and then the suitability of modal options. These are described below.

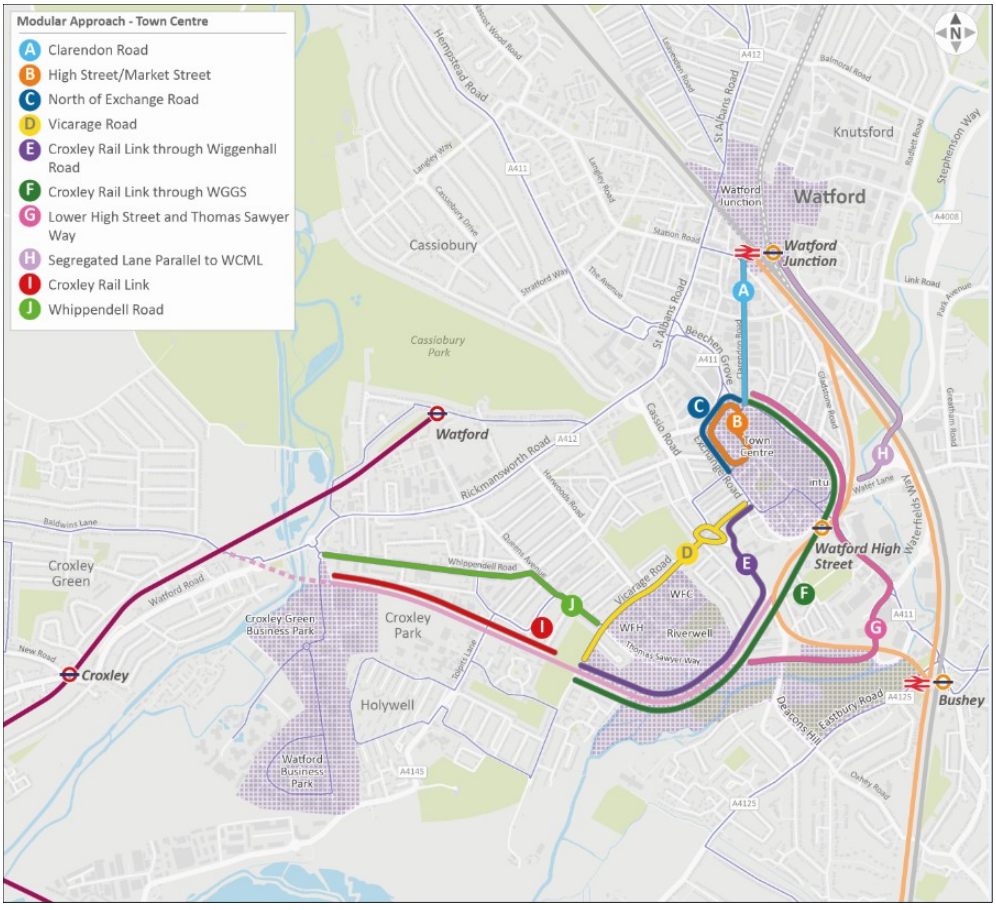
Geographical Scope of Options

7.7 Potential infrastructure and routing options across three geographical areas were considered.

7.8 The first section is the 'core' area comprising broadly between Croxley LUL station / Ascot Road and Watford Junction, reflecting the geography of the MLX and the area within which the key attractors and development areas for which the objective of enhancing 'local connectivity' is fundamental.

7.9 We then considered how core route sections could potentially support strategic connections (directly or via interchange) eastwards towards St. Albans, for example via the Abbey Line or the A414 corridor, and west and southwards towards Rickmansworth, Watford Gateway and London (Metropolitan Line corridor). The core section is shown in Figure 7.1; the potential strategic connections are described in each option description from paragraph 9.36.

Figure 7.1: Core Section Route Options



7.10 The infrastructure constraints of each of the individual pieces of infrastructure presented above are described in detail in Chapter 2 and have been taken into consideration in the option generation process and its assessment.

Modal Options – Transit

7.11 The connectivity and capacity requirements delivered by the MLX, and the scheme objectives, point clearly to the consideration of mass passenger transit options as an alternative to MLX.

7.12 The potential levels of demand for this scheme, as suggested by early MLX demand studies (notwithstanding the expected differences in demand between MLX and the options developed as part of this study) with a number of demand attractors along the corridor, e.g. business parks, hospital, industrial parks, etc., point towards a transit solution that would provide the necessary capacity to cater for the anticipated levels of demand. This would need to be confirmed in the next stage of the scheme development.

7.13 Having identified potential route and infrastructure options, we considered the suitability of different routes to each transit mode under consideration (including underground, rail, light rail, rubber-tyred mass transit) to develop coherent scheme options. The transit modal options considered are summarised in Table 7.1.

Table 7.1: Modal Options – Passenger Transit

Mode / Description	
Underground / Metropolitan Line • High frequency and capacity • Fully segregated running • Driver operation supported by signalling system	
Conventional Rail • Moderate frequency • High capacity • Fully segregated running • Driver operation supported by signalling system	
Light Rail / Tram • High frequency and capacity • Can run on segregated and on-street sections • Driver operated 'line of sight'	

steer

Tram-Train • Hybrid of tram and conventional rail • Can run on segregated and on-street sections • High frequency and capacity • Signalised operation	
Mass Rapid Transit (rubber-tyred) • High Frequency and capacity • Can run on segregated and on-street sections • Can run guided or unguided • Various potential guidance systems (kerb, optical)	
Conventional Bus • High frequency • Moderate capacity • Operates on-street and segregation/ prioritisation possible	

Modal Options – Other Modes and Interventions

7.14 Non-transit options have also been identified which have the potential to meet of contribute to the scheme objectives if implemented as freestanding schemes or have the potential to complement the conventional transit-based options outlined above. Other options considered are summarised in Table 7.2.

Table 7.2: Other Modal Intervention Options

Mode / Description	
Pods • Small, lightweight, driverless electric vehicles provide on-demand, direct (non-stop) trips between origin and destination. • Vehicles are rubber-tyred and battery powered. • Can operate within infrastructure constraints where other modes cannot (e.g. tight curves) • Ultra PRT system operates at Heathrow Airport on 3.8 km of unidirectional guideway (capacity of 800 passengers per hour per direction).	
Demand Responsive Transport • Between taxi & bus • Pre-booked via app to / from designated pick-up point • Adapted to localised demand	

Walking and Cycling • Can act as a standalone option or complementary to transit or non-transit interventions • Promotion of an active lifestyle, yet some users do not naturally feel inclined to use cycling or walking	
Complementary initiatives • Demand management / parking management – fiscal or physical • Travel planning / behaviour change	

7.15 We present below an overview of the main characteristics of two of these complementary interventions: Demand Responsive Transport and pods. As relatively novel technological transport solutions, these can complement a more classic transit-based scheme either as a feeder to it from/to areas which are not directly served or to cater for specific peaks in demand across the day or the scope area which it would be cost ineffective to serve through a transit-based scheme. These should be considered throughout the report as complementary interventions that support the core options.

Demand Responsive Transport

Demand responsive transport (DRT) offers potential to be commercially viable and deliver transport benefits in areas where there is relatively high in-scope demand but underserved by existing public transport services. Parts of the Croxley Branch Line corridor fit this profile, in particular in and around the business parks and potentially around the new Riverwell development.

Arriva, the dominant operator in Watford, has been at the forefront of piloting DRT services in Kent, Leicester and Liverpool. Findings from Sittingbourne[6] have shown that:

- The equivalent of 12% of Sittingbourne's population have downloaded the app.
- Six in ten ArrivaClick customers (61%) use the service a few times a week or more, with just under half (43%) adopting the service for their daily commute.
- One third (34%) of customers used the service for leisure trips, while just over three in ten (31%) used ArrivaClick to visit friends and relatives.
- More than half (52%) of customers switched from private motor transport, including taxis (22%) driving their own car (18%) or being a passenger in a car (12%).
- Almost nine in ten (8.9/10) customers would recommend using the service to a friend.

Watford Borough Council issued a brief in March 2019 inviting tenders from providers of demand responsive transport services to introduce an initial on-demand ride-share scheme to Watford, with the ability to scale-up the service as demand grows. As a result, Arriva Click was launched in Watford in March 2020. This forms a key part of the council's sustainable transport strategy to encourage a modal shift in travel behaviours and relieve pressure on the transport network.

[6] Sources: https://news.arriva.co.uk/news/arrivas-on-demand-public-transport-service-a-success
https://www.arrivabus.co.uk/arrivaclick/about-arrivaclick/where-you-can-go/

Personal Rapid Transit/Pods

Personal Rapid Transit (PRT) vehicles or pods are rubber-tyred, battery-powered vehicles, capable of carrying around four to six passengers (and other items such as luggage or bicycles). With a turning radius of only 5m and an empty weight of 850kg, pods can navigate complex routes with lightweight infrastructure.

Pods typically operate on elevated guideways, providing an effective segregation from other transport modes while securing space beneath the infrastructure to be used by pedestrians, cyclists or private vehicles.

They are suited to respond to specific demand flows connecting existing hubs where a classic transit system would prove to be cost inefficient or where the infrastructure constraints would be too restrictive to deploy another system. It typically works as a non-stop on-demand connectivity system, enabling point-to-point journeys, with higher reliability than other modes due to its segregated nature.

Pods are used in urban areas, retro-fitted into existing spaces, in airports and within campuses and leisure centres, such as office, university, medical campuses or theme parks. As an example, pods are used on Heathrow Airport and are believed to be economical, with a reported total cost between £3m and £5m per kilometre of guideway, including vehicles, infrastructure and control systems (although the total deployment cost for Heathrow was £30m for 3.8 kilometres).

PRT has been included in the long-list of options as it can potentially deliver the connectivity needs established as part of the scheme objectives.

Long List of Options – Summary

7.16 The full long-list of options considered is summarised in Table 7.3. The full description of each option and the option assessment is presented in Chapter 8.

7.17 This list presents the standalone options, but not all the complementary interventions which can help to meet the project objectives, which are covered in the options assessment.

Table 7.3: Long-list of options

Option Mode	Option Name	Description
Underground	Underground 1	Former MLX scheme
Underground	Underground 2	Tunnel under Cassiobury Park linking Watford LUL station to Watford Junction
Heavy Rail	Rail 1	Rail shuttle using the former Croxley Branch Line running Watford Junction-Croxley Green Business Park
Heavy Rail	Rail 2	Rail spur of London Overground using Croxley Branch Line then back onto Watford Junction through triangular junction
Heavy Rail	Rail 3	Rail connection of underground line north of Moor Park to existing LO railway through Ebury Way
Tram-train	Tram 1	Segregated alignment east of WCML to join converted Croxley Branch using LO track. Joins eastwards with converted Abbey Line.
Mass Rapid Transit	MRT 1	MRT service through Clarendon Road, Exchange Road and connecting to Croxley Branch through Watford Girls Grammar School
Mass Rapid Transit	MRT 2	MRT service through Clarendon Road, Exchange Road/town centre and connecting to the Croxley Branch through Wiggenhall Road
Mass Rapid Transit	MRT 3	MRT service through Clarendon Road, Exchange Road, Lower High St to Thomas Sawyer Way connecting to the Croxley Branch
Segregated Pods	Pod 1	PRT using the former Croxley Branch Line into Watford Junction via Watford High Street
Segregated Pods	Pod 2	PRT using the former Croxley Branch Line into Watford Junction via the Watford town centre
Segregated Pods	Pod 3	PRT using the former Croxley Branch Line into Watford Junction via Thomas Sawyer Way
Conventional Bus	Bus 1	Conventional bus using Clarendon Road, town centre/Exchange Road, Vicarage Road and Whippendell Road through to Watford Road
Highway	Highway 1	Conversion of Croxley Branch into general traffic highway, joining Thomas Sawyer Way
Walking and Cycling	Walk & Cycle 1	Conversion of Croxley Branch into walking and cycling route up to Wiggenhall Road

Note: The routes considered for segregated pods have been assumed to be the same as those considered for Mass Rapid Transit. However, a route which follows the rail corridor into Watford Junction could potentially be feasible to be used by pods, whilst that is not the case for Mass Rapid Transit. Commentary on the implications of this alternative route has been added to Chapters 8 and 9 of this report.

8 Option Assessment

8.1 This Chapter sets out the description of each option and an assessment of how each option performs against scheme objectives and deliverability.

Assessment Framework

8.2 An option assessment framework has been developed to summarise and capture the performance of each option. The framework, presented in Table 8.1, considers five main areas:

- **Description and cost** – this summarises the option description (mode, coverage, infrastructure requirement) and ascribes an indicative cost to each option based on cost bands / ranges.
- **Transport benefits & constraints** – this summarises the key transport benefits and constraints based on the 'end-state' (i.e. fully operational) stage. This provides a description / measure of the transport outputs (journey time, reliability, accessibility) that are delivered 'on the ground'. These transport outputs inform the assessment of how well each option delivers against the scheme objectives and wider priorities.
- **Fit with Scheme Objectives and Priorities** – this describes the fit of the options with the scheme objectives, including strategic and local connectivity, enhancing of cycling and walking provision and complementarity with other interventions.
- **Deliverability assessment** – an assessment of how deliverable the option is and whether there are any 'showstopper' risks.
  The above then inform the '**overall summary**' presented at the end of each option.

Table 8.1: Option Assessment Framework

Option Number /Name	
Description & cost	
Key features of option	• Describes features of the route and supporting infrastructure.
Indicative cost / Cost category	• Very high → Above £250m • High → £100m to £250m • Medium → £25m to £100m • Low → up to £25m
Transport benefits / constraints (operational)	
Key benefits (transport)	• What the option delivers in terms of key transport outputs (journey times, connectivity, reliability, etc.)
Key issues / constraints (transport)	• Key issues related to option, e.g. complex technical interface, constraints on operational performance, conflict with other modes, etc.
Fit with Scheme Objectives / wider priorities	

Strategic connectivity (score and rationale)	• Description of whether / how option enhances strategic connectivity, either as freestanding option or as part of current / future network • Qualitative assessment of overall fit with objective (1-5 scoring scale), and rationale for score
Local connectivity (score and rationale)	• Description of whether / how option enhances local connectivity – specifically Watford Gateway, Riverwell (Health Campus & Hospital) to Watford Town Centre and Watford Junction • Qualitative assessment of overall fit with objective (1-5 scoring scale), and rationale for score
Enhancing cycling and walking provision	• Assessment of option contribution to / complementarity with objectives to enhancing journeys by cycle / foot
Complementarity with other local objectives	• Assessment of option contribution to / complementarity with objectives to reduce traffic congestion and improve journeys by bus • Qualitative assessment of overall fit
Supporting wider connectivity	• Describe how option would connect to east and west
Deliverability Assessment	
Key Deliverability Issues	• Description of key deliverability issues • Risk-based assessment of deliverability issue (**High**, **Medium**, **Low**) • We have given a score of **High/Medium** for risks that are seen to be 'showstoppers' but for which are cannot be certain
Overall deliverability risk	• Overall deliverability assessment – where key deliverability issue or combination of issues is likely to constitute a 'showstopper' • RAG rating (**High**, **Medium**, **Low**) and rationale • We have given a score of **High/Medium** for risks that are seen to be 'showstoppers' but for which are cannot be certain
Overall summary	
• Summary of the option performance	

Commentary on Deliverability Assessment

8.3 This study has considered options at an outline concept level of design. The feasibility assessment is therefore based on professional judgement, informed by an understanding of the key categories of deliverability risk, and whether these are likely to constitute showstoppers for a particular option.

8.4 Key risks considered include:

- **Feasibility** – Is the option technically feasible and constructible?
- **Technology** – Is the option technologically feasible?
- **Acceptability** – Is this option likely to be acceptable to stakeholders and the public?
- **Environmental impact** – Is the option likely to have material environmental impacts that represent risks to deliver?

- **Value for Money** – Is the option likely to represent a significant value for money risk, and therefore not meet funding eligibility criteria?
- **Legal** – Does the option require powers (e.g. Transport and Works Act Order); Is there a risk that planning could be refused?
- **Complex / Interface / Interdependency** – Does the option have a complex interface with, or dependency upon other schemes or proposals?

8.5 For each option we highlight the key risks pertaining to that option, and provide a RAG assessment where:

- **Green** = low risk
- **Amber** = moderate risk. This suggest the risk represents a material consideration in the design and development of the option but is not, at this stage, assessed as a potential showstopper.
- **Red** = high risk. This is where there is a high risk that the individual risk is likely to represent a showstopper and render the option undeliverable.

Indicative Costing

8.6 For those options that are considered to be more deliverable, we have produced an estimate of the potential capital cost estimate for its construction. This has been based on unit rate costs plus lump sums for the largest interventions under each of the options. In addition, we have provided an allowance for overheads, design, and other costs, plus an allowance for optimism bias. These cost estimates are presented in Chapter 9 of this report.

8.7 The cost estimates do not include land and compensation costs, as well as any platform capacity works that would be required at Watford Junction (which were necessary for the former MLX scheme). Therefore, options which require significant and/or uncertain land take, as well as those which use Watford Junction platform, have a higher risk to result in increased costs compared to those presented in Chapter 9.

Supporting evidence on journey times

8.8 We have also undertaken a high-level assessment on the likely comparative journey of each Mass Rapid Transit (MRT) option. This is based on the proportion of the route that is fully segregated, would have high-priority (e.g. dedicated bus lanes) and would have low-priority (e.g. running with general traffic, typically on congested and narrow sections of road with no space available to provide priority). We have calculated overall journey times based on the following reasonable assumed speeds of each route type:

- Segregated route: 35 miles per hour
- On-street (high priority): 30 miles per hour
- On-street (low priority): 15 miles per hour

8.9 We have also assumed a speed of 25 miles per hour for the north-east section of the Ring Road. This reflects the planned upgrades to this section, which are expected to improve journey times (but not enough to be classified as a high-priority route). A summary of the relative journey time performance of some of the options is also presented in Chapter 9 of this report.

Underground Option 1 – Metropolitan Line Extension (MLX)

Option Description

8.10 This option is the previously proposed extension of the Metropolitan Line to Watford Junction, via Watford High Street.

8.11 Key infrastructure requirements are a new viaduct over Ascot Road, conversion of the disused Croxley Branch alignment, new stations at Watford General Hospital and Watford West and works at Watford Junction to provide additional platform capacity.

8.12 The MLX option would provide a direct and fully segregated route between the Metropolitan Line and Watford Junction. There would be a high-frequency transit service running across Watford and directly linking to Central London and Watford Junction, whilst serving major development sites along the corridor.

MLX Option Development and Cancellation

The MLX project was subject to a long process of scheme development, including:

- Receiving provisional funding approval on the basis of the MLX Business Case prepared in 2011, at which time the reported costs were £116.8m.
- Going through Transport and Works Act Inquiry in 2012 and gaining TWAO approval to construct the scheme in 2016. This demonstrated that the option was feasible and, based on the Planning Inspectors recommendations and Secretary of State's decision, that the benefits of the scheme outweighed the adverse impacts.
- The majority of MLX benefits derived from the improved connectivity (as therefore time savings) provided on the new links through to London (730,000 increase in annual trips by 2016, a 50% increase, of which 20% were made by car, 50% from rail and 30% from bus[7]). Local benefits (proxied by level of transfer from bus), are relatively low.
- However, with an estimated final capital cost of £358 million at the time of the projects' cancellation, the project was deemed unaffordable and the Transport for London funding for the project was revoked in 2018.

[7] MLX Statement of Case: Proof of Evidence, 2012

Figure 8.1: Underground Option 1 – Metropolitan Line Extension (MLX)

Option Assessment

Table 8.2: Underground Option 1 Assessment

UG1	
Description & cost	
Key features of option	• Former MLX scheme • Route length 4.7 km, of which 2.9km on new infrastructure and 1.8km on existing rail alignment.
Indicative cost / Cost category	• ££££ (very high)
Transport benefits / constraints (operational)	
Key benefits (transport)	• Provides a fully segregated link between the Metropolitan Line and Watford Junction – fast and reliable journey times. • Directly serves key attractors on Croxley Branch corridor. • Direct connectivity to London via Metropolitan Line.

Key issues / constraints (transport)	• Inter-operability with heavy rail.			
Fit with Scheme Objectives / wider priorities				
Strategic connectivity	**5**	• Provides the best strategic connectivity out of all the options. Fully segregated route providing direct access to London.		
Local connectivity	**5**	• Provides direct access to Watford Junction and serving major development sites across the corridor.		
Enhancing cycling and walking provision	**0**	• Use of the Croxley Branch for rail infrastructure would prevent the implementation of cycle/walking paths.		
Complementarity with other local objectives	**5**	• Contributes to target of reducing general traffic around town centre by providing an alternative mode – however this is dependent on mode shift.		
Supporting wider connectivity		• Increased connectivity would be achieved through new connections at Watford Junction (e.g. expansion of the Abbey Line).		
Deliverability Assessment				
Key Deliverability Issues / Risks	**Low** • Option is feasible and acceptable.		**Moderate** • Complex operational interface between Rail and LUL. • Value for Money performance uncertain, especially given cost increases towards end of MLX project. • Benefits constrained within the Croxley corridor. • Promotion of option would require active support and (in all likelihood) funding commitment from TfL, which is highly uncertain.	**High** • Affordability presents potential showstopper.
Overall deliverability risk	**High**	Option is not affordable for foreseeable future.		
Overall summary				
• Performs very strongly against scheme objectives. • Affordability presents showstopper risk.				

Underground Option 2 – Metropolitan Line Extension to Watford Junction via tunnel

Option Description

8.13 This option would involve extending the Metropolitan Line service from Watford Tube Station to Watford Junction, via a new tunnel approximately 1.6km in length under Cassiobury Park.

8.14 Key infrastructure would include a new underground station at Watford Junction, and potentially also in Watford Town Centre. Major construction works would be required at Watford Met and at Watford Junction, involving significant disruption.

8.15 This option would provide a direct and fully segregated route between the Metropolitan Line and Watford Junction. There would be a high-frequency transit service with very fast journey times. The option would not directly serve new developments along the previous MLX corridor, such as Watford Western Gateway and Riverwell.

Underground Option 2 Variant

8.16 A potential variant of this option is to continue the tunnel under Watford Junction, to connect with the Abbey Line (the Abbey Line would require a complete upgrade to support metro frequency services). This could either support an extended Metropolitan Line to St. Albans or a new rail route from Watford Underground Station to St. Albans via the Abbey Line (with an interchange at Watford Junction).

Figure 8.2: Underground Option 2 – Metropolitan Line Extension to Watford Junction via tunnel

Option Assessment

Table 8.3: Underground Option 2 Assessment

UG2
Description & cost

Key features of option	• Tunnel under Cassiobury Park linking Watford LUL station to Watford Junction • Route length 1.6 km, of which all is new infrastructure.		
Indicative cost / Cost category	• ££££ (very high)		
Transport benefits / constraints (operational)			
Key benefits (transport)	• Provides a fully segregated link between the Watford tube station and Watford Junction – very fast and reliable journey times. • Connectivity to London via Metropolitan Line.		
Key issues / constraints (transport)	• Complex interface at Watford Junction.		
Fit with Scheme Objectives / wider priorities			
Strategic connectivity	**4**	• Provides segregated access to London via the Metropolitan Line.	
Local connectivity	**2**	• Does not directly serve the new development along the MLX corridor.	
Enhancing cycling and walking provision	**0**	• Use of an underground tunnel would not permit for cycle/walking paths.	
Complementarity with other local objectives	**3**	• Contributes to target of reducing general traffic around town centre by providing an alternative mode – however this is dependent on mode shift. • Likely to have a lower mode-shift than UG1, as the route does not directly serve new development along the MLX corridor.	
Supporting wider connectivity	• Increased connectivity would be achieved through new connections at Watford Junction (e.g. expansion of the Abbey Line). • A variant of the option is to continue the tunnel under Watford Junction. This could support wider connectivity through an extended Metropolitan Line to St. Albans or a new rail route from Watford Underground Station to St. Albans via the Abbey Line (with an interchange at Watford Junction).		
Deliverability Assessment			
Key Deliverability Issues	**Low** • Major uncertainty about acceptability and impacts associated with tunnelling option at Watford and Watford Junction.	**High** • Value for Money risk is very high, as cost of similar order as Underground Option 1, but benefits likely to be significantly lower due to poorer local accessibility and not serving the town centre. • Affordability presents potential showstopper. • The option variant outlined above improves performance against strategic connectivity objectives, adds cost, complexity and would add to, rather than mitigate, deliverability risks.	
Overall deliverability risk	**High**	Option very unlikely to represent value for money and is not affordable for foreseeable future.	

Overall summary
• Does not adequately meet scheme objectives. • Likely to be undeliverable and unaffordable.

Rail Option 1 – Rail Shuttle

Option Description

8.17 This option would involve the extension of the London Overground line along the former Croxley Branch line, with new stations at Watford Hospital and Ascot Road. Services would operate as a 'shuttle', terminating at Ascot Road, with no onward connection to the Metropolitan line at Croxley.

8.18 This option would involve less capital infrastructure than an extension of the Metropolitan Line along the Croxley Branch lone, due to the absence of the viaduct over Ascot Road, and a significantly simpler signalling interface since Underground trains would not be inter-operating along the 'heavy rail' section between Watford High Street and Watford Junction.

8.19 This option would provide the comparable local connectivity towards Watford as the original MLX extension (UG1). However, since it does not provide direct accessibility to the Metropolitan Line or Central London and does not provide connectivity with the Croxley and Moor Park area, the strategic connectivity benefits would be significantly less.

8.20 The option would have the potential to use rail rolling stock based on emerging technology (zero-emission powered vehicles rather than diesel), which could reduce localised noise and emissions, as well as potentially a lower operating cost. It is likely that any rail option would need to be electrified (or zero emission at point of use) from the start, with any new diesel service with the air quality implications unlikely to be acceptable. This might have additional rail infrastructure issues to be considered (e.g. third rail vs. overhead electrification).

Figure 8.3: Rail Option 1 – Rail Shuttle

Option Assessment

Table 8.4: Rail Option 1 Assessment

R1	
Description & cost	
Key features of option	• Rail shuttle using the former Croxley Branch Line running Watford Junction-Croxley Green Business Park • Route length 4.1km, of which 2.3km on new infrastructure and 1.8km on existing rail alignment.
Indicative cost / Cost category	• £££ (high)
Transport benefits / constraints (operational)	
Key benefits (transport)	• Provides a segregated link between the Metropolitan Line and Watford Junction – fast and reliable journey times. • Serves key attractors on Croxley Branch corridor.

Key issues / constraints (transport)	• Would require platform capacity works at Watford Junction.	
Fit with Scheme Objectives / wider priorities		
Strategic connectivity	**4**	• Improves access to London via Watford Junction. • Does not connect directly to the Metropolitan line.
Local connectivity	**4**	• Provides access to Watford Junction and serving major development sites across the corridor.
Enhancing cycling and walking provision	**0**	• Use of the Croxley Branch for rail infrastructure would prevent the implementation of cycle/walking paths.
Complementarity with other local objectives	**3**	• Contributes to target of reducing general traffic around town centre by providing an alternative mode – however this is dependent on mode shift.
Supporting wider connectivity	• Increased connectivity would be achieved through new connections at Watford Junction (e.g. expansion of the Abbey Line).	
Deliverability Assessment		
Key Deliverability Issues	**Moderate** • Option would be technically feasible and likely to be acceptable. The option may or may not require additional platform capacity works at Watford Junction (which would need to be checked as part of potential follow-on work). • Value for money highly uncertain, as capital costs would be high, benefits constrained within the Croxley corridor. • Ongoing operational affordability also very uncertain, as shuttle operations have high unit costs (e.g. per vehicle km) and demand mostly on short trips for which fares / revenues are typically low. Emerging technology vehicles would have the potential to reduce the operating costs. • Option would require support and promotion from a combination of Network Rail, DfT and TfL, through their respective planning processes.	
Overall deliverability risk	**Medium-High**	The value for money and affordability issues associated with this option is likely to represent showstopper risks.
Overall summary		
• Option performs well against objectives. • Significant deliverability risk.		

Rail Option 2 – Watford Junction to London via Croxley Branch line

Option Description

8.21 This option is a variant of the rail shuttle option above (Rail Option 1) and includes a triangular junction to allow services to operate from Watford Junction – Watford High Street – Watford Hospital – Abbey Road – Watford Hospital – Bushey and to London.

8.22 This option requires a heavy rail curvature for the new east-west chord. This requires land take where an industry park has recently been built (see Figure 8.5), which represents a significant deliverability risk.

8.23 Compared to Rail Option 1, this option provides increased connectivity to Watford High Street and Watford Junction from the South. However, the impact on these journeys is unlikely to justify circuitous routing, leading to a higher deliverability risk. In addition, similarly to Rail Option 1, this option does not provide connectivity with the Croxley and Moor Park area.

8.24 Further work would need to identify the extent of current long-distance demand using the Watford High Street branch and the impact on their journey time. An increase in journey length would involve an increase in operating cost, and there is a risk that this does not represent a Value for Money alternative.

Figure 8.4: Rail Option 2 – Watford Junction to London via Croxley Branch line

Option Assessment

Table 8.5: Rail Option 2 Assessment

R2	
Description & cost	
Key features of option	• Rail spur of London Overground using Croxley Branch Line then back onto Watford Junction through triangular junction

	• Route length 5.3km, of which 2.8km on new infrastructure and 2.5km on existing rail alignment.	
Indicative cost / Cost category	• £££ (high)	
Transport benefits / constraints (operational)		
Key benefits (transport)	• Provides a segregated link between the Metropolitan Line and Watford Junction – fast and reliable journey times. • Serves key attractors on Croxley Branch corridor.	
Key issues / constraints (transport)	• Would require platform capacity works at Watford Junction. • Likely to have a significant impact on journey time for journeys from the south through Watford High Street.	
Fit with Scheme Objectives / wider priorities		
Strategic connectivity	**4**	• Improves access to London via Watford Junction and Bushey.
Local connectivity	**4**	• Provides access to Watford Junction and serving major development sites across the corridor. • Provides access to and from areas such as South Oxhey/Carpenders Park.
Enhancing cycling and walking provision	**0**	• Use of the Croxley Branch line for rail infrastructure would prevent the implementation of cycle/walking paths.
Complementarity with other local objectives	**4**	• Contributes to target of reducing general traffic around town centre by providing an alternative mode – however this is dependent on mode shift.
Supporting wider connectivity	• Increased connectivity would be achieved through new connections at Watford Junction (e.g. expansion of the Abbey Line) or new connections along the commuter corridor from the south of Bushey.	
Deliverability Assessment		
Key Deliverability Issues	**High** As per Rail Option 1, plus: • Obtaining necessary land for triangular junction and new east-west chord appears very challenging. • The horizontal chord between the existing line and the new spur (suitable for heavy rail) has been built on. Unrealistic to assume that this property can be acquired. • Benefits from London connection will be largely offset by dis-benefits to through trips (e.g. those to Watford High Street from the south), and the additional operating costs associated with reversing spur. • Direct link to London via spur (on the stopping service) unlikely to deliver material time savings over the option of interchanging at Watford Junction onto fast services.	

Overall deliverability risk	**High**	**High** • Land required for new east-west chord unavailable (see additional commentary below). **High/Medium** • The value for money and affordability issues associated with this option is highly likely to represent showstopper risks.
Overall summary		
• Option performs well against objectives. • Significant deliverability risk and likely showstopper		

8.25 For further clarity, the east-west chord that would need to be built linking the existing LO track with the Croxley Branch line would go through the industrial park that is served by Thomas Sawyer Way. This industrial park is already fully built (see Figure 8.5 below, with Thomas Sawyer Way at the back end of the image), so any option going through the industrial park would face very significant costs associated with the demolition of the area and the compensations paid to owners, which we considered to be unaffordable and unacceptable to stakeholders.

Figure 8.5: Industrial park served by Thomas Sawyer Way

Rail Option 3 – Connection Metropolitan Line to Watford Junction through Ebury Way

Option Description

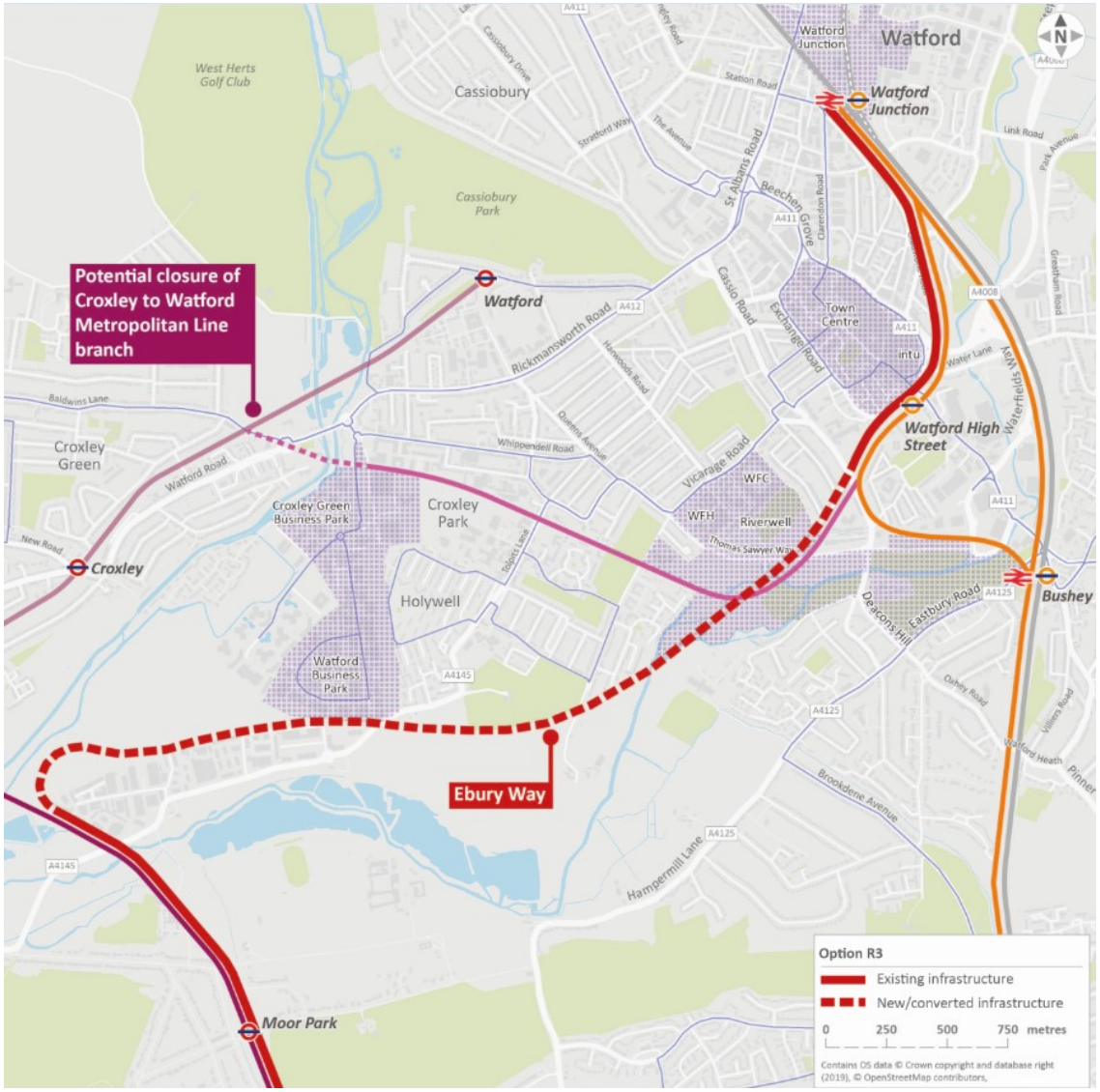
8.26 This rail option proposes to use the disused Ebury Way railway corridor to develop a link between the Metropolitan Line north of Moor Park and the current railway track west of Watford High Street. This alignment runs south of the business parks and is more peripherical to the Watford area than any of the other two rail options. It should also be noted that Ebury Way is currently used as a key cycle route across the town.

8.27 This option would provide the strategic connectivity that the former MLX scheme provided, in the form of through services from London to Watford Junction on the Metropolitan Line, with potentially better connections to the west of Watford area. However, it would provide a lower

local connectivity to the Watford area as it runs south of the Watford Business Park and the Holywell area.

8.28 This option would require a heavy curve to join the Metropolitan Line to the Ebury Way, which might represent a feasibility risk, as the route is not safeguarded and securing the alignment would require significant land and property take. In addition, if operated as a LU services, this option would present similar inter-operability issues as the original MLX scheme.

Figure 8.6: Rail Option 3 – Ebury Way



Option Assessment

Table 8.6: Rail Option 3 Assessment

R3	
Description & cost	
Key features of option	• Rail connection of underground line north of Moor Park to existing LO railway through Ebury Way • Route length 5.8km, of which 4.0km on new infrastructure and 1.8km on existing rail alignment.

Indicative cost / Cost category	• ££££ (very high)		
Transport benefits / constraints (operational)			
Key benefits (transport)	• Provides a fully segregated link between the Metropolitan Line and Watford Junction – fast and reliable journey times. • Direct connectivity to London via Metropolitan Line.		
Key issues / constraints (transport)	• Inter-operability with heavy rail • Unless the LU Croxley branch was completely closed, this would provide a further subdivision of the Metropolitan Line destinations		
Fit with Scheme Objectives / wider priorities			
Strategic connectivity	**4**	• Fully segregated route providing direct access to London.	
Local connectivity	**2**	• Does not directly serve the new development along the MLX corridor, operating south of the Watford area.	
Enhancing cycling and walking provision	**0**	• Use of the Ebury Way for rail infrastructure would result in loss of existing cycle/walking paths.	
Complementarity with other local objectives	**4**	• Contributes to target of reducing general traffic around town centre by providing an alternative mode – however this is dependent on mode shift. • Likely to have a lower mode-shift than other options, as the route does not directly serve new development along the MLX corridor.	
Supporting wider connectivity	• Increased connectivity would be achieved through new connections at Watford Junction (e.g. expansion of the Abbey Line).		
Deliverability Assessment			
Key Deliverability Issues	**Moderate** • Route not safeguarded and securing alignment would require significant land and property take. • Environmental impacts likely to be very significant. • Public and stakeholder acceptability uncertain, but opposition likely given above. • Option would require support and promotion from a combination of Network Rail, DfT and TfL, through their respective planning processes. Not a realistic prospect in medium-term.	**High** • High cost and likely demand unlikely to support a robust value for money or affordability case.	
Overall deliverability risk	**High**	Each of the risks above could represent a showstopper, and overall deliverability therefore assessed as high risk.	
Overall summary			
• Option delivers strategic connectivity but does not meet local connectivity objectives • Significant deliverability risk			

8.29 An alternative to this option would be to connect Ebury Way with the Chiltern Line northwards towards Rickmansworth, providing additional connectivity to the west instead of towards London. This option could be explored further, in the wider Hertfordshire context, but it does not meet either the local objectives corresponding to this study.

Tram / Tram-Train Option – Croxley Branch line to St. Albans via Abbey Line

Option Description

8.30 The option developed is based on a tram-train option which would run from Ascot Road via the Croxley Branch alignment, with shared running (with heavy rail) on the Watford High Street section before utilising a new segregated alignment to provide a connection to the eastern side of Watford Junction to enable through running onto the Abbey Line (which would need converting to tram operation).

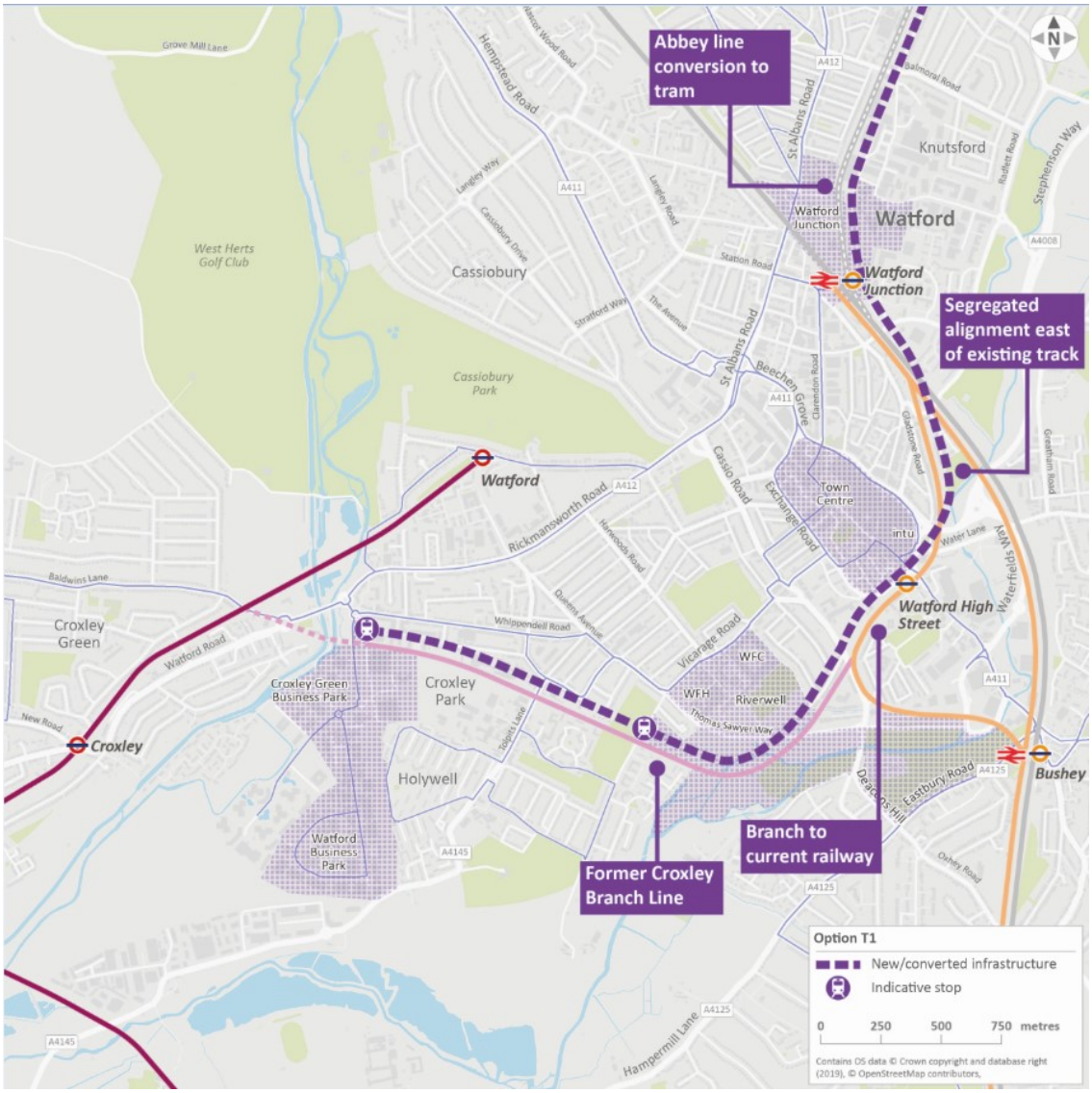
8.31 The basis for the definition of the tram-train option is that:

- Tram (or tram-train) would not be a sensible option as a 'freestanding' system operating only between Watford Junction and Ascot Road, given that this can be provided with a rail-based option. A tram option serving only this section would require inter-operability with heavy rail (adding complexity, cost and risk) and would require a tram-depot location for which there is no obvious site available. The cost of setting up and running a tram over a single line of around 4km route would not be viable.
- A tram option is therefore only sensible to consider if it can form part of a wider network. This underpins the logic of connecting to the Abbey Line (where there has been an aspiration to upgrade provision, including consideration of tram). We have, for the purposes of this assessment, assumed a connection to the Abbey Line via the eastern side of Watford Junction.

8.32 This option would involve the conversion of the Abbey Line to a tram operation, with services running from Watford Junction to Ascot Road via a new segregated alignment to the east of Watford Junction and then along the Croxley Branch. The segregated alignment would seek to run east of the West Coast Main Line to then branch onto Stephenson Way under the current viaduct, branching then onto the current LO railway near Watford High Street and onto the Croxley Branch line. We note the practical complexity of achieving this segregated alignment and we believe this constitutes a high deliverability risk for this option.

8.33 This option would provide the comparable local connectivity towards Watford as the original MLX extension (UG1). It does not provide direct accessibility to the Metropolitan Line or Central London but does provide connectivity to the wider Hertfordshire region (and key commuter areas such as St Albans).

Figure 8.7: Tram / Train-Train Option – former Croxley Branch Line to St. Albans via Abbey Line



Option Assessment

Table 8.7: Tram/Tram-Train Assessment

T1	
Description & cost	
Key features of option	• Segregated alignment east of WCML to join converted Croxley Branch using LO track. Joins eastwards with converted Abbey Line. • Route length 6.8km, of which all is new infrastructure.
Indicative cost / Cost category	• £££££ (very high)
Transport benefits / constraints (operational)	
Key benefits (transport)	• Directly serves key attractors on Croxley Branch corridor. • Direct connectivity to areas along the Abbey Line (e.g. St Albans).
Key issues / constraints (transport)	• Poor economies of scale associated with converting a short section of heavy rail alignment in the vicinity of Watford High Street to tram train, likely to be unaffordable

Fit with Scheme Objectives / wider priorities		
Strategic connectivity	**4**	• Improves access to wider Hertfordshire area. • Improves access to London (with interchange between tram and train).
Local connectivity	**4**	• Provides access to Watford Junction and serving major development sites across the corridor.
Enhancing cycling and walking provision	**0**	• Use of the Croxley Branch for tram-train infrastructure may prevent the implementation of cycle/walking paths, although this would require further investigation.
Complementarity with other local objectives	**4**	• Contributes to target of reducing general traffic around town centre by providing an alternative mode - however this is dependent on mode shift.
Supporting wider connectivity	• Potential for expansion through wider Hertfordshire area e.g. expansion of the Abbey Line or expansion to the west of Watford.	
Deliverability Assessment		
Key Deliverability Issues	**Moderate** • Major technical challenges (as associated costs and risks) of conversion to tram-train, including significant engineering south of Watford Junction. • Land requirement for segregated alignment east of the WCML would entail loss of exiting residential and commercial properties. • Would require duelling the Abbey Line - due to the more frequent services, this would require routing over existing level crossings (particularly in North Watford), which could have a negative impact on the road network. • Link to Abbey Line involved loss of train maintenance siding.	**High** • Only viable as part of a wider network including Abbey Line. This adds cost, complexity and introduces key dependency risk. • Issues above likely to be unacceptable to stakeholders and landowners – major risk to ability to secure powers to construct. • Value for money and ongoing affordability very uncertain. • Option unaffordable as significantly more expensive than MLX.
Overall deliverability risk	**High**	Each of the risks above could represent a showstopper, and overall deliverability therefore assessed as high risk.
Overall summary		
• Option performs well against objectives • Significant deliverability and affordability risks		

Mass Rapid Transit Options – Overview

Description of Mass Rapid Transit in the MLX Alternatives Context

Mass Rapid Transit (MRT) is a generic description to describe high-quality rubber-tyred transit options. These cover a spectrum of vehicles ranging from a high-quality conventional bus (low floor, low emission) to vehicles similar in specification to trams.

The key features of MRT for the purpose of this assessment are that:

- They have been developed to meet the scheme objectives in terms of the transport outputs they deliver and the locations they would serve.
- MRT options seek fast and reliable journey times, through either fully segregated or largely segregated of priority running. Therefore, options have been developed to make use of disused Croxley Branch alignment, as achieving equivalent journey speed and reliability on existing roads (e.g. Vicarage Road and Rickmansworth Road) is not possible.
- Options have been developed to fit with the wider HCC aspirations for an MRT Network operating on a largely east-west axis across Hertfordshire serving Watford, St. Albans, Welwyn Garden City and further east (see paragraph 5.8 onwards).
- MRT options would be complementary with, rather than an alternative to, the existing bus network. MRT would be provide a limited stop service serving key origins and destinations (and hence operating faster), whereas conventional buses would continue to provide local and inter-urban accessibility.

Routing of MRT Options through Watford Town Centre

Given the current unidirectionality of the Ring Road around Watford Town Centre, buses currently operate in different routes for their inbound and outbound trips, following the direction of the Ring Road, including some buses through High Street in the town centre,

There is a desire to remove buses from the pedestrian core to provide a better ambience for pedestrians, as well as considerations of downgrading or repurposing the Ring Road to support bus movements. While some of the previously proposed interventions included switching the Ring Road to two-direction operations or closing the bridge on the north-west of the Ring Road to bus operations only, options developed more recently involve improving bus and cycle provision around the Ring Road and reducing traffic dominance (two-way operation of the Ring Road is no longer under consideration).

Any emerging MRT option could utilise any reconfigured bus routing through the town centre and the Ring Road. Some of the alternatives to go through the town centre are described below (see MRT2 option).

8.34 Any MRT option would seek to provide an optimal balance between segregation and direct routing. Segregation may be challenging to achieve but will be key to create a service which is more attractive that the private car for end-to-end journeys.

Mass Rapid Transit Option 1 – former Croxley Branch Line to Watford Junction via Watford High Street

Option Description

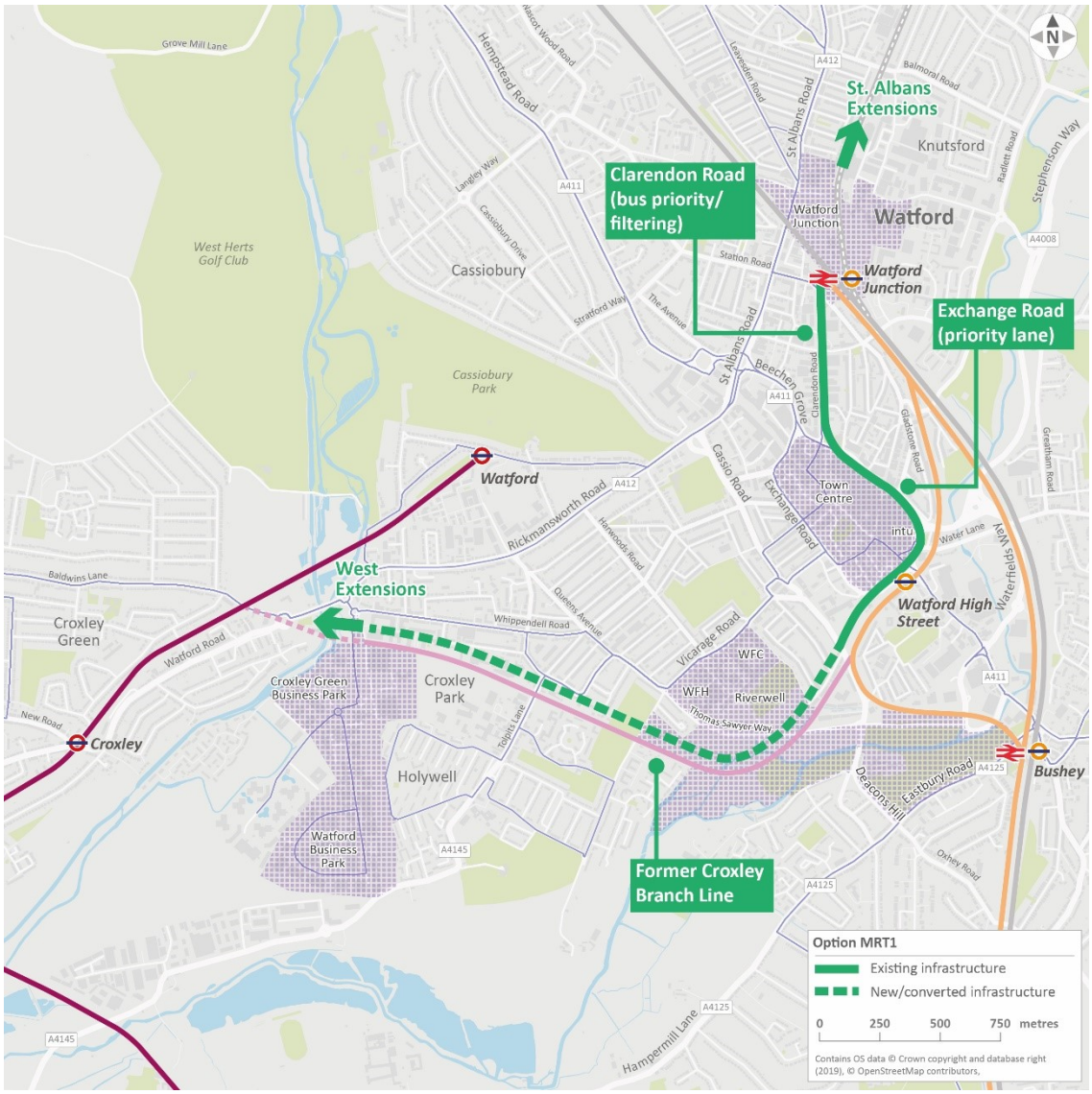
8.35 This option involves the use of a priority lane running down Clarendon Road and Exchange Road to Watford High Street station. There is then a new segregated route from Watford High Street station to the former rail overbridge at Vicarage Road (via the edge of the Watford Girls Grammar School (WGGS) playing fields) and along the Croxley Branch alignment to Ascot Road.

8.36 Provision of bus priority/filtering, which is common to all MRT options, will need to be investigated in further detail in the next stage of the scheme development to understand the compatibility with the current approved intervention (which provides a width of 6.2m along the corridor).

8.37 This option serves both Watford Junction and Watford High Street whilst using a less congested route than most existing bus services, leading to improved journey times. Use of the Croxley

Branch alignment means that major development sites across the corridor are also served. However, the need to use land from the WGGS playing fields is likely to affect the deliverability of this option.

Figure 8.8: Mass Rapid Transit Option 1 – Croxley Branch to Watford Junction via Watford High Street



Option Assessment

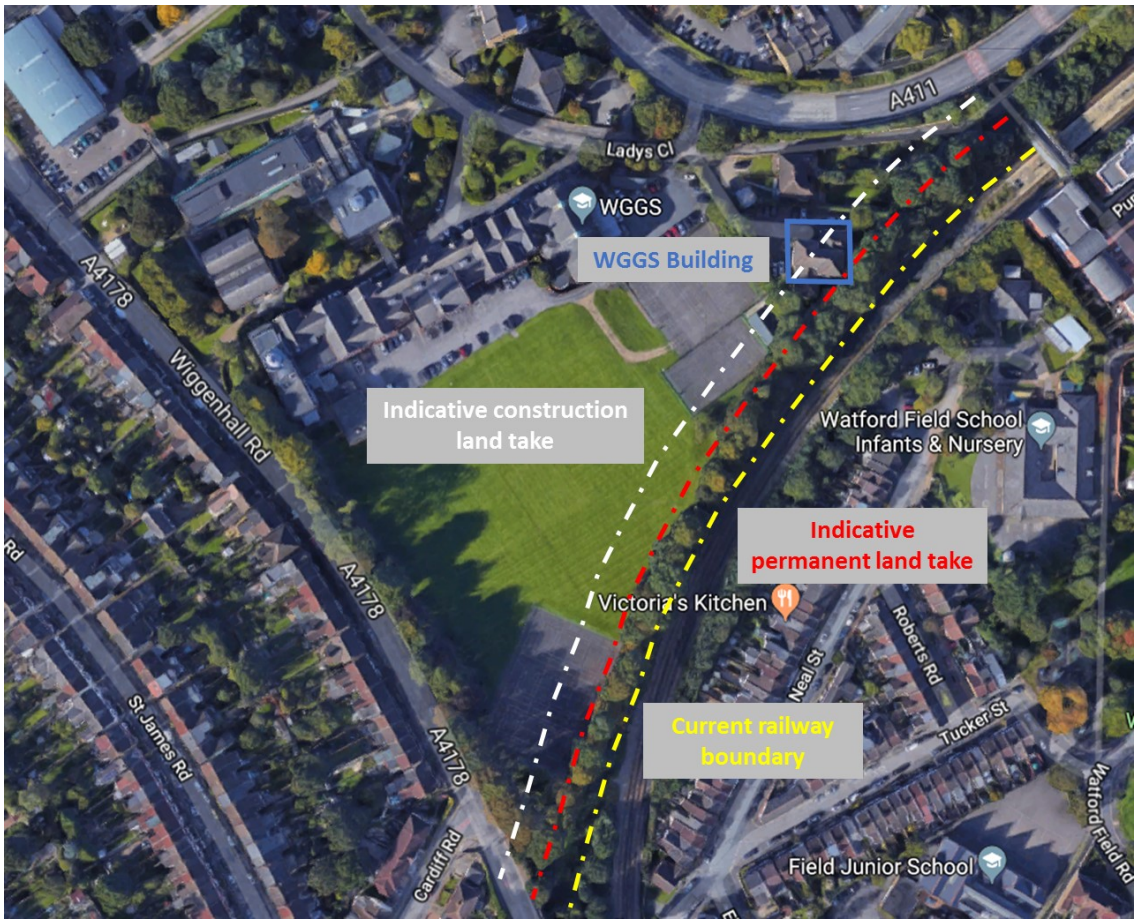
Table 8.8: MRT Option 1 Assessment

MRT1	
Description & cost	
Key features of option	• MRT service through Clarendon Road, Exchange Road and connecting to Croxley Branch through Watford Girls Grammar School • Route length 4.2km, of which 2.7km on new infrastructure and 1.5km on existing road.
Indicative cost / Cost category	• £££ (high)
Transport benefits / constrains (operational)	
Key benefits (transport)	• Segregated route along the Croxley Branch alignment will provide faster journey times and a more reliable service than conventional bus.

Key issues / constraints (transport)	• Requires the use of land from the WGGS playing fields.		
Fit with Scheme Objectives / wider priorities			
Strategic connectivity	**4**	• Provides direct connectivity to Watford Junction and Watford High Street, enabling access to the wider area through rail services	
Local connectivity	**5**	• Delivers the best connectivity of all the MRT options. Provides direct connectivity to Watford Junction, Watford High Street, Watford town centre and key developments on the Croxley Branch corridor	
Enhancing cycling and walking provision	**1**	• Potential to implement cycle/walking paths along the Croxley Branch alignment	
Complementarity with other local objectives	**4**	• Contributes to target of reducing general traffic around town centre by providing an alternative mode - however this is dependent on mode shift.	
Supporting wider connectivity	• Potential to integrate with the planned Hertfordshire BRT network (e.g. St. Albans extension) and a potential Park and Ride site at Junction 5 of the A41 • Potential to extend the services westbound towards Rickmansworth and south west of Watford area		
Deliverability Assessment			
Key Deliverability Issues	**Moderate** • The right of way for the transit route would sever the school grounds (permanent land take) and require the demolition and rebuild of school buildings. • Construction access is constrained by the proximity of the existing rail line • Alignment would run close to existing buildings and elicit potential objections. **High** • Each of the above result in major risk around acceptability and objections at any planning inquiry.	**Moderate** • Value for money uncertain. • Lower cost than MLX (and rail, LUL options), but affordability uncertain.	
Overall deliverability risk	**High**	Required temporary and permanent land required at WGGS, as well as demolition and rebuild of school buildings, is likely showstopper.	
Overall summary			
• Option delivers against objectives, replicating many of the connectivity benefits of MLX. • Key risk over deliverability related to land required to secure segregated route on section to Watford High Street.			

8.38 Figure 8.11 presents the indicative land take impact on the WGGS of the construction of the MRT1 option. As described above, a permanent land take strip would need to be taken off the WGGS and, in addition, an additional land strip would need to be taken off to allow for the alignment construction, which would involve the demolishing of one of the buildings of the school (white line in the figure below). We consider this is a deliverability showstopper from an acceptability point of view.

Figure 8.9: Indicative permanent and construction land take at WGGS



Mass Rapid Transit Option 2 – Croxley Branch to Watford Junction via Wiggenhall Road

Option Description

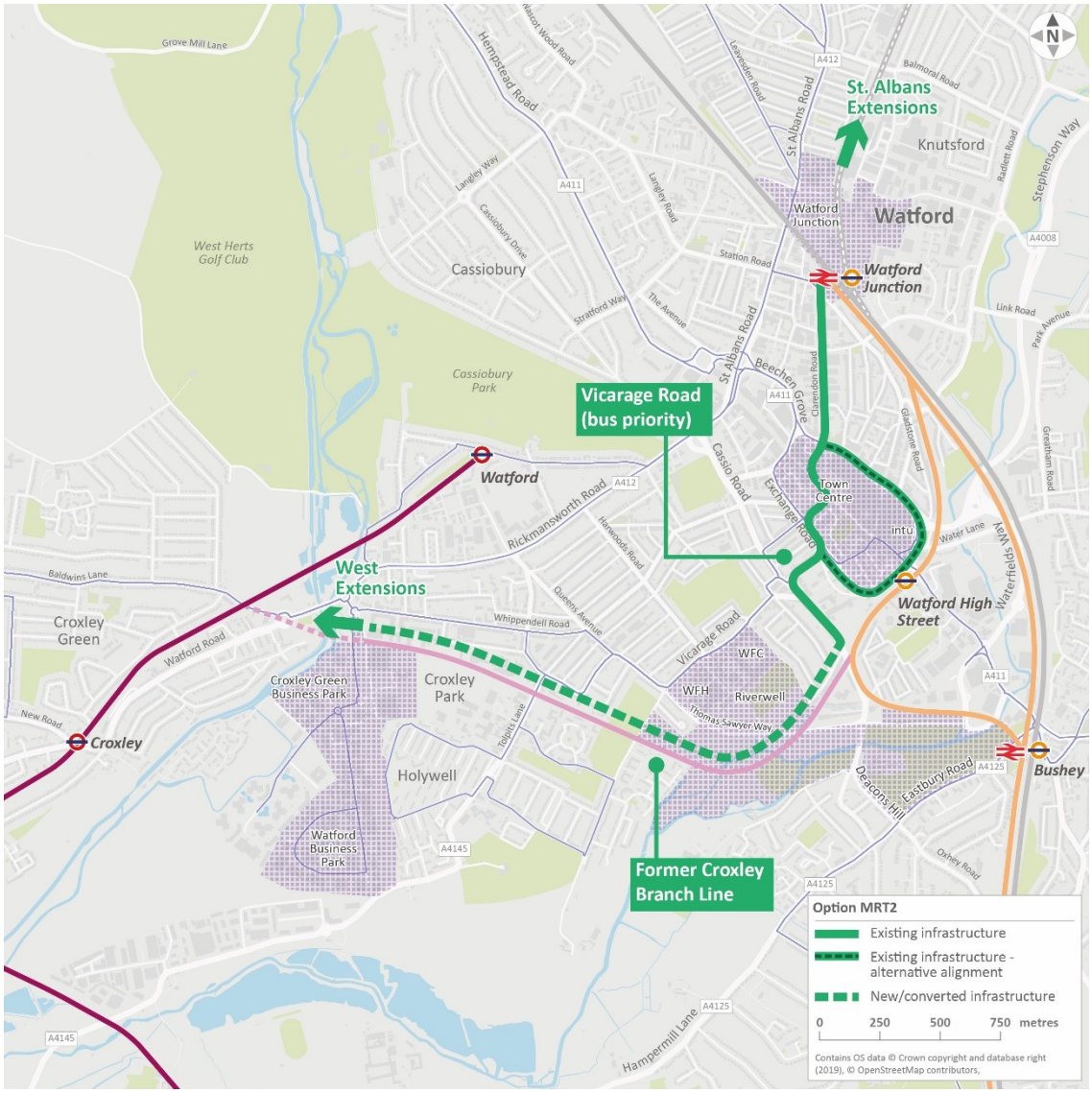
8.39 This option involves the use of a priority lane running down Clarendon Road and along Exchange Road (between Market Street and Vicarage Road). There is then shared running along Vicarage Road to Merton Road and along Wiggenhall Road to the former rail overbridge. There is then a new segregated route running along the Croxley Branch alignment to Ascot Road. There is also the potential to include filtering and/or bus priority to reduce congestion for services along Vicarage Road.

8.40 There are a number of possibilities for this MRT option to go through the city centre. For instance, if Exchange Road were converted to a 2-way carriageway, the alignment could use this in both directions; otherwise it could go through High Street through the town centre in one direction and using Exchange Road in the other direction, mirroring the operating patterns of the current bus lines. Alternatively, if there was an intervention on the bridge west of Exchange Road that would allow to have bus priority, this could be an alternative for the option to get to Vicarage Road.

8.41 Compared to MRT Option 1, this option routes through Watford town centre using shared running rather than a segregated route along the ring road. Journey times are likely to be slower due to narrow roads and increased levels on congestion on roads such as Market Street, where

most bus services currently route. The alternative route using the ring road between Clarendon Road and Vicarage Road would be able to serve Watford High Street.

Figure 8.10: Mass Rapid Transit Option 2 – Croxley Branch to Watford Junction via Wiggenhall Road



Option Assessment

Table 8.9: MRT Option 2 Assessment

MRT2	
Description & cost	
Key features of option	• MRT service through Clarendon Road, Exchange Road/town centre and connecting to the Croxley Branch through Wiggenhall Road • Route length 4.2km, of which 2.4km on new infrastructure and 1.8km on existing road.
Indicative cost / Cost category	• ££ (medium)
Transport benefits / constraints (operational)	

Key benefits (transport)	• Segregated route along the Croxley Branch alignment will provide faster journey times and a more reliable service than conventional bus	
Key issues / constraints (transport)	• Potential slower journey times and less reliable services due to routing through the Watford town centre with shared running	
Fit with Scheme Objectives / wider priorities		
Strategic connectivity	**4**	• Provides direct connectivity to Watford Junction, enabling access to the wider area through rail services
Local connectivity	**4**	• Provides direct connectivity to Watford town centre and to key developments on the Croxley Branch corridor. Potential slower journey times due to congestion in Watford town centre.
Enhancing cycling and walking provision	**1**	• Routes through the town centre. The impact on traffic in the area depends on the level of mode shift from car to bus • Potential to implement cycle/walking paths along the Croxley Branch alignment
Complementarity with other local objectives	**3**	• Routes through the town centre which might add to congestion. The overall impact on depends on the level of mode shift from car to bus
Supporting wider connectivity	• Potential to integrate with the planned Hertfordshire BRT network (e.g. St. Albans extension) and a potential Park and Ride site at Junction 5 of the A41 • Potential to extend the services westbound towards Rickmansworth and south west of Watford area	
Deliverability Assessment		
Key Deliverability Issues	**Moderate** • Access from Croxley Green alignment onto Wiggenhall Road (bridge and retaining walls) presents feasibility challenge, and costly. • The transitway would need to be raised to the level of Wiggenhall Road with a retained ramp, with the possibility to rebuild the current bridge. • Challenging to secure attractive journey times on-street, as Wiggenhall Road is a narrow residential street. • Acceptability risk, as residents affected by retaining walls and on Wiggenhall Road may object • Value for money uncertain • Lower cost than MLX (and rail, LUL options), but affordability uncertain.	
Overall deliverability risk	**Medium**	Overall risk assessment as medium – challenging issues but no showstoppers
Overall summary		
• Option delivers against objectives (though not as well as MRT1 due to on-street sections). • Deliverability challenges but no showstoppers.		

Mass Rapid Transit Option 3 – Croxley Branch to Watford Junction via Thomas Sawyer Way

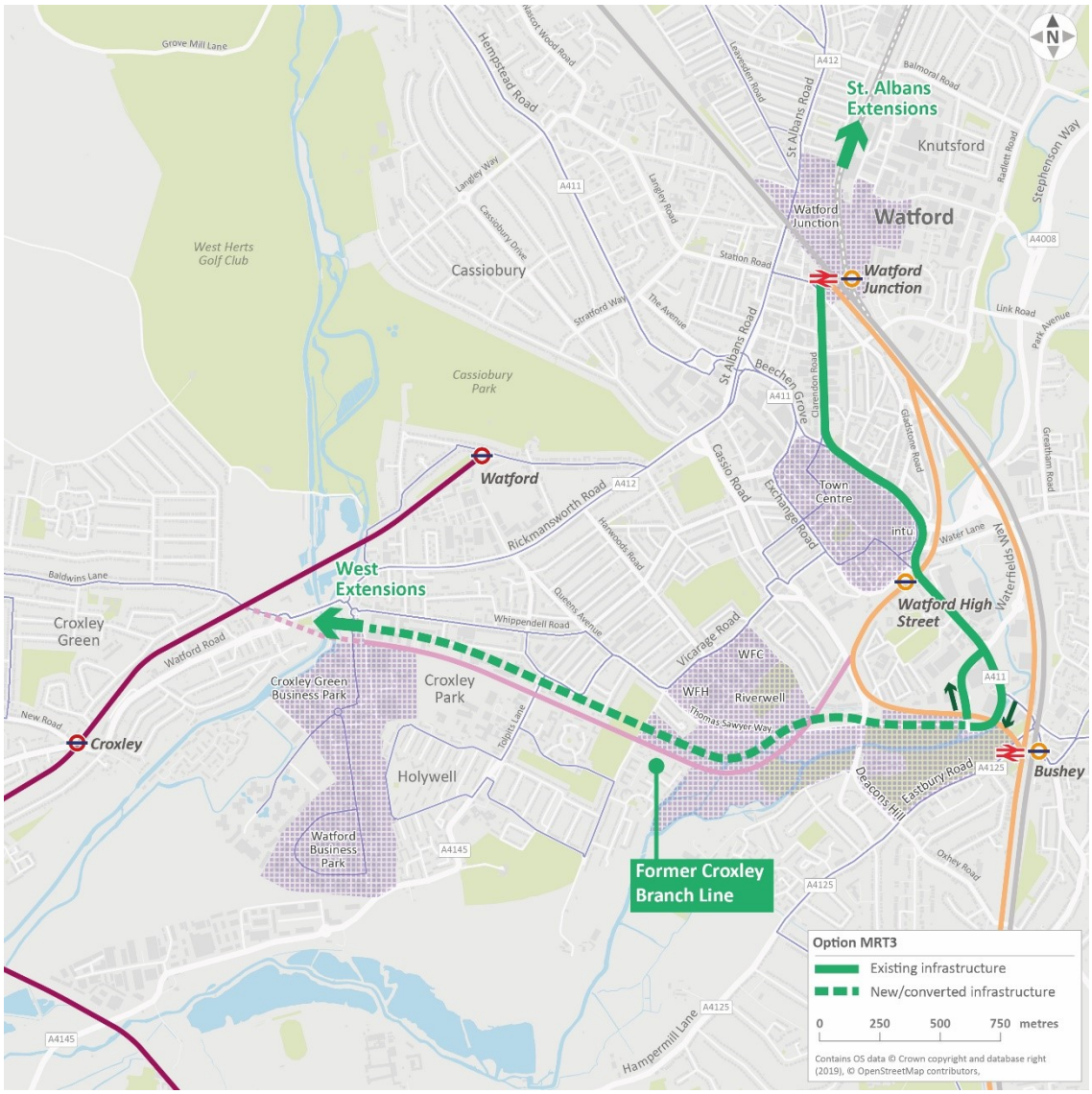
Option Description

8.42 This option involves the use of a priority lane running down Clarendon Road and Exchange Road to Watford High Street station. There is then a new segregated route from Watford High Street station to the former rail overbridge at Vicarage Road, via Lower High Street, Dalton Way gyratory, Thomas Sawyer Way and the Croxley Branch alignment to Ascot Road.

8.43 Compared to the other MRT options, this option would use a fully segregated route from Watford High Street station, improving journey times and service reliability. However, the route provides less direct connectivity to key attractors, such as Watford Stadium and Watford Hospital.

8.44 Faster journey times would be attractive for an MRT options that expands beyond the core Watford area (towards St. Albans and Rickmansworth).

Figure 8.11: Mass Rapid Transit Option 3 – Croxley Branch to Watford Junction via Thomas Sawyer Way



Option Assessment

Table 8.10: MRT Option 3 Assessment

MRT3	
Description & cost	
Key features of option	• MRT service through Clarendon Road, Exchange Road, Lower High St to Thomas Sawyer Way connecting to the Croxley Branch • Route length 4.8km, of which 2.0km on new infrastructure and 2.8km on existing road.
Indicative cost / Cost category	• ££ (medium)
Transport benefits / constraints (operational)	
Key benefits (transport)	• Segregated route from Watford High Street station would improve journey times and service reliability

	• Faster journey times for journeys on the wider network (e.g. from St. Albans and Rickmansworth) due to a more segregated route through the town centre	
Key issues / constraints (transport)	• Connection of Thomas Sawyer Way with Croxley Branch would need to be at-grade, which would require rebuilding the new bridge. With the current development plans, this needs to be actioned in the short-term.	
Fit with Scheme Objectives / wider priorities		
Strategic connectivity	**4**	• Provides direct connectivity to Watford Junction, Watford High Street and Bushey, enabling access to the wider area through rail services
Local connectivity	**4**	• Less local connectivity than the other MRT options, as the route would not directly serve the town centre / key routes such as Vicarage Road, but faster journey time due to likely segregation • Provides direct connectivity to key developments on the Croxley Branch corridor • Serves the Lower High Street area, which could be a target for mixed-used developments in Watford Borough Council's upcoming Local plan
Enhancing cycling and walking provision	**1**	• Potential to implement cycle/walking paths along the Croxley Branch alignment and the segregated route (e.g. Thomas Sawyer Way)
Complementarity with other local objectives	**3**	• Contributes to target of reducing general traffic around town centre by providing an alternative mode - however this is dependent on mode shift.
Supporting wider connectivity	• Potential to integrate with the planned Hertfordshire BRT network (e.g. St. Albans extension) and a potential Park and Ride site at Junction 5 of the A41 • Potential to extend the services westbound towards Rickmansworth and south west of Watford area	
Deliverability Assessment		
Key Deliverability Issues	**Low** • Infrastructure cost and complexity less challenging than other MRT options (notwithstanding the point above). More acceptable and less risk of objections at Inquiry.	**Moderate** • Need to secure ability to connect between Croxley Branch alignment and Thomas Sawyer Way. Current development proposals mean this needs to be integrated into near-term plans. • Routing via Lower High Street and Dalton Way is longer, but highway alignment allows for priority to be given to MRT meaning journey times could be comparable, and reliability likely to be better. • Value for money uncertain. • Lower cost than MLX and MRT1 & 2, but affordability uncertain.
Overall deliverability risk	**Medium**	Overall risk assessment as medium – challenging issues but no showstoppers. Likely to be more deliverable that other MRT options provided

		connection from Thomas Sawyer Way to Croxley Green alignment can be safeguarded.
Overall summary		
• Option delivers against objectives. • Some deliverability challenges but no showstoppers.		

Segregated Pod Options – Overview

Description of Personal Rapid Transit or Pods in the MLX Alternatives Context

Personal Rapid Transit or Pods, in the context of this report, refer to lightweight rubber-tyred, battery-powered vehicles, with segregated operation on elevated guideways and capacity to carry between four and six passengers, and other items such as bicycles, per vehicle.

The route options which have been considered are the same as for the MRT options presented above, displaying a range of potential connectivity benefits and infrastructure constraints.

The key features of PRT for the purpose of this assessment are that:

- Similar to the MRT options, the route options have been developed to meet the scheme objectives in terms of the transport outputs they deliver and the locations they would serve.
- Operation through segregated infrastructure throughout their journey allows to potentially achieve relatively quick journey times (maximum pod speed is between 30 and 35 mph) and journey reliability, as it does not operate alongside other modes.
- The capacity of a pod is significantly lower than capacity of other options (4 to 6 passengers per vehicle), but the system allows short headways between vehicles (with a theoretical minimum of 6 seconds). However, the level of service in practice will be determined by the demand at a given moment, as pods operate as an on-demand service.
- These PRT options require the construction of elevated guideways in a dense urban centre. For each of the three route solutions, there is existing infrastructure that may constitute a constraint to build the elevated guideways at certain locations. This appears more prominent for the option where pods have to travel through Watford town centre. Likewise, operation of pods close to an operational railway may equally constitute a barrier from a safety point of view.
- Pods are complementary with other modes of transport, particularly active modes such as walking or cycling, given that a dedicated route for pedestrians and cyclists can be built beneath the guideways.

Segregated Pods Option 1 – former Croxley Branch Line to Watford Junction via Watford High Street

Option Description

8.45 This option follows the same route as MRT option 1 (the description of the route can be found in the section named *Routing of MRT Options through Watford Town Centre*).

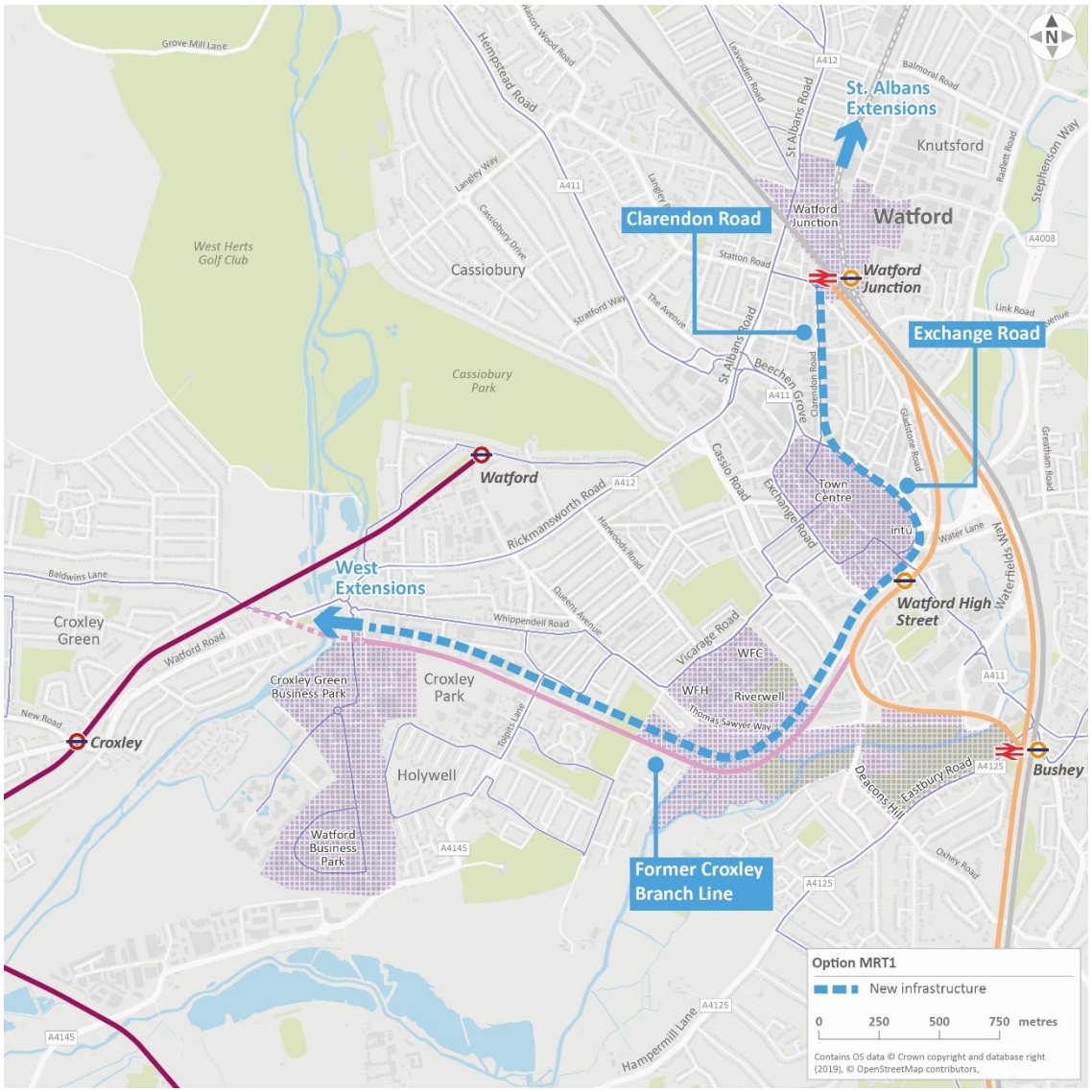
8.46 The main characteristics of this option, in comparison with MRT option 1, are the following:

- Local connectivity benefits might be higher for this option than for MRT option 1, given that it is an on-demand service, reducing wait times, and it operates on segregated infrastructure, providing quicker and more reliable journey times.

- The elevated guideway would need new infrastructure along the entire corridor, including new structures. These may present challenges from a deliverability and stakeholder acceptability perspective, for instance, along Clarendon Road.
- Costs and system deliverability are uncertain, as there are no similar operational PRT systems in dense urban areas in the UK (the most similar example is the Heathrow pods which presented less severe deliverability constraints).
- Similarly, consideration will need to be given to the constraints associated with operating pods alongside an operational railway between the Croxley Branch Line and Exchange Road near Watford High Street.

8.47 The assessment of this option is presented in the section below.

Figure 8.12: Segregated Pods Option 1 – Croxley Branch to Watford Junction via Watford High Street



Option Assessment

Table 8.11: Segregated Pods Option 1 Assessment

Pods 1	
Description & cost	
Key features of option	• Segregated pods through Clarendon Road, Exchange Road and connecting to Croxley Branch Line through Watford Girls Grammar School • Route length 4.2km, all of which is on new infrastructure (elevated guideways).
Indicative cost / Cost category	• ££ (medium)
Transport benefits / constrains (operational)	
Key benefits (transport)	• On-demand service operating on a segregated infrastructure throughout the entire will provide faster journey times and a more reliable service than other options, including MRT.

Key issues / constraints (transport)	• Requires the use of land from the WGGS playing fields. • Stakeholder acceptability, particularly in certain sections of the route, such as Clarendon Road.	
Fit with Scheme Objectives / wider priorities		
Strategic connectivity	**4**	• Provides direct connectivity to Watford Junction and Watford High Street, enabling access to the wider area through rail services (equivalent to MRT options)
Local connectivity	**5**	• Delivers the best connectivity of all the PRT options. Provides direct connectivity to Watford Junction, Watford High Street, Watford town centre and key developments on the Croxley Branch corridor
Enhancing cycling and walking provision	**1**	• Potential to implement cycle/walking paths beneath the guideways, although this needs further detail to fully assess its viability
Complementarity with other local objectives	**4**	• Contributes to target of reducing general traffic around town centre by providing an alternative mode - however this is dependent on mode shift.
Supporting wider connectivity	• Potential to extend system along Abbey Line towards St Albans • Potential to extend the services westbound towards Rickmansworth and south west of Watford area, although the option becomes less efficient for serving less populated surburban areas.	
Deliverability Assessment		
Key Deliverability Issues	**Moderate** • The right of way for the PRT route may require some of the school grounds but the permanent land take would be lower than in the case of MRT. Impact on existing buildings would need to be assessed in detail, but remains uncertain. • Construction access is constrained by the proximity of the existing rail line. Feasibility of construction and operation of PRT near or above the Overground line would need to be assessed in more detail, but would present significant deliverability challenges. • Alignment would run close to existing buildings and elicit potential objections. This is more significant than for MRT options, given that pods would operated on elevated gudieways. • Value for money uncertain, given that demand projections and capital expenditure are both uncertain. • Lower cost than MLX (and rail, LUL options), but affordability for the promoter uncertain.	
Overall deliverability risk	**Medium-High**	Required temporary and permanent land required at WGGS, but potentially permanent land take is less than for MRT Option 1. The main deliverability challenge is the feasibility and acceptability of constructing and operating PRT within 'railway land', which would need to be assessed in more detail.
Overall summary		
• Option delivers against objectives, replicating many of the connectivity benefits of MLX. • Key risk over deliverability related to land required to secure segregated route on section to Watford High Street.		

8.48 A potential variant of this option would be the operation of PRT between Watford High Street and Watford Junction alongside or above the Overground line. This would present similar

deliverability challenges around constructability and operation of PRT within railway land which would need to be explored in more detail.

8.49 Compared to the option presented above, it removes the feasibility constraints along Exchange Road and Clarendon Road, but increases the overall feasibility of its construction and operation, as explained above, and provides lower local connectivity and it does not serve directly the town centre, other than at Watford High Street station.

8.50 This would result in a trade off in the scoring of the option combining a lower local connectivity (down to a score of 4 from a score of 5 for the option considered in this section), due to the fact this option would no longer serve the town centre directly, and a potentially better feasibility and lower deliverability risk, subject to a detailed investigation. This is because it removes the constraints in the town centre (still with a deliverability risk of medium high as the risk of constructing and operating PRT within railway land still needs to be explored in more detail).

Segregated Pods Option 2 – Croxley Branch to Watford Junction via Wiggenhall Road

Option Description

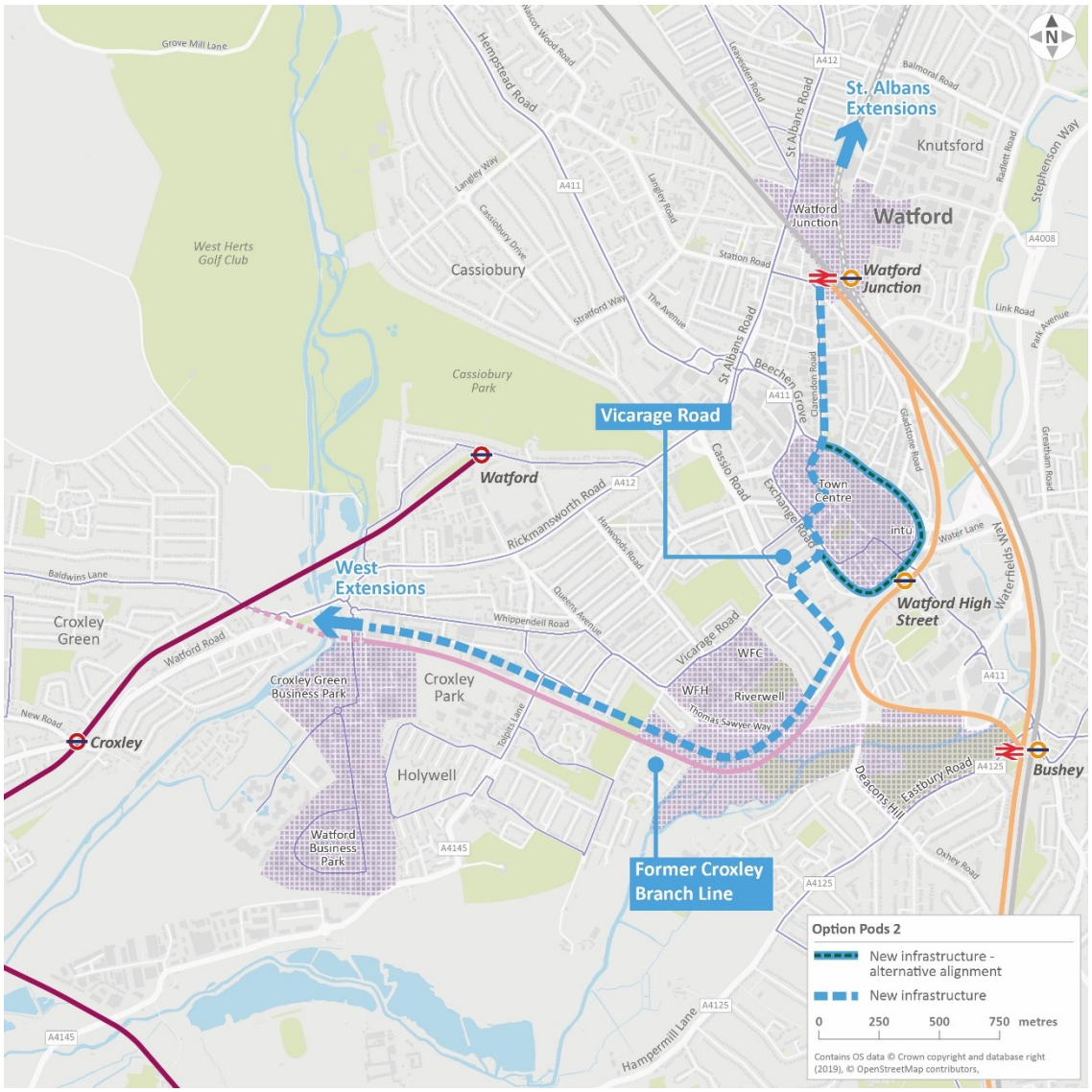
8.51 This option follows the same route as MRT option 2 (the description of the route can be found in the section named *Mass Rapid Transit Option 2 – Croxley Branch to Watford Junction via Wiggenhall Road*).

8.52 The main characteristics of this option, in comparison with MRT option 2, are the following:

- Similar to Pods option 1, local connectivity benefits might be higher for this option than for MRT option 2, given that it is an on-demand service, reducing wait times, and it operates on segregated infrastructure, providing quicker and more reliable journey times.
- The elevated guideway would need new infrastructure along the entire corridor, including new structures. In particular, its construction through Watford town centre and especially Vicarage Road appears particularly challenging. While Exchange Road could be used to avoid the town centre, there are no obvious alternatives to Vicarage Road. A more detailed assessment on the impact of traffic if Vicarage Road were to be used should be undertaken.
- Costs and system deliverability are uncertain, as there are no similar operational PRT systems in dense urban areas in the UK (the most similar example is the Heathrow pods which presented less severe deliverability constraints).

8.53 The assessment of this option is presented in the section below.

Figure 8.13: Segregated Pods Option 2 – Croxley Branch to Watford Junction via Wiggenhall Road



Option Assessment

Table 8.12: Segregated Pods Option 2 Assessment

Pods 2	
Description & cost	
Key features of option	• Segregated pods through Clarendon Road, Exchange Road/town centre and connecting to the Croxley Branch through Wiggenhall Road • Route length 4.2km, all of which is on new infrastructure (elevated guideways).
Indicative cost / Cost category	• ££ (medium)
Transport benefits / constraints (operational)	
Key benefits (transport)	• On-demand service operating on a segregated infrastructure throughout the entire will provide faster journey times and a more reliable service than other options, including MRT.

Key issues / constraints (transport)	• Stakeholder acceptability, particularly in certain sections of the route, such as Vicarage Road or Clarendon Road.	
Fit with Scheme Objectives / wider priorities		
Strategic connectivity	**4**	• Provides direct connectivity to Watford Junction and Watford High Street, enabling access to the wider area through rail services (equivalent to MRT options)
Local connectivity	**5**	• Delivers the same local connectivity as Pods option 1. Provides direct connectivity to Watford Junction, Watford High Street, Watford town centre and key developments on the Croxley Branch corridor
Enhancing cycling and walking provision	**1**	• Potential to implement cycle/walking paths beneath the guideways, although this needs further detail to fully assess its viability
Complementarity with other local objectives	**4**	• Contributes to target of reducing general traffic around town centre by providing an alternative mode - however this is dependent on mode shift.
Supporting wider connectivity		• Potential to extend the services westbound towards Rickmansworth and south west of Watford area, although the option becomes less efficient for serving less populated surburban areas. • Potential to extend system along Abbey Line towards St Albans
Deliverability Assessment		
Key Deliverability Issues	**High** • Access from Croxley Green alignment onto Wiggenhall Road (bridge and retaining walls) presents feasibility challenge, and costly. • Construction of elevated guideway on Wiggenhall Road and Vicarage Road presents feasibility challenge given the physical constraints of both roads, which are narrow.	**Moderate** • Alignment would run close to existing buildings and elicit potential objections. This is more significant than for MRT options, given that pods would operated on elevated gudieways. • Acceptability risk, as residents affected by retaining walls and on Wiggenhall Road may object • Value for money uncertain, given that demand projections and capital expenditure are both uncertain. • Lower cost than MLX (and rail, LUL options), but affordability for the promoter uncertain.
Overall deliverability risk	**High**	Construction of elevated guideway on Vicarage Road is a likely showstopper. Stakeholder acceptability could be an issue, but does not appear to be a showstopper.
Overall summary		
• Option delivers against objectives similarly to Pods option 1. • Deliverability challenges around construction of elevated guideway along Vicarage Road.		

Segregated Pods Option 3 – Croxley Branch to Watford Junction via Thomas Sawyer Way

Option Description

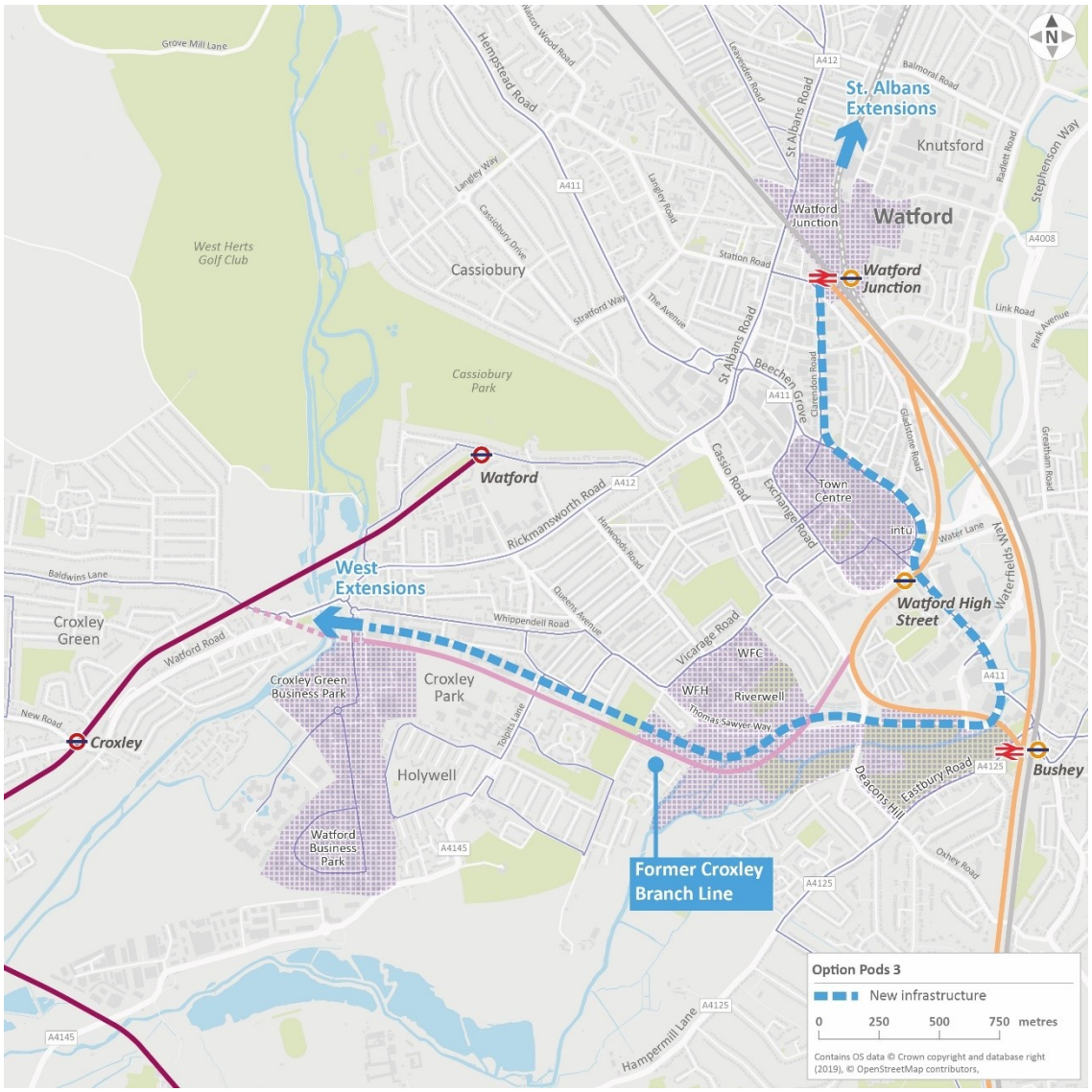
8.54 This option follows the same route as MRT option 3 (the description of the route can be found in the section named *Mass Rapid Transit Option 3 – Croxley Branch to Watford Junction via Thomas Sawyer Way*).

8.55 The main characteristics of this option, in comparison with MRT option 3, are the following:

- While local connectivity benefits might be higher for this option than for MRT option 3 (given that it is an on-demand service, reduces wait times, and operates on segregated infrastructure, providing quicker and more reliable journey times), these are lower than for Pods options 1 and 2 as it does not fully serve Watford town centre and journey times are longer.
- The elevated guideway would need new infrastructure along the entire corridor, including new structures. The physical constraints for this option are less material than for Pods options 1 and 2.
- Costs and system deliverability are also uncertain, as there are no similar operational PRT systems in dense urban areas in the UK (the most similar example is the Heathrow pods which presented less severe deliverability constraints).

8.56 The assessment of this option is presented in the section below.

Figure 8.14: Segregated Pods Option 3 – Croxley Branch to Watford Junction via Thomas Sawyer Way



Option Assessment

Table 8.13: Segregated Pods Option 3 Assessment

Pods 3	
Description & cost	
Key features of option	• Segregated pods service through Clarendon Road, Exchange Road, Lower High St to Thomas Sawyer Way connecting to the Croxley Branch • Route length 4.8km, of which all of it is on new infrastructure
Indicative cost / Cost category	• ££ (medium)
Transport benefits / constraints (operational)	
Key benefits (transport)	• On-demand service operating on a segregated infrastructure throughout the entire will provide faster journey times and a more reliable service than other options, including MRT.

	• Journey times might be longer than for alternative Pods options due to longer end-to-end routing.	
Key issues / constraints (transport)	• Stakeholder acceptability, particularly in certain sections of the route, such as Clarendon Road.	
Fit with Scheme Objectives / wider priorities		
Strategic connectivity	**4**	• Provides direct connectivity to Watford Junction and Watford High Street, enabling access to the wider area through rail services (equivalent to MRT options)
Local connectivity	**4**	• Delivers good local connectivity but lower than other PRT options, given that it does not directly serve Watford town centre.
Enhancing cycling and walking provision	**1**	• Potential to implement cycle/walking paths beneath the guideways, although this needs further detail to fully assess its viability
Complementarity with other local objectives	**3**	• Contributes to target of reducing general traffic around town centre by providing an alternative mode - however this is dependent on modal shift. Given that it does not serve town centre, potential for modal shift is lower than other pods options.
Supporting wider connectivity	• Potential to extend system along Abbey Line towards St Albans • Potential to extend the services westbound towards Rickmansworth and south west of Watford area, although the option becomes less efficient for serving less populated surburban areas.	
Deliverability Assessment		
Key Deliverability Issues	**Moderate** • Need to secure ability to connect between Croxley Branch alignment and Thomas Sawyer Way. Current development proposals mean this needs to be integrated into near-term plans, which appears to have already been done. • Infrastructure complexity less challenging than other pods options (notwithstanding the point above). More acceptable and less risk of objections at Inquiry. • Value for money uncertain, given that demand projections and capital expenditure are both uncertain. • Lower cost than MLX (and rail, LUL options), but affordability for the promoter uncertain.	
Overall deliverability risk	**Medium-high**	Overall risk assessment as medium-high – challenging issues, more complex than equivalent MRT option but no showstoppers. Likely to be more deliverable that other pods options provided connection from Thomas Sawyer Way to Croxley Green alignment can be safeguarded.
Overall summary		
• Option delivers against objectives, but lower local connectivity than other pod options. • Some deliverability challenges but no showstoppers.		

Conventional Bus Option 1 – Enhancement of Bus Corridor

Option Description

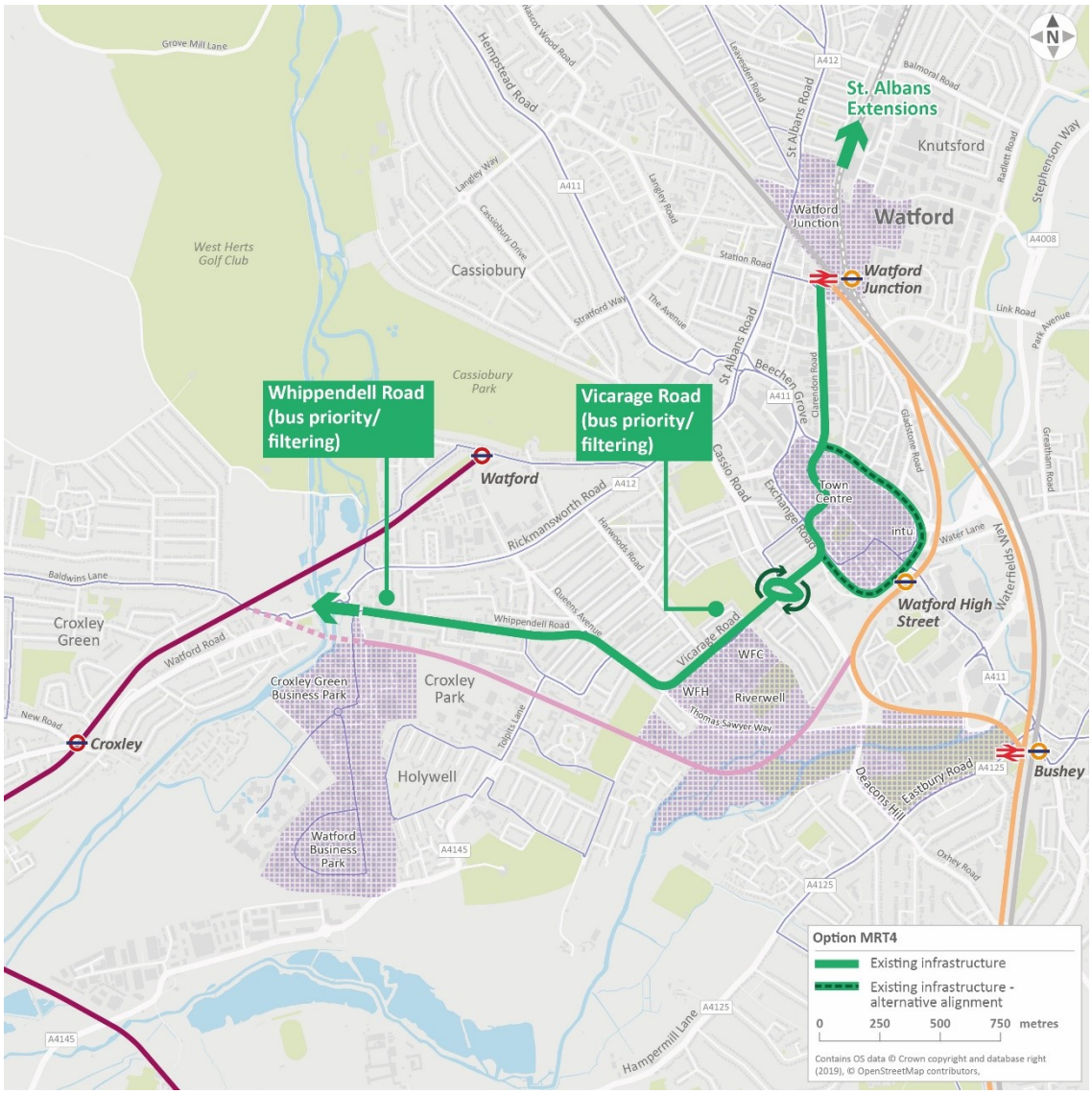
8.57 This option involves improving the existing bus corridor. The route is used by the majority of bus services in Watford and uses a priority lane running down Clarendon Road and along Exchange Road or High Street (between Market Street and Vicarage Road – see options to go through town centre on MRT Option 2). There is then shared running along Vicarage Road to Watford General Hospital towards Whippendell Road.

8.58 There is the potential to include filtering and/or bus priority to reduce congestion for services along Vicarage Road, although it should be noted that this is a very narrow street and the knock-on impact on generally traffic would need to be studied in more detail. Bus priority was identified as the main action point by bus operators involved in the development of the Intalink Strategy.

8.59 As this option uses shared running rather than a segregated route, it can be thought as a conventional bus option rather than MRT. Journeys would therefore be slower and potentially less reliable in comparison. The route also does not serve local connectivity objectives as well as the MRT options. However, implementing a conventional bus service has a lower cost, could be incrementally phased and could be done in addition to other transit interventions in response to more local connectivity objectives.

8.60 There is the potential to improve the current bus network without the requirement to significantly invest in any infrastructure enhancement, simply by optimising the current bus offer. We would recommend that this option be explored in addition to any preferred transit option (or as an initial phase of a given intervention) as part of a subsequent study.

Figure 8.15: Conventional Bus Option 1 – Watford Junction via Vicarage Road / Whippendell Road



Option Assessment

Table 8.14: Conventional Bus Option Assessment

BUS1	
Description & cost	
Key features of option	• Conventional bus using Clarendon Road, town centre/Exchange Road, Vicarage Road and Whippendell Road through to Watford Road • Route length 3.6km, of which all is existing infrastructure.
Indicative cost / Cost category	• £ (low)
Transport benefits / constraints (operational)	
Key benefits (transport)	• Potential bus priority/filtering – improved journey times and reliability in comparison to existing bus services • Potential for optimisation of current bus offer with relatively 'light touch' adjustments

Key issues / constraints (transport)	• Lack of route segregation – slower and less reliable journeys	
Fit with Scheme Objectives / wider priorities		
Strategic connectivity	**2**	• Does not provide any additional connections – instead improves an existing corridor
Local connectivity	**2**	• Less local connectivity the MRT options, as the route would not directly serve key developments on the former Croxley Branch Line corridor
Enhancing cycling and walking provision	**0**	• Low potential to implement cycle/walking paths as there is no segregated running
Complementarity with other local objectives	**1**	• Routes through the town centre which might add to congestion. The overall impact on depends on the level of mode shift from car to bus
Supporting wider connectivity	• Potential to integrate with the planned Hertfordshire BRT network (e.g. St. Albans extension), although lower potential than MRT options as this is only considered as an incremental option to the current bus offer	
Deliverability Assessment		
Key Deliverability Issues	**Low** • Delivery of modest incremental improvements are possible, but constraints on existing highway (narrow roads and frontage activity) mean that scale of improvement will be modest compared with other options.	
Overall deliverability risk	**Low**	Overall risk assessment as low
Overall summary		
• Would not deliver against scheme objectives but may have merits in their own terms in delivering incremental improvements for existing bus services and passengers. • Incremental improvements would be deliverable. • Can be analysed in more detailed as a complementary/initial phase intervention to any other transit alternative		

Highway Option 1 – Conversion of former Croxley Branch Line to Southern Access Road

Option Description

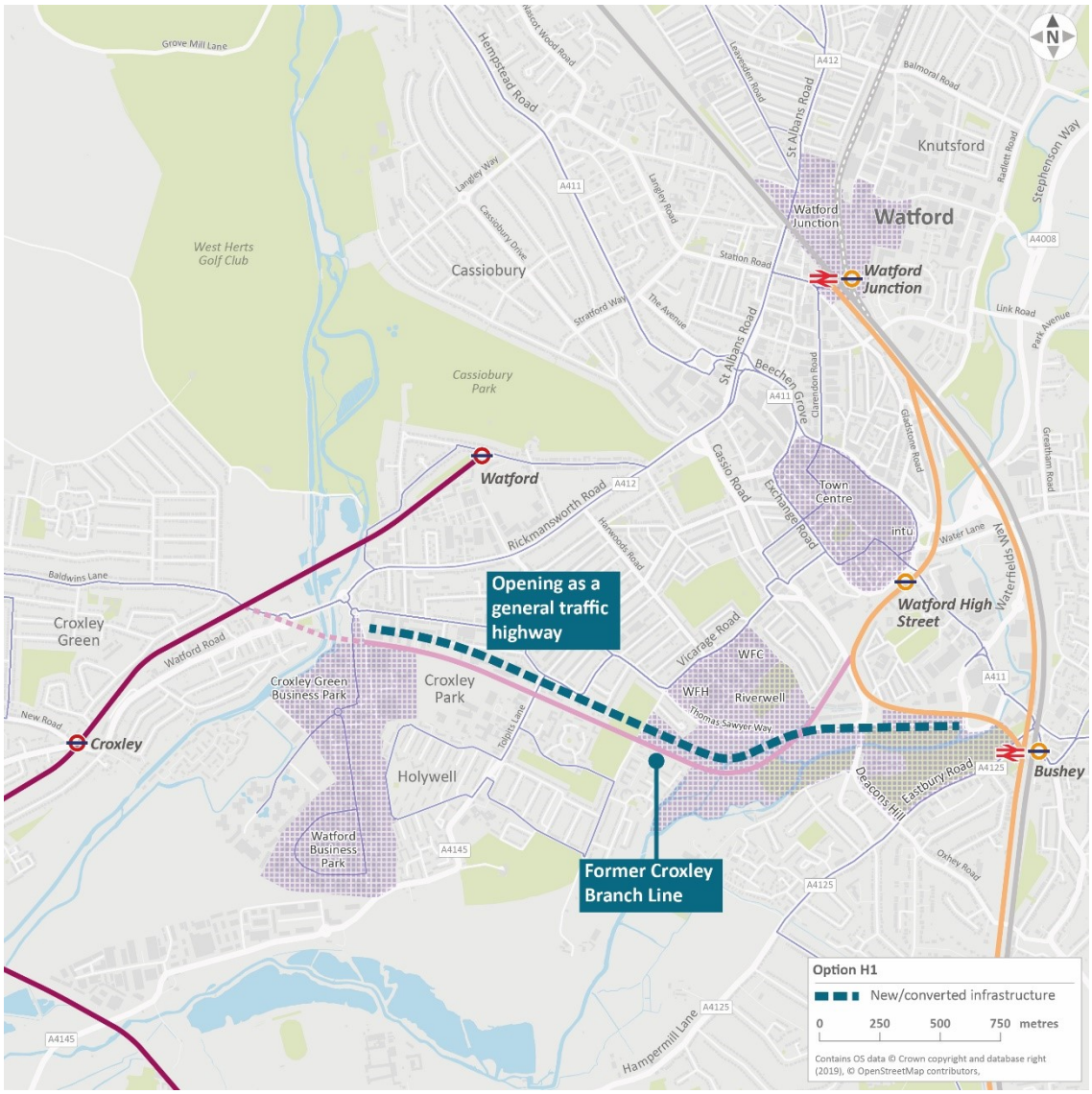
8.61 This option would involve extending the existing Thomas Sawyer Way road from the Riverwell development site to Ascot road, via the former Croxley Branch Line, and opening the road to general traffic. A new junction could be provided to Willow Lane (by removing the existing bus gate), Vicarage road and/or Tolpits Lane. This would effectively provide a 'Southern bypass' to Watford, between the Bushey and Croxley areas.

8.62 The resulting route is essentially the same as for Option MRT3, but for general traffic rather than MRT. The lack of segregation from Watford High Street to Ascot Road, which could be achieved partially for MR through bus priority/filtering, would mean higher levels of congestion and longer journey times in comparison. However, the provision of a southern by-pass could enable traffic reduction on other corridors and allow for improved priority for bus (or a prospective MRT route), for example along Rickmansworth Road which provides the more direct connection from St. Albans towards Rickmansworth via Watford.

8.63 The option could also be combined with MRT3, whereby MRT (or bus) services could operate along the new by-pass route. However, the risk would be that in permitting general traffic on the route will reduce the journey times and journey times reliability than can be provided to MRT.

8.64 Also, this option is not in line with the policy priorities, which seek to incentivise a shift to more sustainable modes of transport, so it would not meet those objectives.

Figure 8.16: Highway Option 1 – Conversion of former Croxley Branch Line to Southern Access Road



Option Assessment

Table 8.15: Highway Option Assessment

H1	
Description & cost	
Key features of option	• Conversion of Croxley Branch into general traffic highway, joining Thomas Sawyer Way • Route length 2.0km, of which all is new infrastructure.
Indicative cost / Cost category	• £££ (high)
Transport benefits / constraints (operational)	
Key benefits (transport)	• A southern by-pass could enable traffic reduction and space for bus priority on other key corridors, such as Rickmansworth Road
Key issues / constraints (transport)	• Loss of segregated bus access along the route (in comparison to Option MRT3) – increased congestion and journey times

Fit with Scheme Objectives / wider priorities		
Strategic connectivity	**2**	• Does not provide additional direct connectivity to the wider Watford or Hertfordshire region
Local connectivity	**2**	• Does not directly serve Watford town centre, making it unlikely to be used for commuting journeys • Provides connectivity to key developments on the former Croxley Branch Line corridor
Enhancing cycling and walking provision	**0**	• Lack of segregation might prevent the implementation of cycle/walking paths, although this would require further investigation.
Complementarity with other local objectives	**2**	• The impact on traffic in the area depends on whether the option would enable traffic reduction on other key routes (which are located more towards the town centre) • This option would not be compliant with the policy objectives associated to a shift to more sustainable modes of transport
Supporting wider connectivity	• This southern by-pass might help to decongest Rickmansworth Road and would enable to ease traffic congestion on a wider area	
Deliverability Assessment		
Key Deliverability Issues	**Moderate** • Likely to be unacceptable on policy grounds unless accompanied by wider traffic reduction measures on other radial corridors. • Traffic impacts uncertain, with potential impacts where the new route joins the local road network. • This also presents a risk at any future Inquiry.	
Overall deliverability risk	**Medium-High**	Overall risk assessment as medium-high
Overall summary		
• Not considered to take forward – deliverability and fit with objectives and policy		

Walking and Cycling Option 1 – Conversion of former Croxley Branch Line to Cycle Route

Walking and Cycling

- The option below is assessed as a 'freestanding' option, against the project objectives
- Within assessment of all options, we comment on compatibility of options with enhancement of cycling

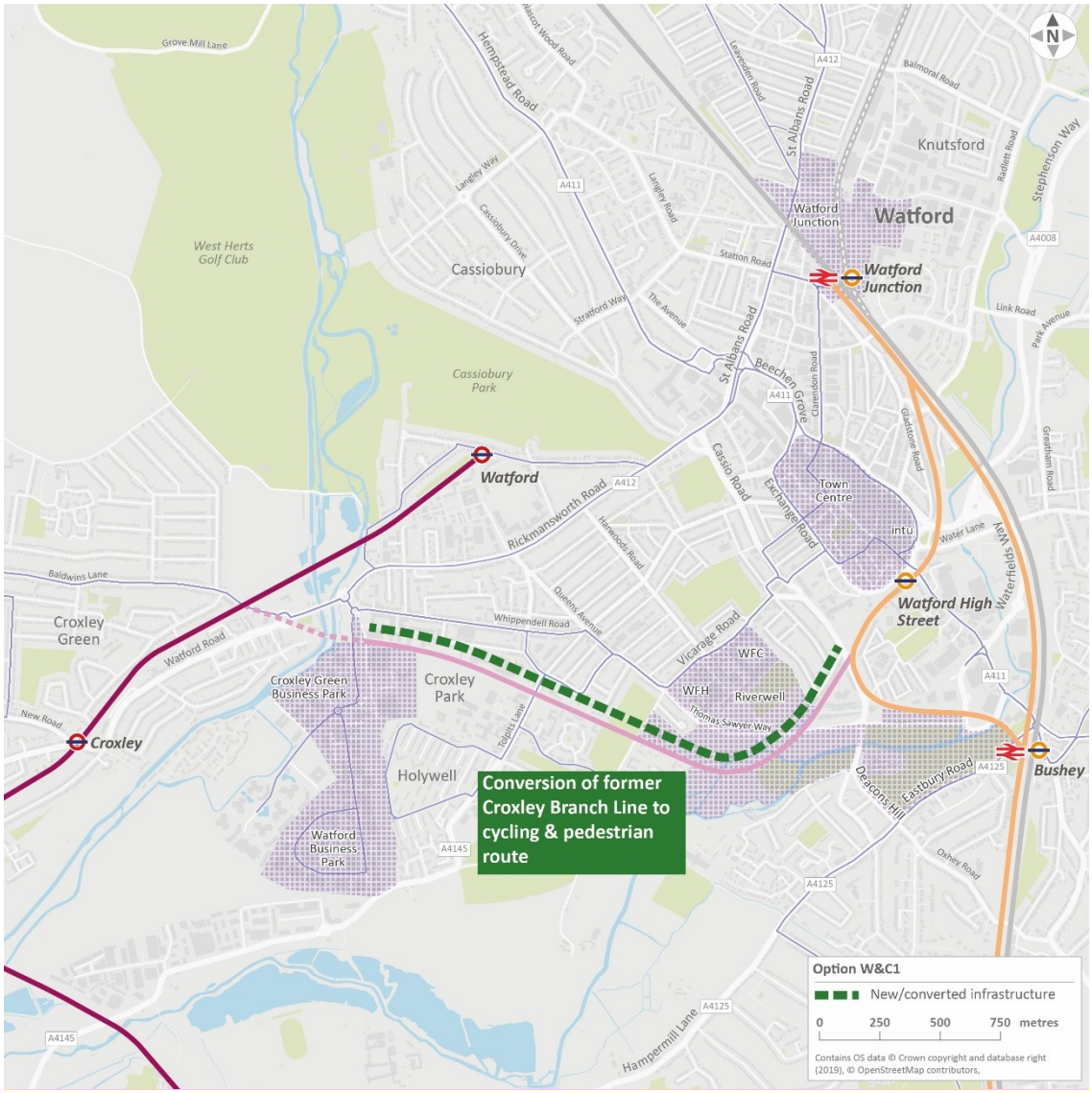
Option Description

8.65 This option would involve converting the former Croxley Branch Line alignment into a walking and cycling route, broadly between the River Gade/Grand Union Canal at Ascot Road, the River Colne at Riverside Park, and Wiggenhall Road. Access onto local streets could also be provided.

8.66 This option is likely to be the cheapest of those that reuse the Croxley corridor, but makes a limited contribution to the scheme objectives of supporting development and improving accessibility along the corridor. The route would not directly serve Watford Town Centre, and is hence likely to be poorly used for commuting journeys. However, it could form a popular leisure route.

8.67 In addition, this option could be considered as an interim stage before the development of a transit option, as described above. We have discussed the compatibility of walking and cycling with all options.

Figure 8.17: Walking and Cycling Option 1 – Conversion of former Croxley Branch Line to Cycle Route



Option Assessment

Table 8.16: Walking and Cycling Option Assessment

WC1	
Description & cost	
Key features of option	• Conversion of Croxley Branch into walking and cycling route up to Wiggenhall Road • Route length 2.6km, of which all is new infrastructure.
Indicative cost / Cost category	• ££ (medium)
Transport benefits / constraints (operational)	

Key benefits (transport)	• If mode switch from vehicular traffic to cycling and walking takes place, there is the potential for reduced congestion levels	
Key issues / constraints (transport)	• Slower journey times for cycling and walking when compared to public transport options	
Fit with Scheme Objectives / wider priorities		
Strategic connectivity	**1**	• Does not provide connectivity to the wider Watford or Hertfordshire region
Local connectivity	**2**	• Does not directly serve Watford town centre, making it unlikely to be used for commuting journeys • Provides connectivity to key developments on the former Croxley Branch Line corridor
Enhancing cycling and walking provision	**1**	• Contributes towards wider objectives of reducing congestion in Watford town centre • Directly contributes towards wider objectives of improving walking and cycling
Complementarity with other local objectives	**2**	• Potential for mode shift is relatively small as the route is unlikely to be used for commuting trips
Supporting wider connectivity	• Limited potential for expansion, due to need for a viaduct at Ascot Road to west and the presence of the rail alignment to the east	
Deliverability Assessment		
Key Deliverability Issues	**Low** • Option is feasible	**Moderate** • Option likely to be more acceptable at the point where the case for a transit-based solution (which would deliver more against connectivity objectives) has been ruled out. • Uncertain value for money given cost of conversion and likely usage.
Overall deliverability risk	**Medium**	Overall risk assessment as medium
Overall summary		
• Feasible, but does not meet fully all the project connectivity objectives • More likely if a transit-based solution has been ruled out or as a complement to this		

Options Assessment Summary

8.68 A summary of the options assessment main criteria is provided in Table 8.17 below.

Table 8.17: Options Assessment Summary

Mode	Option code	Option number	Strategic Connectivity	Local Connectivity	Enhancing cycling and walking provision	Complementarity with other local objectives	Overall deliverability risk
Underground	UG1	**1**	**5**	**5**	**0**	**5**	**High**
	UG2	**2**	**4**	**2**	**0**	**3**	**High**
Heavy Rail	Rail1	**3**	**4**	**4**	**0**	**3**	**Medium-High**
	Rail2	**4**	**4**	**4**	**0**	**4**	**High**
	Rail3	**5**	**4**	**2**	**0**	**4**	**High**
Tram	Tram1	**6**	**4**	**4**	**0**	**4**	**High**
Mass Rapid Transit	MRT1	**7**	**4**	**5**	**1**	**4**	**High**
	MRT2	**8**	**4**	**4**	**1**	**3**	**Medium**
	MRT3	**9**	**4**	**4**	**1**	**3**	**Medium**
Segregated Pods	Pod1	**10**	**4**	**5**	**1**	**4**	**Medium-High**
	Pod2	**11**	**4**	**5**	**1**	**4**	**High**
	Pod3	**12**	**4**	**4**	**1**	**3**	**Medium-High**
Conventional Bus	Bus1	**13**	**2**	**2**	**0**	**1**	**Low**
Highway	HW1	**14**	**2**	**2**	**0**	**2**	**Medium-High**
Walking and Cycling	W&C1	**15**	**1**	**2**	**1**	**2**	**Medium**

9 Commentary on Options and Implications

Commentary on High-Capacity Passenger Transit Options

Options 1 to 6: Underground, Rail and Tram

9.1 The MLX delivers best against the local and strategic connectivity scheme objectives and, in this respect, is the best performing of all the options considered. However, the affordability issues are such that there is no realistic prospect of the MLX scheme being progressed in the near or medium-term.

9.2 Of the other rail-based (underground, rail and tram) options, most are assessed as undeliverable based on a combination of affordability and / or deliverability considerations:

- Affordability – both underground options (options 1 and 2) are in the same cost order of magnitude as the discontinued MLX scheme (on affordability grounds) and all rail and tram options (options 3 to 6) are considered expensive and unlikely to be value for money/affordable, including operationally affordable.
- Deliverability – in particular, Rail 2, Rail 3 and tram-train options (options 4, 5 and 6) are considered unacceptable from a deliverability point of view.
  - Rail 2 (option 4) would have to demolish a recently new-built industrial park to build the new east-west chord, which would have strong opposition and high costs. Benefits from London connection will be largely offset by disbenefits to through trips (e.g. those to Watford High Street from the south), and the additional operating costs associated with reversing spur.
  - Rail 3 (option 5) does not have a safeguarded route and securing the alignment would require significant land and property take. In addition, the environmental impacts are likely to be very significant. Support and promotion from a combination of Network Rail, DfT and TfL, through their respective planning processes, results in a non-realistic prospect in medium-term.
  - The tram option (option 6) has major technical challenges (as associated costs and risks) of conversion to tram-train, including significant engineering south of Watford Junction. The land requirement for segregated alignment east of the WCML would entail loss of exiting residential and commercial properties. It would also require duelling the route due to the more frequent services, requiring routing over existing level crossings (particularly in North Watford), which could have a negative impact on the road network.

9.3 The best performing of these options (taking account of the objective-led and deliverability criteria) is the rail shuttle option (Rail 1, option 3). However, we conclude that there are very material delivery risks associated with this option which fundamentally relate to the ability of a

shuttle service over a short route length offering no through connectivity[8] to be justifiable on value for money grounds, or to deliver an ongoing operating surplus (revenues vs. costs).

9.4 The operation of this rail shuttle using alternative technology/power sources for the rolling stock could be explored as an alternative to reduce operating costs should this option be explored further.

Costing of Rail 1 Option

9.5 We have undertaken a high-level assessment of the indicative cost of Rail 1 Option. This is based on the understanding of the options at a pre-feasibility level and is intended to provide a broad order of magnitude of cost and the relative costs of deliverable options.

9.6 The very high-level estimated cost of this option includes:

- Around 2.48km of new single track, at £20m per km (all included in rate). This does not include the electrification of the new section of track.
- Two heavy rail stations (Croxley Green Business Park and Vicarage Road), costed at £5m each. Note that this costing estimate assumed an at-grade simple station, with single track, a single platform and no lifts or footbridges.
- Signalling and telecoms, costed at £5m.
- Renewal of existing loop line in the vicinity of the new double junction to accommodate switch and cant (i.e. 'cross slope' of the track) requirements, for 0.65km at £5m per km.

9.7 This assumes that the shuttle operates on a single track, with a simple single line turn back, and that the current platform capacity at Watford Junction does not require any works. MLX required additional platform capacity, so this might result in an increase in costs for this option if it required similar works, which would need to be checked as part of follow-on work.

9.8 In addition, we have added other costs that would be incurred (such as preliminary works, design and NR costs), as well as an indicative optimism bias, as required by WebTAG guidance, of 66% corresponding to a pre-feasibility stage cost estimate.

9.9 The overall cost for this option (which does not include any land or compensations cost) is presented in Table 9.1. Note that costs for the purchase of lease of vehicles are not included in the below estimate given that no detail about the operational plans have been studied yet.

[8] The business case for the MLX scheme was underpinned, in large part, by the demand, revenues and benefits that accrued from former rail and car users using the Metropolitan Line to/from destinations towards London. These benefits are not replicable with any other the other rail-based options considered.

Table 9.1: Rail 1 Option Indicative Cost

Item	Estimated Proportion (%)	Cost (£m)
Route Infrastructure	Using assumptions above	£67.9m
Prelims, Overheads and Profit	20%	£13.6m
Design & Management	10%	£6.8m
Depot	-	-
Vehicles	-	-
Operator procurement	5%	£3.4m
Testing and commissioning	5%	£3.4m
Network Rail costs	10%	£6.8m
Rail replacement/TOC compensation costs	5%	£3.4m
Sub-total		**£105.2m**
Optimism bias	66%	£69.4m
Land and compensation	Not included	-
TOTAL		**£174.6m**

9.10 The overall cost for the option is therefore estimated at around £175m (subject to the assumptions and high-level costing approach).

Option 7 to 9: Mass Rapid Transit

9.11 Rubber-tyred Mass Rapid Transit (MRT) options (options 7 to 9) offer a potentially more attractive option that rail-based MLX alternative options for several key reasons.

9.12 First, MRT options offer the potential to be developed as part of a wider MRT network providing connections towards St Albans, Rickmansworth and to the south (towards North London). From a passenger perspective this offers attractive through services and has the potential to offer a viable and attractive alternative to car.

9.13 In terms of the value for money case for MRT within the Croxley corridor, these wider connections provide a larger demand base to which the benefits of the 'core' are infrastructure (in-vehicle, service frequent, quality, reliability) would be applied. This is likely to improve the potential value for money case compared to rail-based options.

9.14 The MRT option also offers greater flexibility, in that the infrastructure element of the network can be developed incrementally, and route/service flexibility whereby services can cater for a wider catchment and routes and services can better respond to demand growth over time.

9.15 These benefits combined with the lower cost of MRT (compared to rail-based options) make the likely deliverability of MRT more realisable from a value for money and affordability perspective.

9.16 Second, the conversion of the Croxley Green alignment for MRT can also be complemented by infrastructure measures that would support the usage of other modes on the route. These could include:

- Cycle provision
- Conventional buses
- Demand Responsive Transport
- Pods

9.17 The feasibility of the usage of other modes on the route would need to be explored further if these options are continued, but these offer a priori more flexibility for complementing modes.

9.18 The key issue for the MRT options is that it is challenging to create end-to-end route segregation/priority that would support the fast and reliable journey times that deliver material benefits over existing bus service provision.

9.19 While routing via the Croxley Green alignment would deliver faster and reliable journey times (and service discrete demand attractors) the route length would be longer than that of existing bus services.

9.20 We have undertaken a high-level assessment on the likely comparative journey times for each route, based on the route lengths, the proportion of running that is fully segregated, would have high-priority (e.g. dedicated bus lanes) and section that would run with general traffic (typically on congested and narrow sections of road, with no space available to provide priority).

9.21 We have looked at overall journey times based on reasonable assumed speeds on each section type, and the results are summarised in Table 9.2.

Table 9.2: MRT Options - Comparative Analysis

Mode	Total length (m)	% route segregated of high-priority	Journey time / reliability rank (1 = best)	Infra cost rank (1 = lowest cost)	Fit with objectives	Deliverability risk
MRT1	4,190	68%	1	4	Yes	High
MRT2	4,190	56%	3	3	Yes	Medium
MRT3	4,840	73%	2	2	Yes	Medium
Bus 1	3,570	35%	4	1	No	Low

9.22 The analysis shows:

- MRT1 (Croxley Branch to Watford Junction via Watford High Street, option 7) would deliver the best journey times, as it is a relatively direct route with around 70% segregation. However, MRT1 is not deemed deliverable because the required land take at WGGS is considered to be unacceptable.
- MRT3 (Croxley Branch to Watford Junction via Thomas Sawyer Way, option 9), despite being longer than MRT2 (Croxley Branch to Watford Junction via Wiggenhall Road, option 8) would deliver a comparable or, likely, a better journey time than MRT2, due to the higher proportion of segregated/priority running on this route. This would also deliver better reliability. It is also notable that MRT3 is likely to be slightly lower cost than MRT2, due to the shorter section of wholly new infrastructure required.
- Bus 1 (option 10) would operate along existing bus corridors, and therefore speeds and reliability would be poor. Bus 1 would not serve key developments and would therefore not meet the local connectivity objective set for the scheme. This could be considered as an interim low-cost solution that complement a transit-based scheme.

9.23 In any further work, it will be key to understand (and represent in transport modelling) the implications of future growth on highway traffic and bus journey times. The network performance analysis undertaken for 2031 (presented in Chapter 4) indicates a significant worsening of journey times and reliability resulting from the effects of future growth and development.

9.24 This means the relative attractiveness of MRT (provided segregation and priority is maintained) is likely to increase over time, and therefore be of importance in supporting sustainable growth (and related objectives to reduce traffic and increase public transport shares) over the longer-term.

Costing of MRT Options

9.25 We have undertaken a high-level assessment of the indicative cost of MRT Options. This is based on the understanding of the options at a pre-feasibility level and is intended to provide a broad order of magnitude of cost and the relative costs of deliverable options.

9.26 The very high-level estimated cost of these options includes:

- Around 2.67km (MRT1 and 2) and 2.33km (MRT3) of new busway, at £5.4m per km, with an additional £1.0m per km for cycle track, including ramps to bridges where possible.
- 5 or 6 MRT stations, costed at £0.5m each.
- Refurbishment of River Gade bridge (£1.0m) and reinstate of Ascot Road dual carriageway bridge (£7.5m) and renew old Ascot Road bridge (£7.5m).
- Major upgrade to Watford Road roundabout for transit priority (£5.0m). This is required for Bus1 as well.
- Retained tamps to school area for MRT1 (£1.5m) and to Wiggenhall Road for MRT2 (£1.5m). Rebuild of Wiggenhall Road bridge to connect with MRT2 (£7.5m)
- Between 2 and 5km of on-street priority measures (£1m per km)

9.27 This assumes line of sight operation, simple right of way (e.g. highway type carriageway) and infrastructure only costing. For MRT 1, this does **not** include any amendments or compensations to school buildings and grounds, which could be significant. The same additional cost categories, including optimism bias, have been included in the table below (see commentary on Rail 1 option cost estimate).

9.28 The overall cost for this option (which does not include any land or compensations cost) is presented in Table 9.3. Note that costs for the purchase of lease of vehicles are not included in the below estimate given that no detail about the operational plans have been studied yet.

Table 9.3: Indicative costs of MRT and conventional bus options

Item	Estimated Proportion (%)	MRT 1 (£m)	MRT 2 (£m)	MRT 3 (£m)	Bus 1 (£m)
Route Infrastructure	Using assumptions above	£45.7m	£52.5m	£43.4m	£12.1m
Prelims, Overheads and Profit	20%	£9.1m	£10.5m	£8.7m	£2.4m
Design & Management	10%	£4.6m	£5.3m	£4.3m	£1.2m
Depot	-	-	-	-	-
Vehicles	-	-	-	-	-
Operator procurement	5%	£2.3m	£2.6m	£2.2m	£0.6m
Testing and commissioning	5%	£2.3m	£2.6m	£2.2m	£0.6m
Network Rail costs	-	-	-	-	-
Rail replacement/TOC compensation costs	-	-	-	-	-
Sub-total		**£64.0m**	**£73.5m**	**£60.8m**	**£16.9m**
Optimism bias	66%	£42.2m	£48.5m	£40.1m	£11.2m
Land and compensation	Not included	-	-	-	-
TOTAL		**£106.2m**	**£122.0m**	**£100.9m**	**£28.1m**

9.29 The overall cost for these options is therefore estimated between £100m and £122m for the MRT options and £28m for the conventional bus option (subject to the assumptions and high-level costing approach).

Options 10 to 12: Segregated Pods

9.30 Segregated pods (options 10 to 12) allow to meet the scheme objectives for transport connectivity (strategic and local), potentially achieving greater benefits than alternative options such as MRT options.

9.31 This is because it would operate on fully segregated infrastructure (elevated guideways), which would result in faster and more reliable journey times, in combination to no wait times given it is an on-demand service.

9.32 Demand for these services has the potential to be higher than for other options, such as MRT, due to the benefits described above. Capital costs for delivery of the necessary infrastructure are uncertain, as there are no operational PRT systems in urban areas in the UK, with the closer example being the PRT system at Heathrow airport. There is uncertainty around whether a PRT system would represent Value for Money, which would need to be explored further in detail.

9.33 There are some deliverability and acceptability challenges associated with the construction of the necessary infrastructure. Akin to MRT option 1, permanent use and temporary access to land at the WGGS presents a feasibility challenge, although of a lower scale than in the case of MRT; likewise, operating a PRT system close to or above an operational railway would appear

to be another deliverability issue. Both the construction and operation of this option would need to be assessed in more detail. The second route option has a significant constraint at Vicarage Road, connecting the town centre with Wiggenhall Road, as this is a very narrow street. Option 3 does not appear to present any deliverability showstopper.

9.34 A further issue for segregated pods is that they are typically procured as turnkey systems from a single supplier or consortia. The procurement of these within a private sector setting (e.g. within an airport, or theme park) is more straightforward, but is relatively untested through public sector procurement processes. The bespoke and proprietary nature of any pod-based solution would make it challenging to develop an output specification that was broad enough to support a competitive process in line with public sector procurement requirements and competition law.

9.35 Therefore, procurement routes which at the same time respect the public sector rules and are suitable for a private sector led bespoke turnkey system will need to be considered, noting that these might be different to the usual procurement of infrastructure schemes in the UK. In particular, a key challenge would be to demonstrate that the adopted solution provides Value for Money for the taxpayer, given that a competitive process could potentially not be run. This would need to be explored should the solution be developed further at any stage.

Linking into Wider Network Vision - Towards St Albans

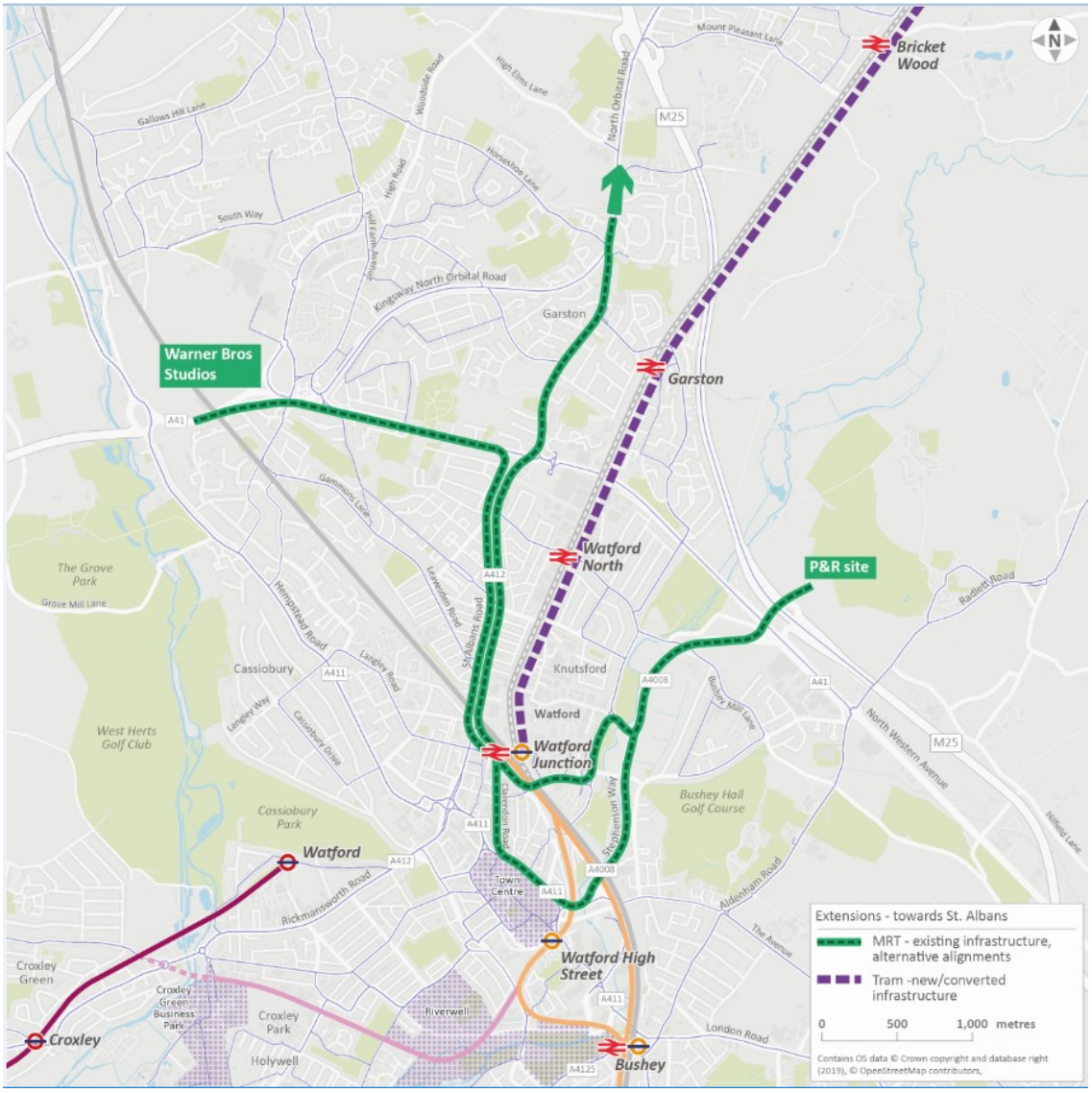
Routes and Options

9.36 There are two main strategic corridors that link Watford Junction to St. Albans. These are:

- The A412/St Albans Road and the A405
- The Abbey Line

9.37 In addition, there is the potential to connect to a new Park and Ride site on Junction 5 of the M1/A41.

Figure 9.1: Strategic Extension Options towards St. Albans



9.38 The Abbey Line currently is currently serviced by rail services that are relatively infrequent and also irregular, due to the constraints imposed by single track running for all of the route.

9.39 A range of options for enhancing provision of the Abbey Line have been considered or suggested. These include:

- Upgrade of the exiting rail service through the provision of passing loops to support more frequent and regularised services.
- Conversion of the Abbey Line to tram or tram-train operation, which could support a 'metro' style service at higher frequencies with potentially more intermediate stops.
- Conversion or the Abbey Line to support MRT services.

9.40 The A414 is a dualled road running from the A41 west of Hemel Hempstead all the way to Chelmsford. This road is characterised by high congestion levels.

9.41 However, the A414 is the key route between Watford – St Albans and Welwyn and has been identified by HCC as a potential route for MRT.

Compatibility with 'Core' MLX Alternatives Options

9.42 Any of the options above is compatible with the core MLX alternative options developed, insofar that each would provide for an interchange at Watford Junction between the Croxley and St. Albans corridors.

9.43 However, only a subset of these options are compatible with the provision of a direct through service that would line the St. Albans and Croxley corridors without the need for interchange. These are:

- A tram or tram-train option although, for the reasons set out in the previous chapter, we think such an option is likely to be unaffordable and undeliverable.
- MRT options with via the A412/A405 or via a converted Abbey Line.
- PRT options equally alongside the A412/A405 or via a converted Abbey Line.

9.44 Whereas there is a clear inter-dependency between the corridor solutions for tram-train options, this is less the case for MRT or PRT. The development of MRT and PRT options for the A412/A405 and the Abbey Line corridor could be developed and assessed on their own merits, cognisant of the potential link to the Croxley corridor but not dependent upon the form of solution that comes forward.

9.45 In order for the option(s) taken forward to represent a step-change in service throughout Hertfordshire, this would need to provide fast services connecting to the main centres of demand in the wider area and within Watford area and this would necessitate sufficient segregation/priority through Watford town centre, in order to promote mode shift.

Towards the West and South

9.46 There are several strategic routes towards the west and south west of the Watford area which could connect to the options presented in this report. These are:

- Watford Road and A412 to Rickmansworth.
- Through the business parks to Tolpits Lane and Moor Lane to connect with the Moor Park and South Oxhey area.

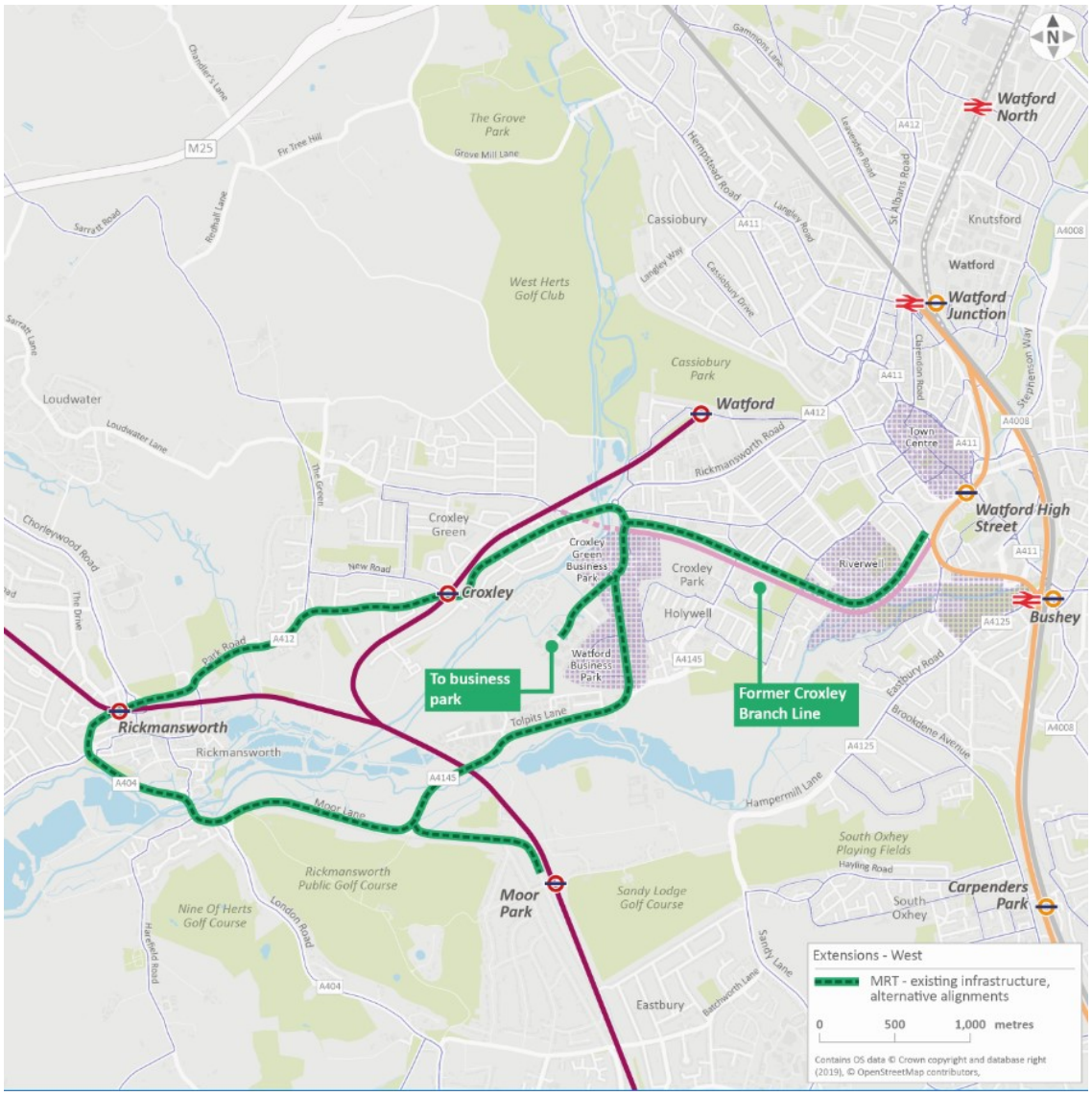
9.47 The route to Rickmansworth is currently used by some inter-urban buses (for instance, route 320 between Rickmansworth to Hemel Hempstead, route 520 between Maple Cross and Hemel Hempstead or route 724, with different onward connections) through Watford town centre, with half hourly frequency and fairly high levels of congestion, so it does not constitute currently a very strong alternative to cars, due to the inexistent route segregation and low frequency. This could constitute a strategic west-east corridor making use of the preferred option through Watford.

9.48 There are also no direct bus routes between Moor Park and the business parks/Watford town centre, being a corridor where people use mostly their private vehicles. There would be an opportunity to connect the preferred option to Moor Park underground station to provide an interchange for passengers accessing the business parks and the town centre that use (or would shift to use) the LU arriving at Moor Park station.

9.49 These extensions would only be possible as a continuation of the MRT alternatives, which strengthens their flexibility and ability to cater for a wider demand catchment area.

9.50 PRT options also have the potential to be extended towards the west, but given that these are less densely populated areas, it is less likely that such extensions represent Value for Money.

Figure 9.2: Strategic Extension Options towards the west and south



Improving Access to Watford Gateway

9.51 As part of the local connectivity objectives identified in Chapter 6, one of the priorities was to improve the access to the Watford Gateway area. At the moment, access by public transport is provided by bus route W30, which is primarily a commuter route, linking the business parks to the town centre and rail station. Routes 320, 520 and 10 serve the hospital, football stadium and High Street and call at bus stops in Whippendell Rd which would be within 400m of some of the business park area. Also, route 10 serves the Holywell estate and is within 400m of some of the southern part of Watford business park as there is a pedestrian route through.

9.52 Given that a transit-based alternative, due to its conceptual nature, is unlikely to directly serve the business parks, alternative arrangements will need to complement these alternatives to provide with the necessary connectivity. The access to the nearest transit stop would need to be provided as an interchange with another mode, which could include:

- Cycle (own bike, cycle hire, e-bike)
- Conventional bus (e.g. W30 extended through Tolpits Lane and interchanging with MRT)
- Walking

- Pods
- Demand Responsive Transit

9.53 In particular, the latter two seem appropriate to cater with specific demand needs that transit would not be able to accommodate, due to infrastructure constraints such as narrow roads (see Chapter 7 for detailed description about features of these modes).

9.54 Certain infrastructure enhancements might be needed within Western Gateway to accommodate for these, which would need to be analysed in further detail should a mass transit option be taken forward.

Safeguarding

9.55 This report has identified options at an outline concept level and undertaken an objective-led and deliverability assessment of each.

9.56 Through this we have highlighted those options that are better performing against these criteria.

9.57 While the study was not remitted to produce a single 'preferred option', is it clear that the use of the former Croxley Branch Line does offer the potential to support improved transport provision in Watford and beyond.

9.58 While these options need to be subject to more detailed scheme development, forecasting and assessment work it is important that the alignments over which the better performing options could operate are safeguarded or protected while further development work is undertaken.

Funding potential

9.59 All of the options identified above that address the connectivity needs require a significant capital investment and therefore funding sources will need to be identified to pay for the upfront investment to deliver them.

9.60 The main funding sources that will be available will come from public organisations. These could include:

- **Watford Borough Council**, as part of the allocated budget for transport interventions, which will need to cover the proposed interventions highlighted in the new Local Plan.
- **Hertfordshire County Council**, as part of the packages included in their South West Herts Growth and Transport Plan Prospectus.
- **Transport for London**, which are likely to only contribute to funding any LU option. As these have been assessed as unaffordable, it is unlikely that this source of funding will be available.
- **Department for Transport (rail)**: if the preferred option were rail-based, the Department for Transport might be able to provide some funding to support the investment. This would typically need to be part of their railway High Level Output Specification (HLOS) and follow the standard DfT approval processes (GRIP process, five-case business case, etc.).
- **Department for Transport (other)**: the DfT may be able to provide funding for projects that prove to have transport and wider benefits but not necessarily be rail based. An example for this would be the Transforming Cities fund, which called for proposals in March 2018.

9.61 As part of the next stage of options development, we would seek to identify potential sources of public funding.

9.62 In addition, transport scheme might sometimes receive some funding from private contributors. The most typical case is through Section 106 or Community Infrastructure Levy (CIL) contributions from developers, which need to contribute to the enhancement of the transport infrastructure to gain approval for their proposed developments.

9.63 However, in the case of this project, most of the developments along the corridor that could be considered dependent on a potential scheme have already been built or approved, therefore the potential to attract developers' contributions is very limited. Other private funding sources (such as work parking levy or congestion charge) are unlikely to be deliverable, but might need to be investigated further as part of refinement work.

Recommendations

9.64 We have presented a range of options that meet the identified project objectives and have presented their key benefits and constraints, highlighting those that present significant showstopper risks at this stage.

9.65 We have five recommendations based on the technical findings of this study:

1: Consider options that address separately the strategic and the local connectivity needs

9.66 We have identified that there are both strategic and local connectivity needs within the Watford area, as well as across the wider area within Hertfordshire. We have noted that the former MLX scheme was able to address both types of needs through a scheme that provided strategic connectivity, mainly to London (with the majority of the benefits arising from trips from/to London) and local connectivity, serving the business parks and the other areas along the Croxley Branch corridor.

9.67 As part of this study, we have found out that no option delivers the same scale of benefits as MLX did (particularly the London benefits) and that all of them present constraints, to a certain extent, to provide both the strategic and local connectivity, which was the remit of this study (i.e. to replicate the connectivity needs MLX addressed).

9.68 Therefore, it might be sensible to study separate options that address strategic needs, e.g. all the MRT options were part of a wider network within Hertfordshire, and local needs, e.g. some of the lower cost option, such as working towards Enhanced Partnership with bus operators or complementary interventions such as pods or DRT as feeders to a transit-based scheme.

9.69 By disentangling both types of connectivity needs, it might be possible to find options that satisfy both types of requirements.

2: Continue to develop options that are considered as deliverable

9.70 This study has identified a number of options that have potential to be deliverable and affordable. These include, for instance, MRT 2 and MRT 3 options, PRT 3 option, but potentially also Rail 1 option.

9.71 In addition, Chapter 8 describes an alternative to PRT 1 which follows the rail corridor into Watford Junction. This option does not present the challenges of providing an elevated guided system through the town centre, so it could be a potentially deliverable option if the challenges of building the necessary infrastructure within and alongside the railway land can be addressed. This would need to be explored with Network Rail as part of at any future stage of development.

9.72 We suggest that, in line with our recommendation above, these options are explored in further detail to understand better their potential benefits and constraints.

3: Study in detail options through the Watford town centre

9.73 The on-street options (e.g. MRT or PRT options) link Watford Junction to west Watford through the town centre. However, we have identified a number of constraints that we have flagged as part of this study but which would merit from further investigation.

9.74 These include the integration of any option with the recently approved Clarendon Road scheme (i.e. reduction in width to 6.2m) or aspirations around Exchange Road, which include the conversion to 2-way operation or intervention on the bridge north of the Ring Road.

9.75 All of these will need to be assessed further in detail as part of the next stage of the study.

4: Use findings of this study to inform the new Watford Local Plan (autumn 2019)

9.76 As Watford Borough Council prepares the new Local Plan due to be published in autumn 2019, the findings of this study might help to identify to connectivity shortcomings and some of the options to address these.

9.77 Also, feedback from any consultation undertaken as part of the new Local Plan would support the option development as part of the next stage of this study.

5: Safeguard the Croxley Branch corridor and Thomas Sawyer Way

9.78 We would finally recommend safeguarding the Croxley Branch alignment between Ascot Road and around Wiggenhall Road as most options seek to use this disused corridor. In addition, any safeguarding along the Thomas Sawyer Way corridor that can be secured from forthcoming developments might be sensible, given that this is one of the most promising options on a balance between objective meeting and affordability/deliverability grounds.

10 Conclusions and Next Steps

10.1 This study has focused on identifying and assessing alternatives to the former MLX scheme. For that, we have analysed the transport needs that an eventual transport intervention would need to address, as well as defined the project objectives (Phase 1), and identified and assessed a range of options that meet these objectives against a number of pre-defined criteria (Phase 2).

10.2 The study has identified project objectives along these three main aims:

- Enhancing the strategic connectivity;
- Enhancing the local connectivity; and
- Supporting the accessibility to, and improvement of, Watford Town Centre.

10.3 The options have been developed based on objective-led criteria and have then been assessed against these project objectives, as well as affordability and deliverability criteria (with a qualitative risk categorisation allocated to each of them).

10.4 As such, the study has concluded that no alternative meets the project objectives as well as the former MLX scheme did, which was discontinued due to affordability reasons. All the other underground/rail/tram options are either considered undeliverable or present significant affordability/deliverability risks, to the extent that this study has looked into them.

10.5 Mass Rapid Transit (MRT) options have been identified as a suitable range of solutions that can both meet the project objectives and also be acceptable from the deliverability and affordability perspectives. We have discussed the trade-offs between segregation, impact in journey time and direct routing, as well as the potential of all MRT options to accommodate extensions towards St. Albans and Rickmansworth which would enable to cater for a larger demand catchment area, potentially strengthening the value for money case.

10.6 In addition, we have described potential lower cost interventions that could be targeted at the current conventional bus offer which could provide some quick wins at a lower cost, which could be undertaken as a standalone option or as a complement to any transit-based option.

10.7 We have also described how the different options could be complemented by cycling and walking provision (which has also been assessed in its own merit), as well as other technologies (e.g. pods or DRT), for instance to provide a service to the business parks area.

10.8 Overall, the study concludes that there are some potentially deliverable options, which make use of the Croxley Branch corridor, that can meet the project objectives which would require further investigation and a more detailed assessment to understand its implications for the transport network as well as their constraints.

10.9 We therefore provide the following recommendations:

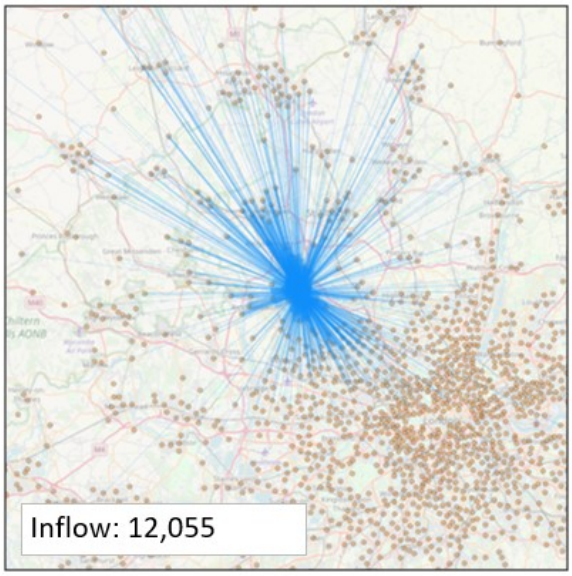
- consider options that address separately the strategic and the local connectivity needs;
- continue to develop options that are considered as deliverable;
- study in detail options through the Watford town centre;

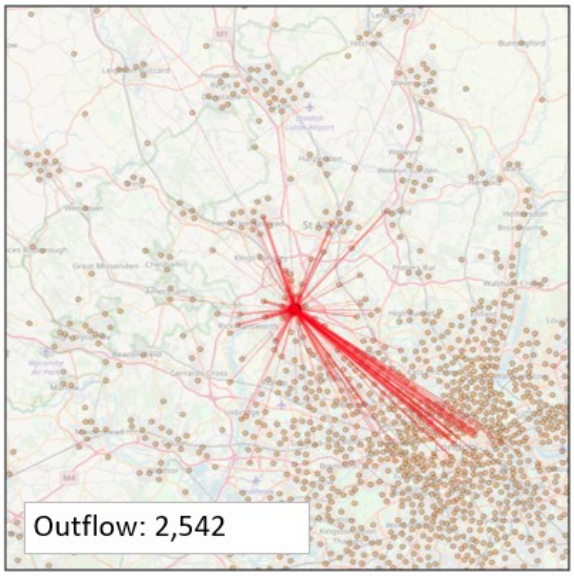
- use findings of this study to inform the new Watford Local Plan (autumn 2019); and
- safeguard the Croxley Branch corridor and Thomas Sawyer Way.

Appendices

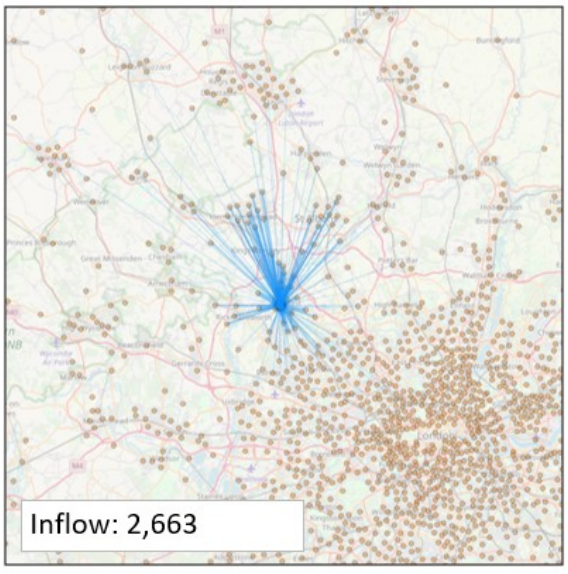
A DataShine Journey to Work maps

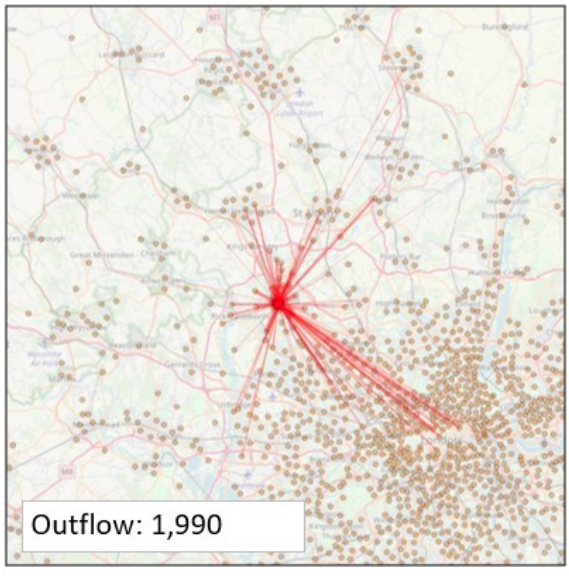
DataShine Journey to Work flows, Central Watford



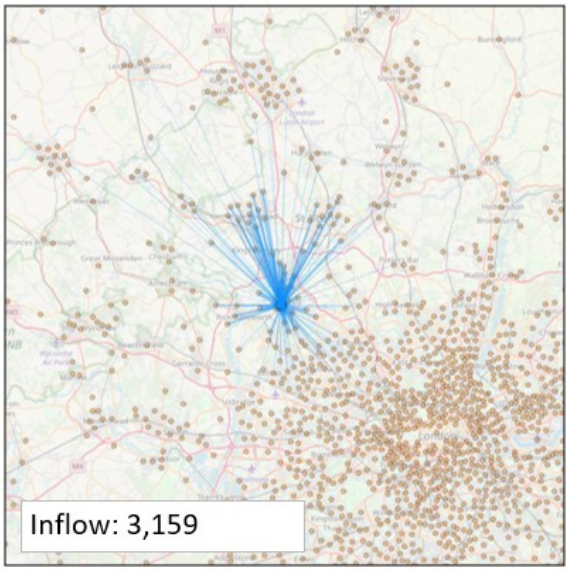


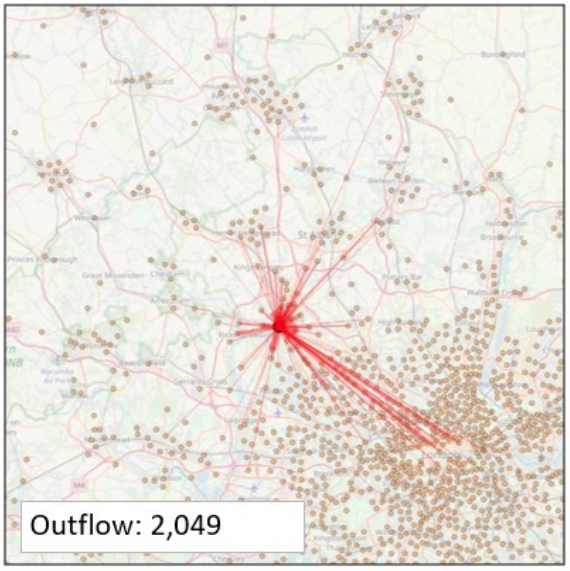
DataShine Journey to Work flows, West Watford



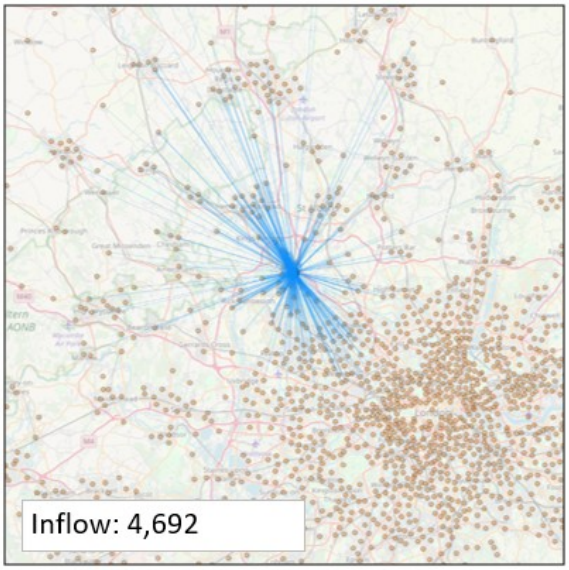


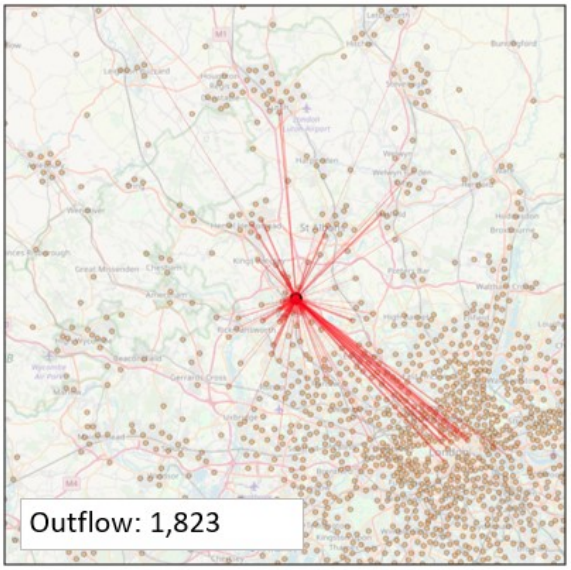
DataShine Journey to Work flows, Holywell





DataShine Journey to Work flows, Tudor





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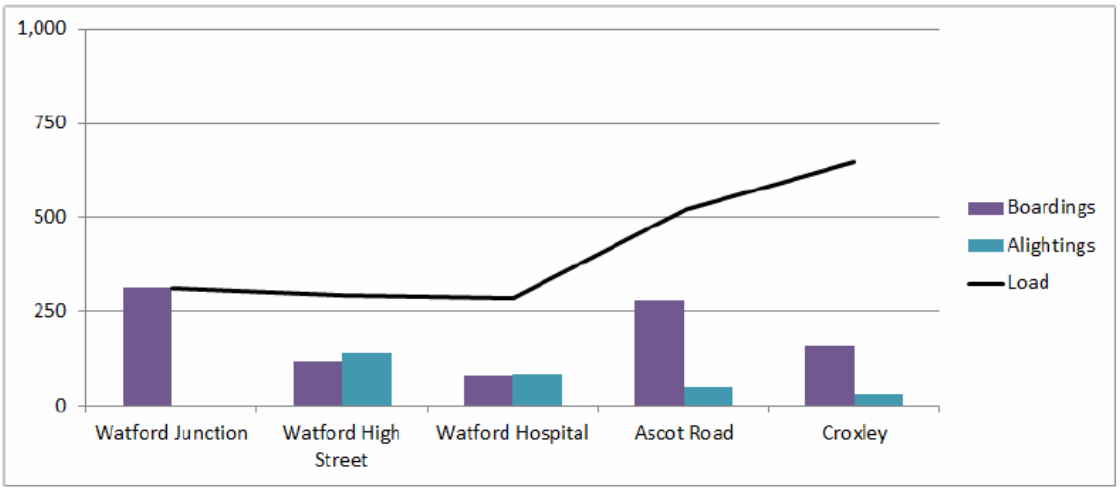
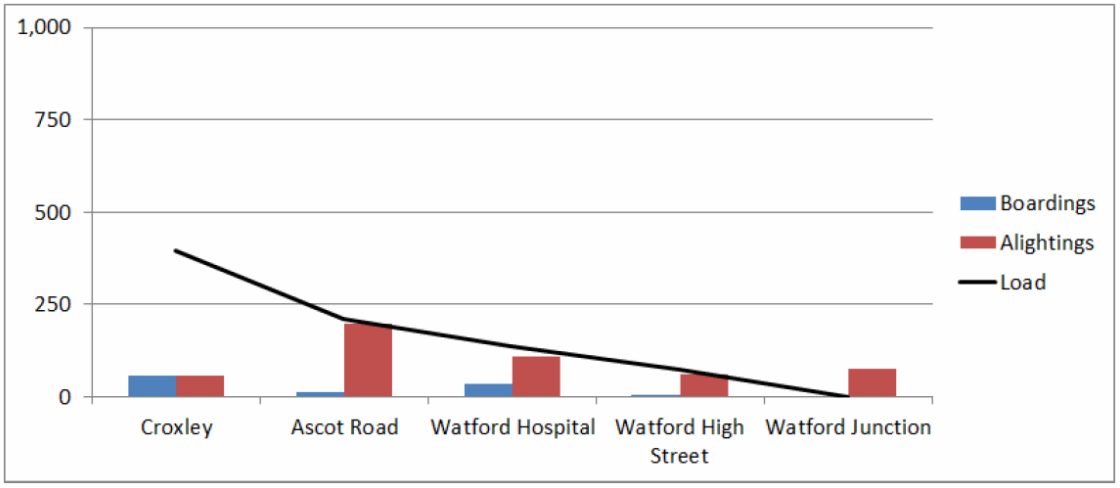
B MLX Demand Profiles

2016 AM Peak Southbound



2016 AM Peak Northbound



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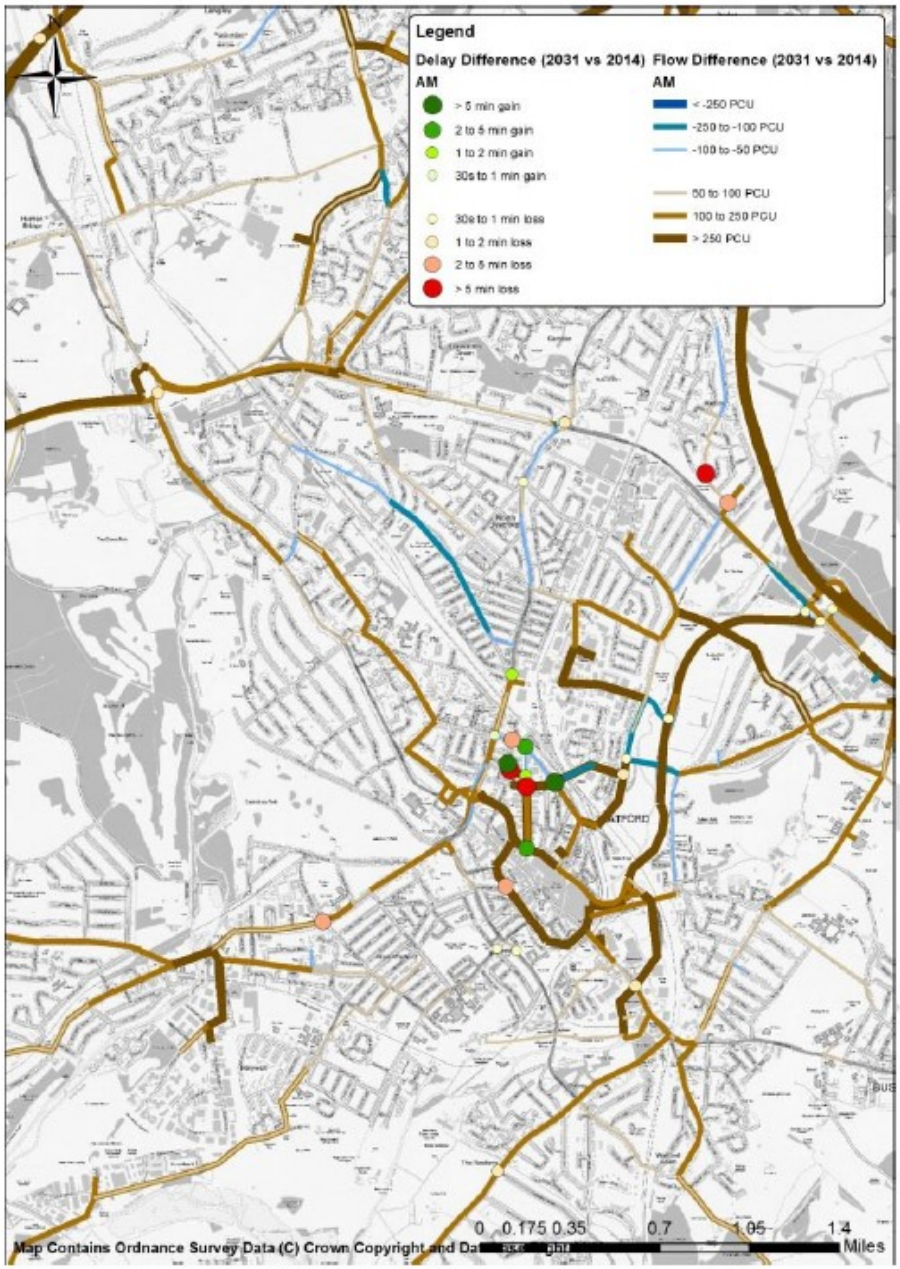
C Journey to Work flows within Watford

usual residence	Woodside & Leavesden Green	Stanborough	Garston	Leggatts	Tudor	North Watford	Nascot	Cassiobury Park	Central Watford	West Watford	Holywell	Watford Heath
Woodside & Leavesden Green	157	38	79	42	183	58	31	70	296	61	88	13
Stanborough	69	132	90	53	152	67	32	85	341	90	93	9
Garston	61	46	174	39	212	62	25	53	337	72	122	16
Leggatts	48	22	46	112	205	104	59	110	308	97	118	24
Tudor	23	8	31	23	254	80	24	58	344	62	72	9
North Watford	23	11	50	55	247	144	37	71	428	88	114	7
Nascot	18	5	15	32	109	44	95	120	395	62	89	9
Cassiobury Park	12	12	13	9	87	33	27	198	376	105	116	8
Central Watford	12	5	19	33	132	50	39	87	714	146	180	20
West Watford	24	27	33	27	91	53	53	114	579	412	258	20
Holywell	11	5	20	20	111	41	23	116	487	276	402	14
Watford Heath	8	2	12	12	57	23	21	68	279	66	68	105

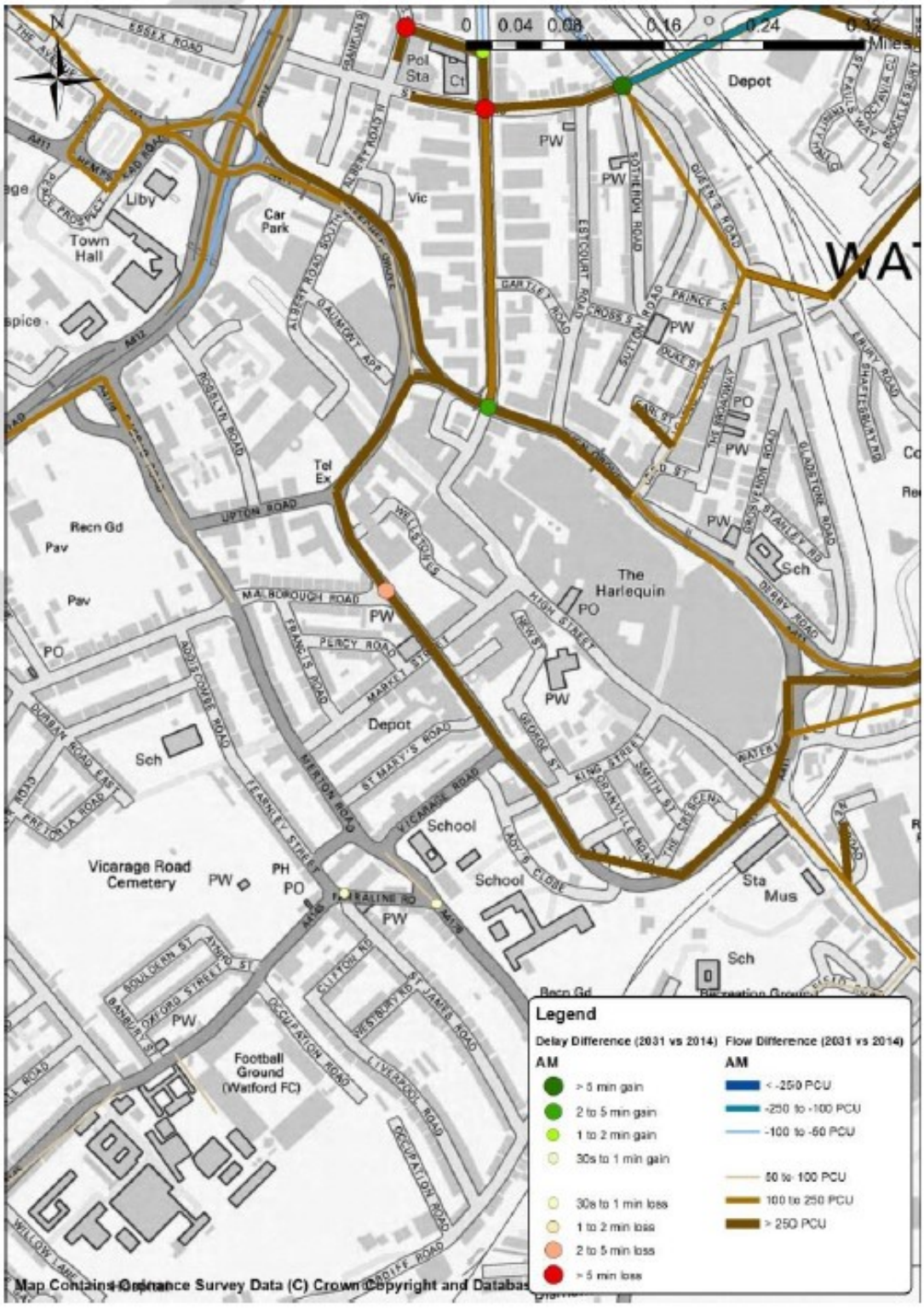
D Hertfordshire County Council COMET Model Outputs

D.1 It should be noted that, at the time of writing this report, more up to date versions of these figures have been developed, following recent policy updates.

Traffic flow (PCUs) and junction delay (minutes) differences (2031 vs 2014), Watford area, AM

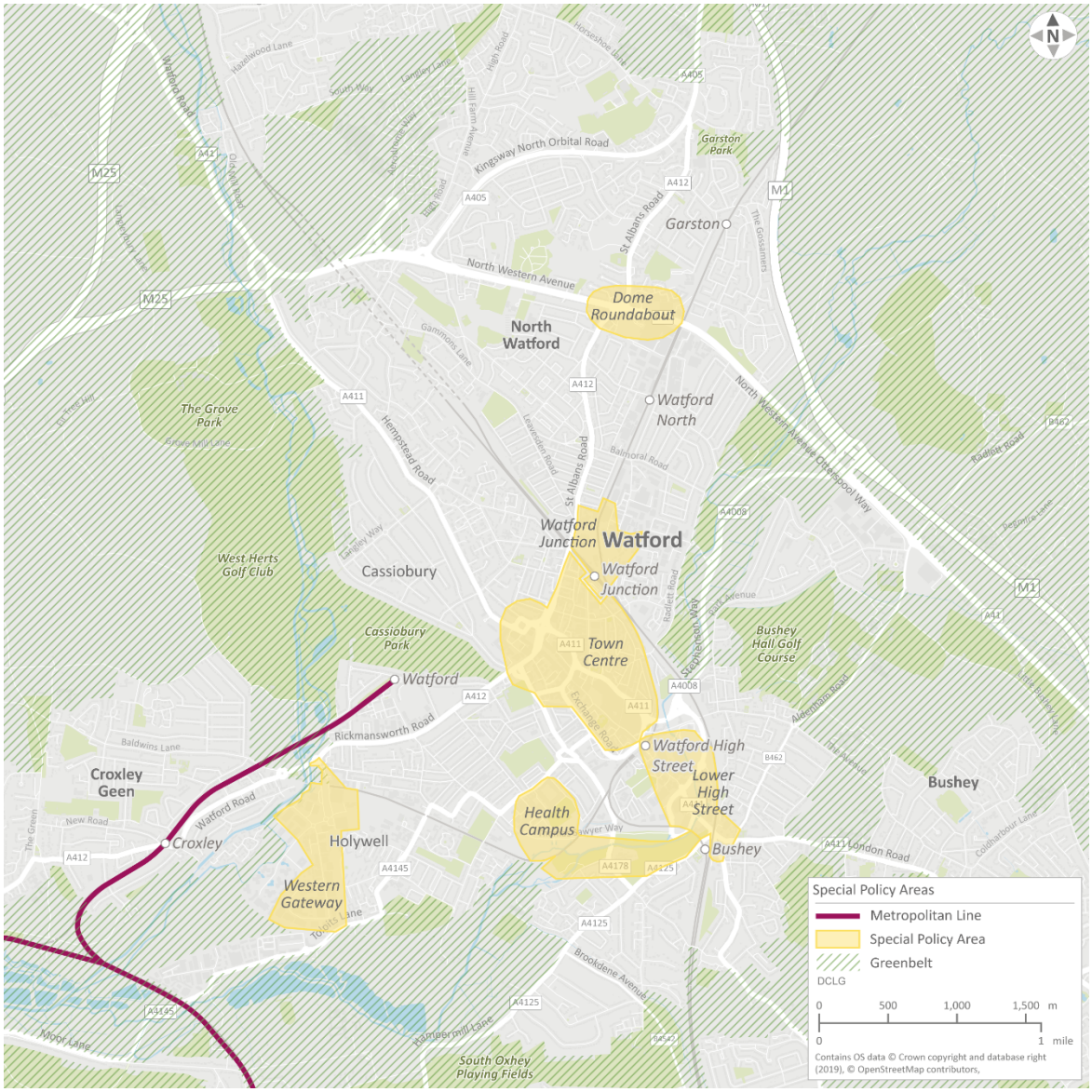


Traffic flow (PCUs) and junction delay (minutes) differences (2031 vs 2014), Watford area, AM



E Special Policy Areas and Greenbelt land

E.1 It should be noted that, at the time of writing this report, more up to date versions of the inputs of the below figure have been developed, following recent policy updates.



Source: Steer

Control Information

Prepared by	Prepared for
Steer 28-32 Upper Ground London SE1 9PD +44 20 7910 5000 www.steergroup.com	Transport for London 5 Broadway London Sw1H 0BD United Kingdom

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Author/originator	Reviewer/approver
Chloe Cook	Tom Higbee Antonio Beltrán Arranz

Other contributors	Distribution
Helen McKenzie Tom Leach Tim Goss	Client: Transport for London Watford Borough Council Hertfordshire County Council Steer: Project Team

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