Lincolnshire County Council

NORTH HYKEHAM RELIEF ROAD

Economic Impacts Report

70038233
JANUARY 2019

CONFIDENTIAL

Lincolnshire County Council

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Economic Impacts Report

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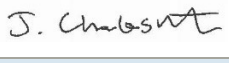
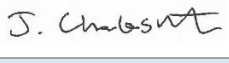
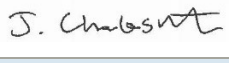
Signature				
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1 INTRODUCTION

1.1 OVERVIEW

WSP have been commissioned by Lincolnshire County Council (LCC) to prepare an Outline Business Case (OBC) for the proposed North Hykeham Relief Road (NHRR).

A comprehensive options development process was concluded by the preparation of the NHRR Options Assessment Report (OAR) (September 2018). The outcome from this was that a preferred option was recommended to, and subsequently approved by, the local Highways Scrutiny and Executive in October 2018.

LCC is seeking funding to develop and construct the NHRR.

An Economic Impacts Report accompanies the Economic Case of a Transport Business Case for a scheme which has specific economic objectives.

This report sits alongside three other appendices to the Economic Case.

- GLTM Local Model Validation Report (LMVR)
  - Details the development of the base year Greater Lincoln Transport Model used for traffic modelling and forecasting of the scheme.
- NHRR Traffic Forecasting Report (TFR)
  - Details the development of the NHRR forecast models including key assumptions, application of variable demand forecasting and forecast model outputs.
- NHRR Economic Appraisal Report (EAR)
  - Details the outputs from the main economic appraisal of the scheme including calculation of scheme costs, derivation of monetised costs and cost-benefit analysis.

1.2 SCHEME ALIGNMENT

The proposed NHRR will provide a new link through a predominately rural area situated to the south of the Lincoln urban area, which is an area encompassing the district of Lincoln plus the primarily residential areas of North Hykeham and Waddington which are situated in North Kesteven district.

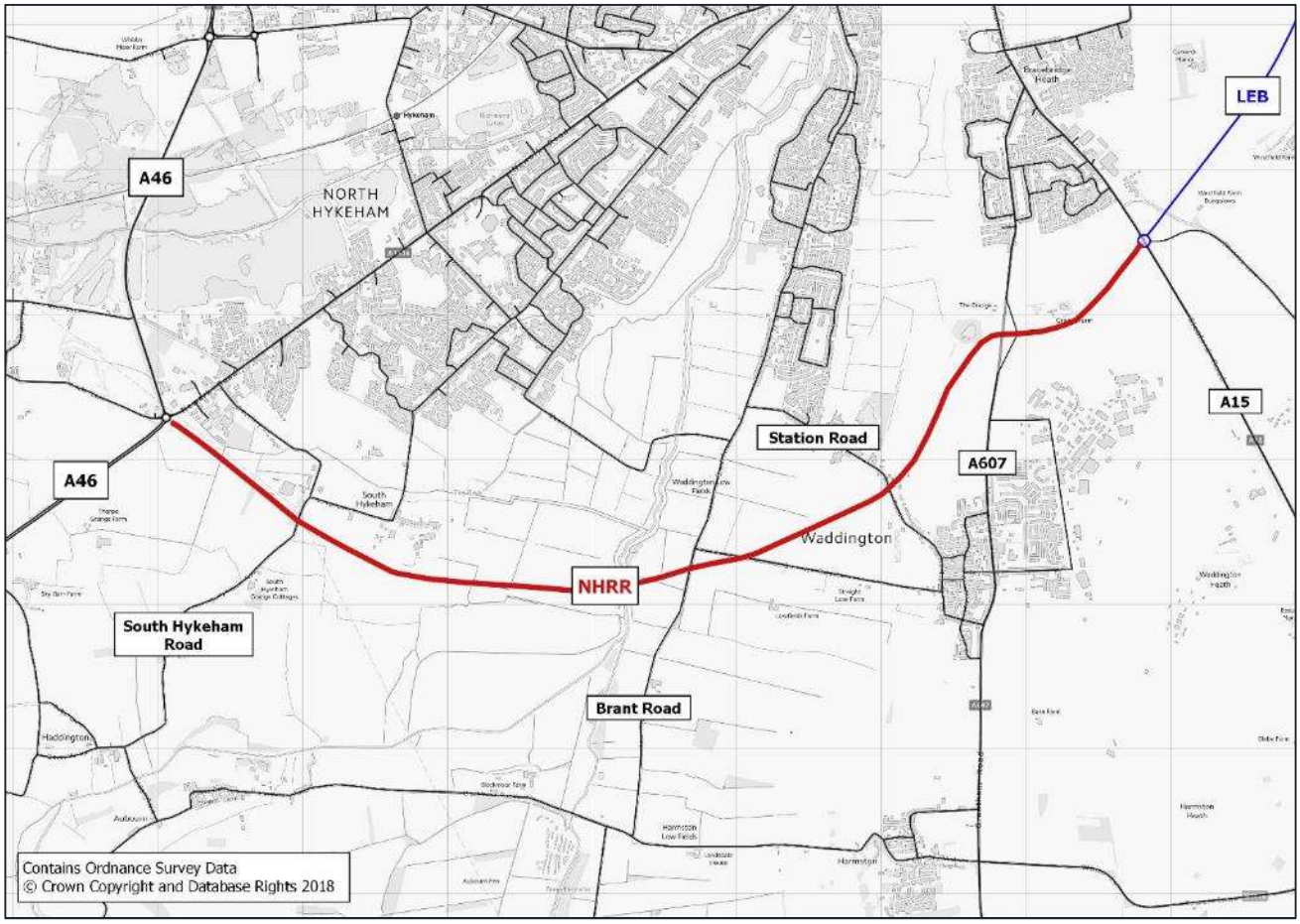
The scheme will link the existing A46 Western Relief Road to the under-construction A15 Lincoln Eastern Bypass (LEB) forming a complete ring road around the Lincoln urban area.

The key design features of the scheme are that it will:

- Tie into an upgraded Pennell's roundabout at the western end and tie into the under-construction LEB / A15 roundabout at the eastern end;
- Have at-grade roundabout junctions with South Hykeham Road, Brant Road and A607 Grantham Road; and
- Pass under Station Road which will cross the scheme with a new overbridge.

The preferred route alignment is shown in Figure 1-1.

Figure 1-1 North Hykeham Relief Road Alignment



1.3 APPROACH FOR ASSESSING WIDER ECONOMIC IMPACTS

WebTAG A2-1 advises that "the assessment of wider economic impacts should only be undertaken … [when] it is proportionate to do so". In particular, what "potential effect the analysis will have on the VfM conclusion or [DfT's] understanding of the impacts".

In line with WebTAG A2-1 guidance an Economic Narrative has been prepared. The purpose of the narrative is to undertake a process to identifying the likely economic impacts of the scheme through to determining an appropriate methodology for assessing each of those identified impacts.

This is documented in Chapter 3.

1.4 PURPOSE OF THIS REPORT

This Economic Impacts Report (EIR) documents the economic narrative and the assessment of economic impacts of the scheme.

The document is structured as follows:

- Chapter 2 summarises the scope of **Wider Economic Impacts** and the assessment approach in this study;
- Chapter 3 sets out the **Economic Narrative**;
- Chapter 4 describes the process of **establishing dependent development**;

- Chapter 5 details the calculation for estimating the **benefits of dependent development**;
- Chapter 6 reports the assessment of **employment effects**; and
- Chapter 7 **summarises** and **concludes** the document.

2 ASSESSING WIDER ECONOMIC IMPACTS

2.1 INTRODUCTION

This chapter sets out the methodology used for assessing wider economic impacts at of the NHRR OBC stage including:

- Definition of wider economic impacts;
- Scheme context and objectives; and
- Approach for assessment of wider economic impacts.

This has been prepared with reference to the guidance set out in WebTAG Unit A2-1 Wider Economic Impacts Appraisal (May 2018).

2.2 SCHEME CONTEXT AND OBJECTIVES

The scheme objectives, taken from the OAR, are grouped into three strategic outcomes. The assessment approach for each impact was set out in the EAR.

- **Delivery of an effective and efficient transport network.**
  - This will be assessed by cost-benefit analysis including transport user benefits, accident benefits and reliability benefits.
- **Delivery of housing.**
  - This will be assessed by the user benefits relating to network performance to support housing growth and a dependent development assessment for South West Quadrant.
- **Sustainable economic growth.**
  - This will be assessed by qualitatively assessing the improvement to network performance to support economic activity and growth plus the impact from increased resilience for the whole Lincoln urban network.

The analysis in this report will contribute to the evidence base for the second and third outcomes. The second outcome directly refers to delivery of housing and there is a specific objective for the scheme to support the delivery of South West Quadrant. Analysis of the third outcome requires consideration of the employment effects of the scheme.

The first outcome was assessed using conventional cost-benefit analysis techniques. The scheme falls within the 'High' value for money category for both the initial and adjusted BCR.

Table 2-1 Summary of Monetised Benefits

Core Scenario	Net Present Value (NPV)	Benefit Cost Ratio (BCR)
Initial	£187.066m	2.4
Adjusted	£216.165m	2.6

2.3 DEFINITION OF WIDER ECONOMIC IMPACTS

The term 'wider impacts' refers to the economic benefits (or disbenefits) of a scheme attributed to distortions or market failures that arise because of transport interventions and feed into the wider economy. This can include productivity gains resulting from increased connectivity for businesses and impacts on employees through structural changes including how and where businesses or households may relocate.

The following subsections define the economic impacts which are considered in WebTAG A2-1 and how they relate to the scheme outcomes set out in Section 2.2.

2.3.1 INDUCED INVESTMENT

The guidance for assessment of induced investment is set out in WebTAG Unit A2-2 Induced Investment (May 2018).

The impacts of transport interventions can include:

- Dependent development – if the transport network cannot reasonably accommodate additional traffic associated with a new development.
- Imperfectly competitive markets – most likely if businesses benefitting from a transport improvement have a large share of their market.

There is a specific scheme objective for dependent development in South West Quadrant which was identified in Section 2.2.

The key to assessing the latter is whether there is a change in the level of economic activity as a result of transport investment and specifically if business benefitting from the transport scheme have large shares of their markets. The outcomes refer to supporting sustainable economic growth but without specific reference or identification of this impact.

2.3.2 EMPLOYMENT EFFECTS

The guidance for assessment of labour market impacts are set out in WebTAG Unit A2-3 Employment Effects (May 2018).

This refers to the changes in level and location of employment because of a transport investment. The impacts of transport inventions can include:

- Labour supply impacts – where transport is a barrier to employment due to poor connectivity between households and employment centres and/or transport costs are high relative to income.
- Move to more productive jobs – most likely when accessibility is increased and jobs relocate to high productivity locations.

The key to these assessments are the impact of 'displacement' and to what extent employment effects at a local level represent a movement of jobs from other locations. The scheme provides a new relief road and increases east-west connectivity and so these impacts are linked to the scheme outcome of supporting sustainable economic growth.

2.3.3 PRODUCTIVITY IMPACTS

The guidance for assessment of productivity impacts is set out in WebTAG Unit A2-4 Productivity Impacts (May 2018).

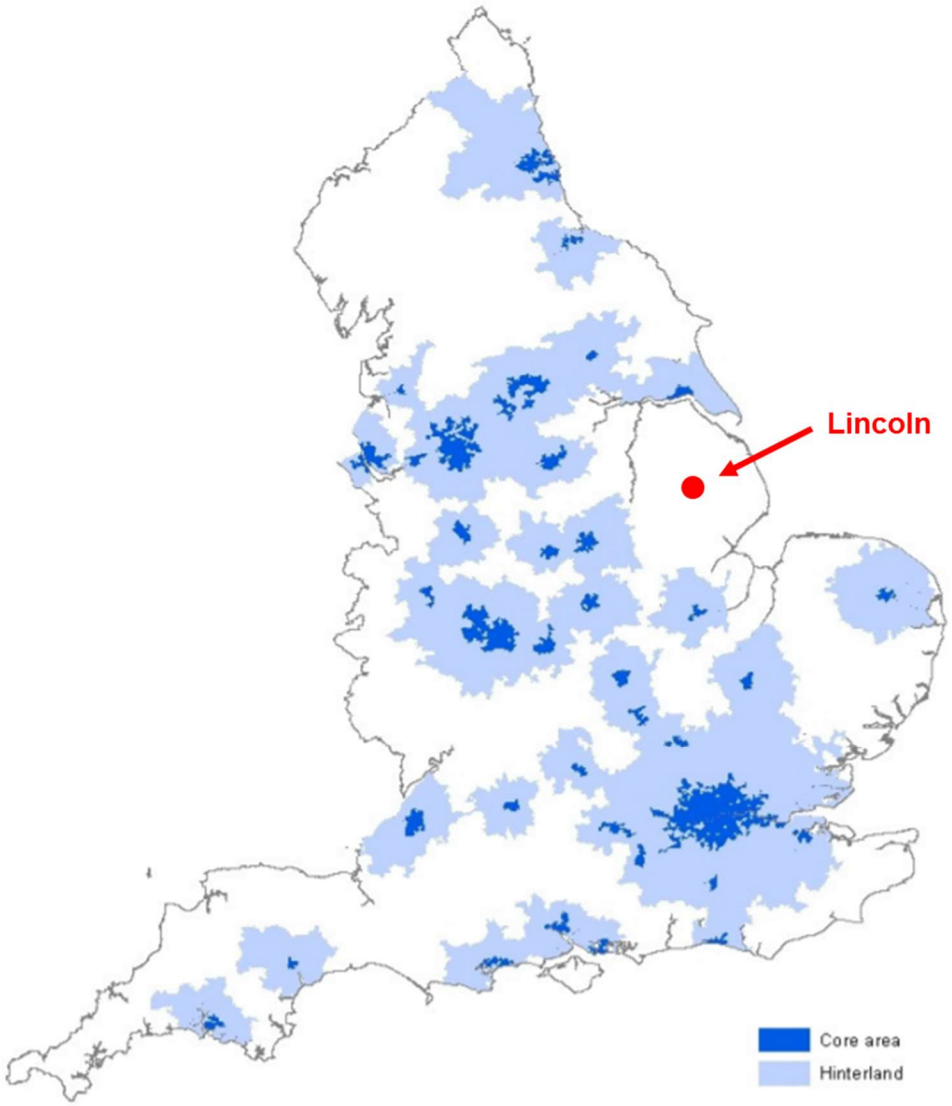
This refers to the 'place based effect' on agglomeration economies where individuals and companies derive productivity benefits through locating near other individuals and companies.

Transport investment can affect these areas in two ways.

- **Static clustering:** individuals and companies can more easily travel within the cluster which facilitates interactions. There is no change to land use.
- **Dynamic clustering:** there is a change to the level and/or location of economic activity which facilitates new or different interactions. This is driven by land use change.

WebTAG defines a set of areas referred to as Functional Urban Regions (FURs) – the map showing their locations is reproduced in Figure 2-1. These are areas where productivity impacts "could be expected to be significant." The scheme and North Hykeham are not within or adjacent to any of these areas.

Figure 2-1 Functional Urban Regions



Source: WebTAG Unit A2-4 Appendix A

2.3.4 STRUCTURAL ECONOMIC IMPACTS

Structural economic impacts can be assessed using supplementary economic modelling if they are expected to be a significant proportion of the overall impacts of a scheme. This is not considered to be appropriate for this scheme and has not been assessed.

3 ECONOMIC NARRATIVE

3.1 OVERVIEW

This chapter details the Economic Narrative including:

- Purpose of the Economic Narrative;
- Supporting evidence; and
- Economic Narrative for the scheme.

This has been prepared with reference to the guidance set out in WebTAG Unit A2-1 Wider Economic Impacts Appraisal (May 2018).

3.2 PURPOSE OF THE ECONOMIC NARRATIVE

The purpose of the Economic Narrative, defined in WebTAG A2-1, is “to articulate why the transport investment is needed to achieve any economic objectives and how it is expected to achieve these”.

There are four stages to the process:

- Identification of the expected impacts and the extent to which they are expected to achieve any economic objectives in the Strategic Case;
- Justification of why these impacts are expected to occur on the basis of economic theory and context specific evidence;
- Identification of the welfare change associated from these impacts; and
- Identification and justification of the proportionate level of analysis to quantify and value the impacts.

WebTAG A2-1 advises that the approach should be “selective” rather than “mechanical”. Analysis should be proportionate to the scheme’s expected economic impacts and balanced for the time, cost and complexity of this analysis against the extent to which it would impact on the Value for Money conclusion and the DfT’s understanding of the impacts.

3.3 SUPPORTING EVIDENCE

Regeneris were commissioned to prepare the NHRR Strategic and Wider Economic Benefits Report (November 2018) to support the Strategic Case and provides “an economic development narrative” for the scheme.

The content and findings in that report have been to support the development of the Economic Narrative set out in Section 3.4.

The Regeneris report is Appendix C to the Strategic Case.

3.4 ECONOMIC NARRATIVE FOR THE SCHEME

The economic impacts considered in WebTAG A2-1 were defined in Section 2.3. This section considers each of those in turn within the four stage process set out in Section 3.2.

3.4.1 DEPENDENT DEVELOPMENT

One of the three scheme outcomes from the Strategic Case (see Section 2.2) is to support the delivery of housing and there is a specific objective within that to support the delivery of South West Quadrant.

The scheme would provide accessibility and network capacity to unlock the South West Quadrant development land which will deliver up to 2,000 homes, 5ha of employment land plus open space and various community and facilities.

The Regeneris report[1] identifies the following welfare benefits from the dependent development:

- Helping to meet the local housing needs through provision of additional housing stock;
- Supporting new employment opportunities that are part of the development;
- Supporting the Lincolnshire economy through household expenditure from residential development plus GVA and wages from employment development; and
- Generating local fiscal impacts in the form of council tax and business rates.

Based on the context above and the importance within the Strategic Case a dependent development assessment has been undertaken to assess the value of dependent development. That is documented in Chapters 4 and 5.

3.4.2 OTHER WIDER ECONOMIC IMPACTS

One of the three scheme outcomes from the Strategic Case (see Section 2.2) is to support sustainable economic growth. The scheme increases connectivity which is a driver of labour supply impacts and move to more productive jobs. Both of those impacts come under employment effects and positively support sustainable economic growth.

It was noted in Section 2.3.3 that the scheme and North Hykeham are not within or adjacent to a Functional Urban Region. However, the scheme will improve conditions across the Lincoln urban area which will make travel easier for people and companies within the area.

The Regeneris report[2] identifies the following welfare benefits from wider economic impacts:

- Reduced costs for businesses through reducing congestion and improved travel time;
- Providing greater certainty to businesses through improving access to skills, labour and markets; and
- Unlocking employment land to attract new businesses or encouraging existing businesses to expand.

The existing evidence base has not identified a major impact on imperfectly competitive markets.

It was decided that a qualitative assessment of these impacts would be proportionate for this OBC stage of the study. The scheme is a relief road and the conventional benefits reported within the cost-benefit analysis – including user benefits, accidents and reliability – form the primary basis for the monetised assessment.

Table 2-1 summarised that the scheme is comfortably in the 'High' Value for Money category and a monetised value for wider economic impacts would not be expected to change the Value for Money conclusion at this stage. The qualitative assessment is documented in Chapter 6.

[1] Sections 6.19 – 6.28
[2] Section 7.3

4 ESTABLISHING DEPENDENT DEVELOPMENT

4.1 INTRODUCTION

This chapter sets out the process for establishing dependent development, specifically in the context of South West Quadrant, including:

- Description of South West Quadrant;
- Establishing dependency; and
- Unlocking development.

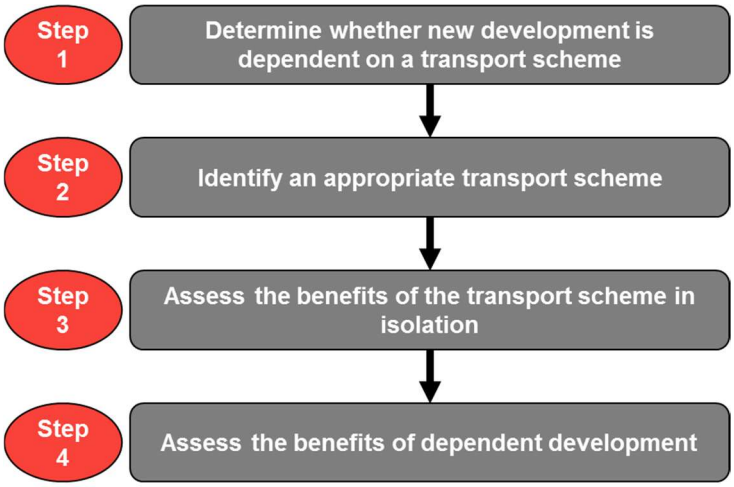
WebTAG Unit A2-2 Induced Investment (May 2018) defines the four-stage process for undertaking a dependent development assessment which is replicated in Figure 4-1.

This chapter considers Step 1 (Section 4.3) and Step 2 (Section 4.4).

Step 3 is the primary cost-benefit analysis of the scheme which is reported in the Economic Case and is summarised in Table 2-2.

Step 4 is detailed in Chapter 5.

Figure 4-1 Assessing Dependent Development



4.2 DESCRIPTION OF SOUTH WEST QUADRANT

Lincoln South West Quadrant (SWQ) is a development site identified in the Central Lincolnshire Local Plan (adopted April 2017), located in the administrative district of North Kesteven.

It is one of four Sustainable Urban Extensions (SUEs) located in the Lincoln urban area. The Lincoln urban area is defined as the area bounded by the existing A46 orbital route, the under-construction LEB and the proposed NHRR and includes Lincoln district plus the residential areas of North Hykeham and Waddington in North Kesteven district. This area is illustrated in Figure 4-2.

The proposed development includes[3]:

- 2,000 dwellings;
- 5ha of employment land;
- Primary school; and
- Community uses including sports pitches, open space, community centre and retail.

Figure 4-3 illustrates the site location from a strategic perspective. Figure 4-4 illustrates the local network detail.

The site has restricted access to the major roads and is bounded by rural land to the south and adjacent to residential areas in the north.

- The nearest major routes are the A46 and A1434 Newark Road.
- The shortest access to Newark Road is via Boundary Lane.
- There is no direct access to the A46 – the shortest route would also be via Boundary Lane to A46 / A1434 Pennell's Roundabout.
- An alternative route for traffic heading towards Lincoln city centre would be to exit the site at Mill Lane or Meadow Lane and use local and/or residential roads (including Tiber Road or Moor Lane) to join Newark Road further north.
- There is poor route access to the major routes on the eastern side of the Lincoln urban area including LEB (under construction) and the A15.
- The only route to the south is South Hykeham Road towards Haddington and Aubourn villages.

[3] Evidence Topic Paper for Lincoln South West Quadrant (August 2016)

Figure 4-2 SWQ – Site Context

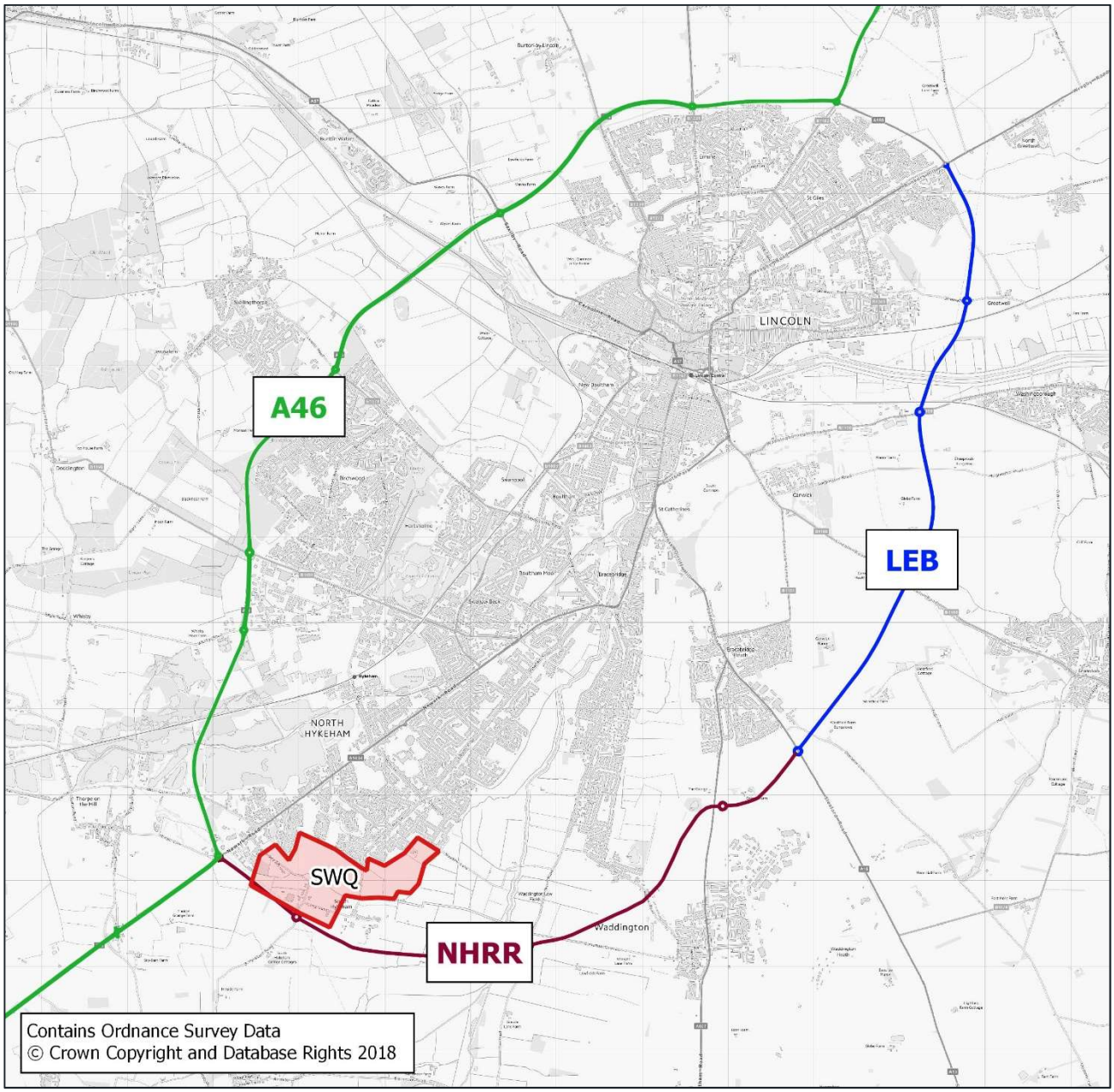


Figure 4-3 SWQ Site Location – Wider Area

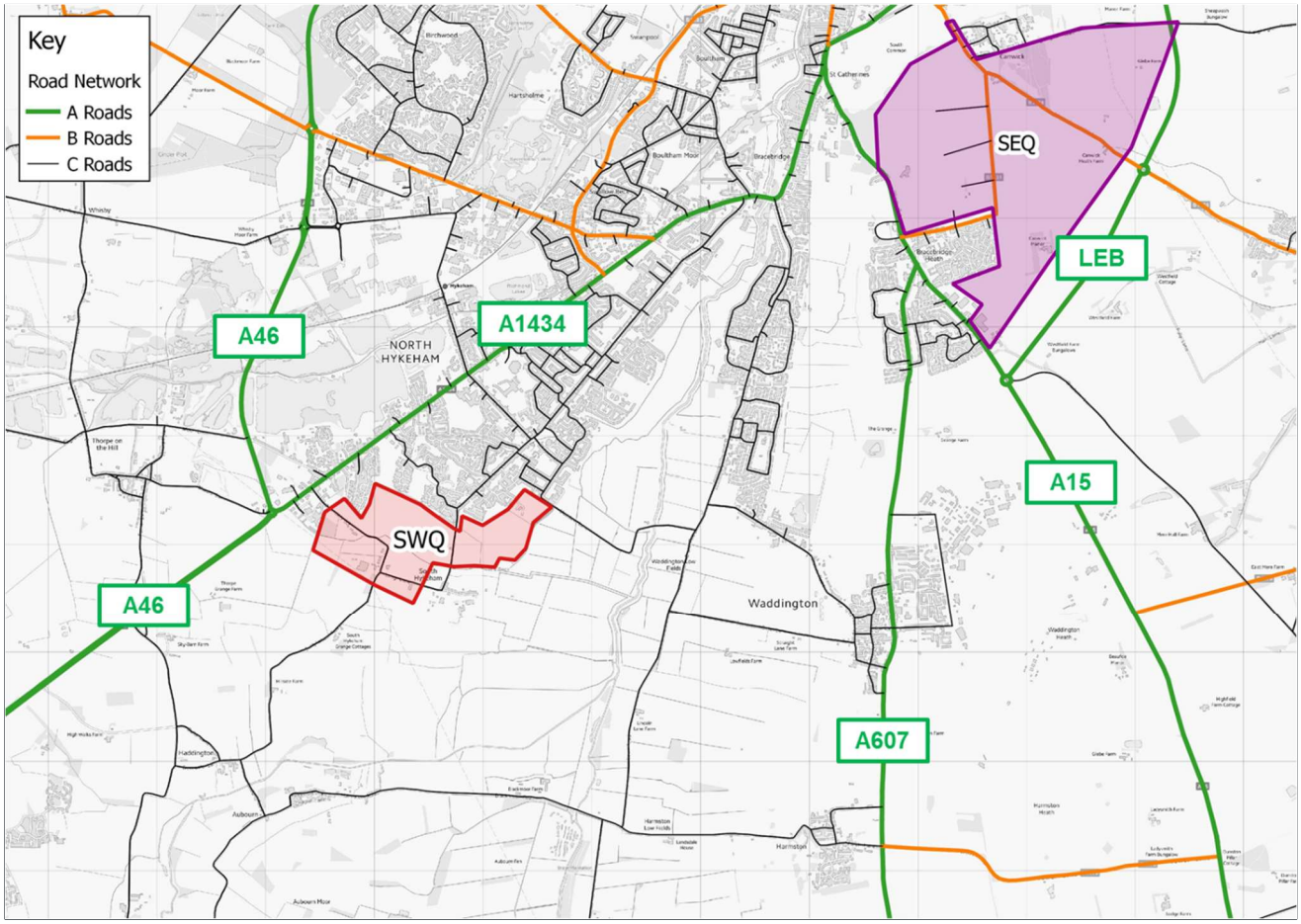
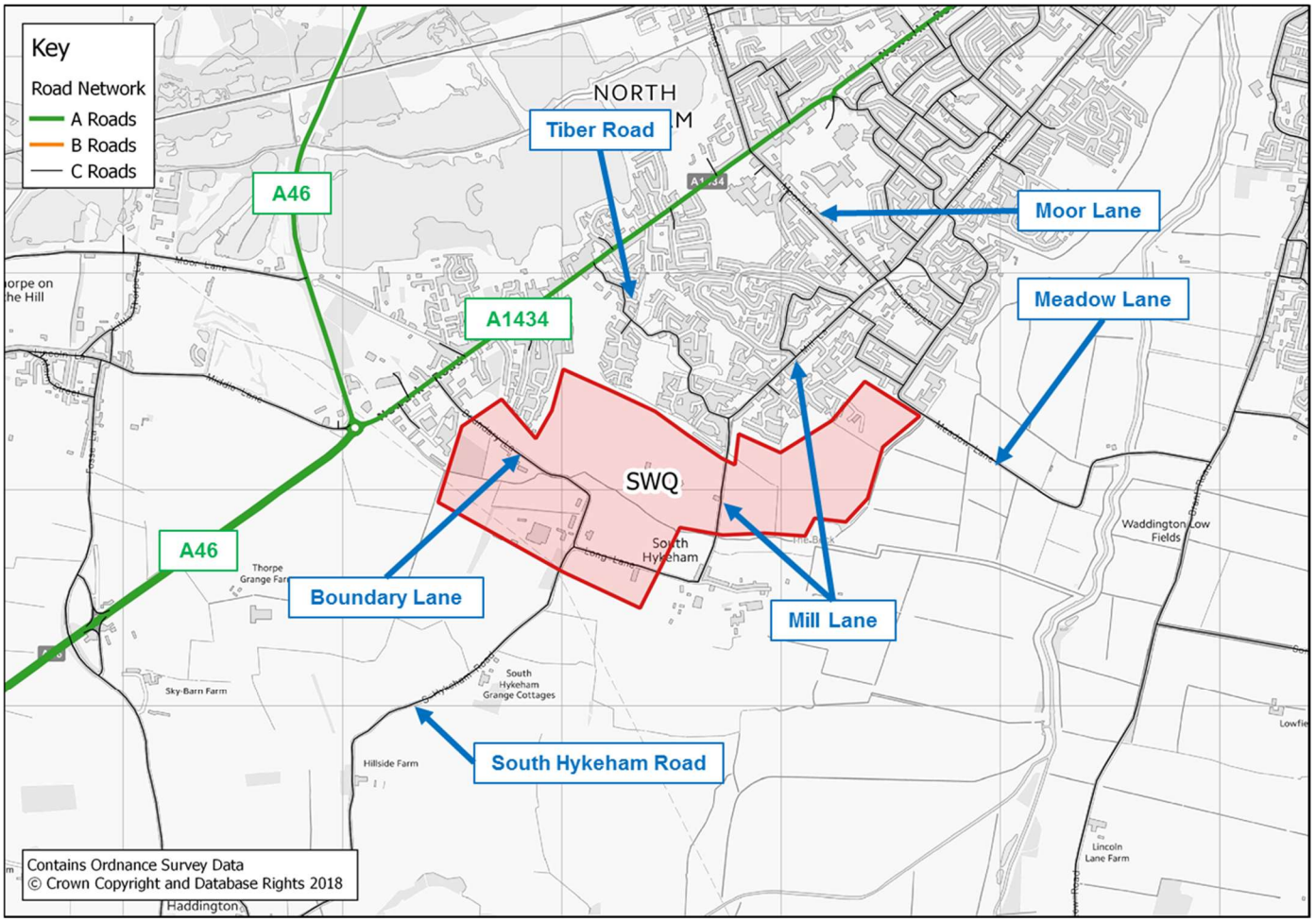


Figure 4-4 SWQ Site Location – Local Network



4.3 ESTABLISHING DEPENDENCY

WebTAG A2-2 defines two scenarios which are required to test for dependency.

- **Baseline:** without development and without any transport scheme.
- **Scenario Q:** with full development and without any transport scheme.

Scenario Q is controlled to NTEM growth across the study area.

The Baseline is formulated by the equation:

$$Total\ Trips\ in\ Baseline = Total\ Trips\ in\ Scenario\ Q - Development\ Trips.$$

4.3.1 LEVEL OF SERVICE

If the Baseline does not provide a reasonable level of service (LOS), the full development is dependent on some form of transport scheme.

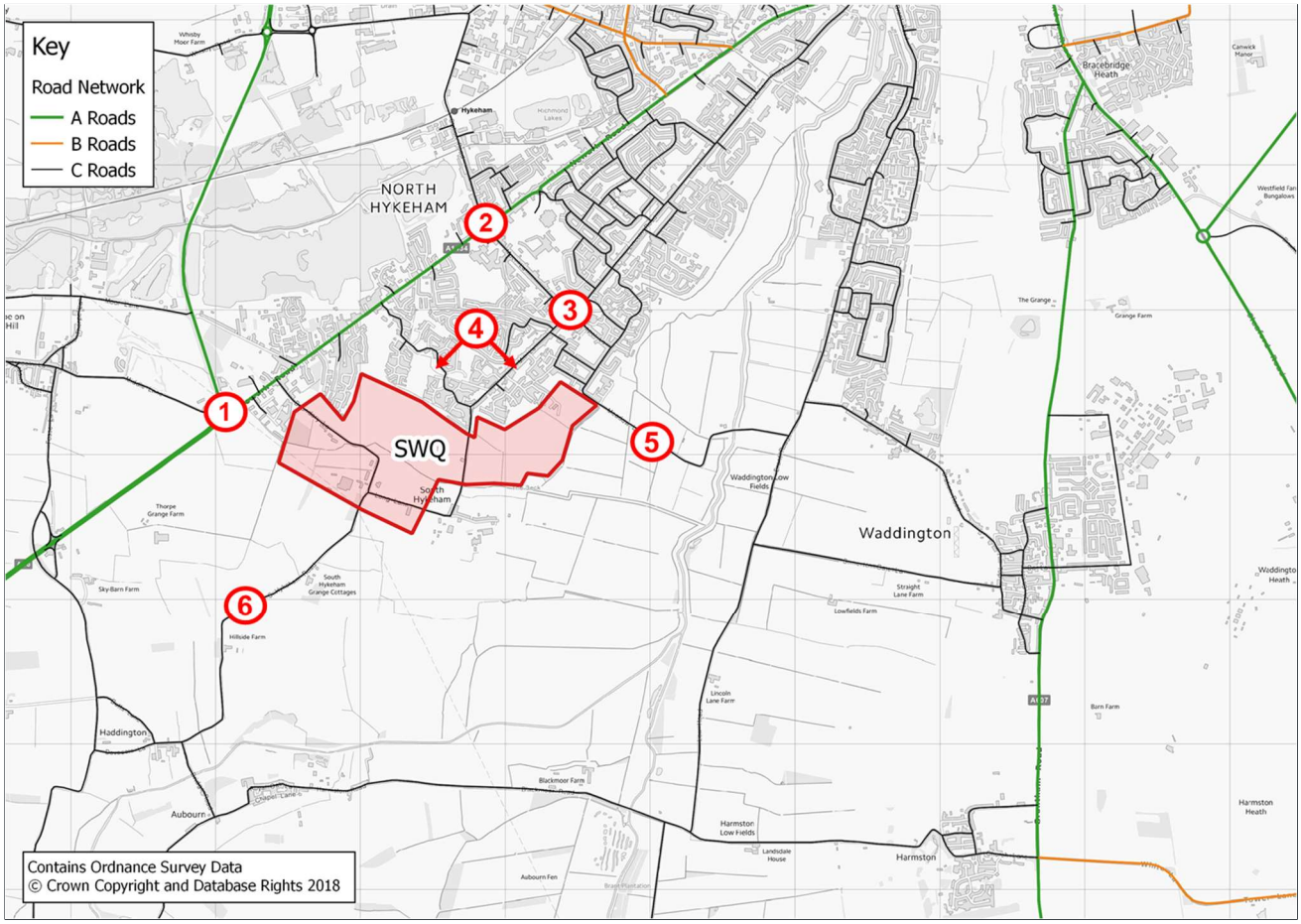
There is no explicit definition for a *reasonable* LOS in WebTAG however indicators may include changes in link transit times or delays which induce a high change in cost for external (non-development) users. Other considerations can include changes in flow volume and the factors which

may determine the suitability of links to accommodate the development traffic such residential roads and roads close to and around schools.

The factors for determining LOS for the SWQ assessment are set out as follows. The primary indicator used was volume over capacity at key junctions.

- **(1)** Junction performance at Pennell's roundabout (A46 / Newark Road / Middle Lane)
  - This is an existing pinch point on the Strategic Road Network and a key location in the Lincoln urban area network.
- **(2)** Junction performance at A1434 Newark Road / Station Road / Moor Lane
  - This is a congested signalised junction on the main route between SWQ and Lincoln City Centre.
- **(3)** Junction performance at Lincoln Road / Mill Lane / Moor Lane / Chapel Lane
  - This is a signalised staggered junction directly north of SWQ on the direct route between SWQ and Lincoln City Centre for trips in the central and eastern areas of the site.
- **(4)** Use of appropriate routes in the Hykeham area in the immediate vicinity of the scheme. In this context, appropriate refers to development traffic using main routes to access and egress the site as opposed to rat-running through residential roads to avoid congested junctions.
  - Tiber Road connects Mill Lane and Newark Road. It is a 30mph winding residential road with traffic calming and adjacent to open spaces (including a park). This road is not considered to be appropriate for development access traffic when considering network capacity and performance.
  - Moor Lane connects Mill Lane and Newark Road. It is a 30mph road primarily through a residential area but currently forms part of the main route between North Hykeham and South Hykeham, with existing bus service provision.
- **(5)** Link journey times and safety considerations on Meadow Lane
  - This is the only east-west route across the River Whitham near to SWQ and will induce development traffic. It is an existing rural A Road with national speed limit. At the eastern end it has a junction with Brant Road which is also a rural A Road. Brant Road reduces from national speed limit to 40mph immediately south of the Meadow Lane junction.
- **(6)** Link journey times and flow volumes on South Hykeham Road
  - This is the only route south of the scheme and may induce development and/or existing traffic that avoids entering Pennell's Roundabout from the A1434 due to the level of congestion and instead joins the A46 further south. This route is adjacent to Aubourn village and goes through Haddington village which has a 30mph speed restriction.

Figure 4-5 Locations of key junctions for Assessing Level of Service



4.3.2 BASELINE SCENARIO

The network conditions in the Baseline are set out extensively in the Strategic Case.

Figures 4-6 to 4-8 illustrate, by time period, the maximum volume over capacity (VOC) at junctions around the SWQ development site. A VOC greater than 85% is an indicator that a junction may experience operational issues, in particular when observed in clusters of adjacent junctions.

In the context of the locations set out Section 4.3.1, it can be seen in the peak hours that:

- Several entry arms to Pennell's Roundabout are close to or above capacity;
- There are multiple adjacent junctions with maximum VOC greater than 85% on Newark Road including the junction with Station Road / Moor Lane – this is also the case in the inter peak; and
- The junction at Lincoln Road / Mill Lane / Moor Lane / Chapel Lane is also around or above the 85% threshold for maximum VOC.

The corresponding delay plots in Figures 4-9 to 4-11 support these conclusions, with large delays observed in the same locations. The level of congestion at key junctions on the main routes leads to high levels of rat-running in the local network through North Hykeham – there is a specific scheme objective around reducing this issue.

A primary contributing factor is the lack of route choice for east-west movements, both within and to bypass the Lincoln urban area. This forms the basis of other specific scheme objectives. These issues will be only become worse with the addition of any development traffic from SWQ in the area.

In addition to modelling outputs, the planning policy context is also important.

Based on this it is determined that the Baseline does not provide a reasonable level of service.

LP30 in Central Lincolnshire Local Plan specifies that the proposals for SWQ should provide part of the scheme connecting the A46 at Pennell's Roundabout to the site's primary access road. The extent of the scheme required is to be "informed by the transport assessment and traffic modelling". This indicates that in a local policy context there is a dependency on at least some variant of the scheme.

The site is also adjacent to the A46 which is part of the Strategic Road Network (SRN). There is guidance provided in DfT Circular 02/2013 'The Strategic Road Network and the Delivery of Sustainable Development' which states that development proposals are likely to be acceptable if "they can be accommodated within the existing capacity of a section" of the SRN or "do not increase demand for use of a section that is already operating at over-capacity levels". It was observed in Figures 4-6 to 4-8 that some entry arms to Pennell's Roundabout operating close to and above capacity in the Baseline which would only be exacerbated with additional demand added into the network at that location from SWQ.

Figure 4-6 Baseline AM Peak – Max VOC

Figure 4-7 Baseline Inter Peak – Max VOC

Figure 4-8 Baseline PM Peak – Max VOC

Figure 4-9 Baseline AM Peak – Delay

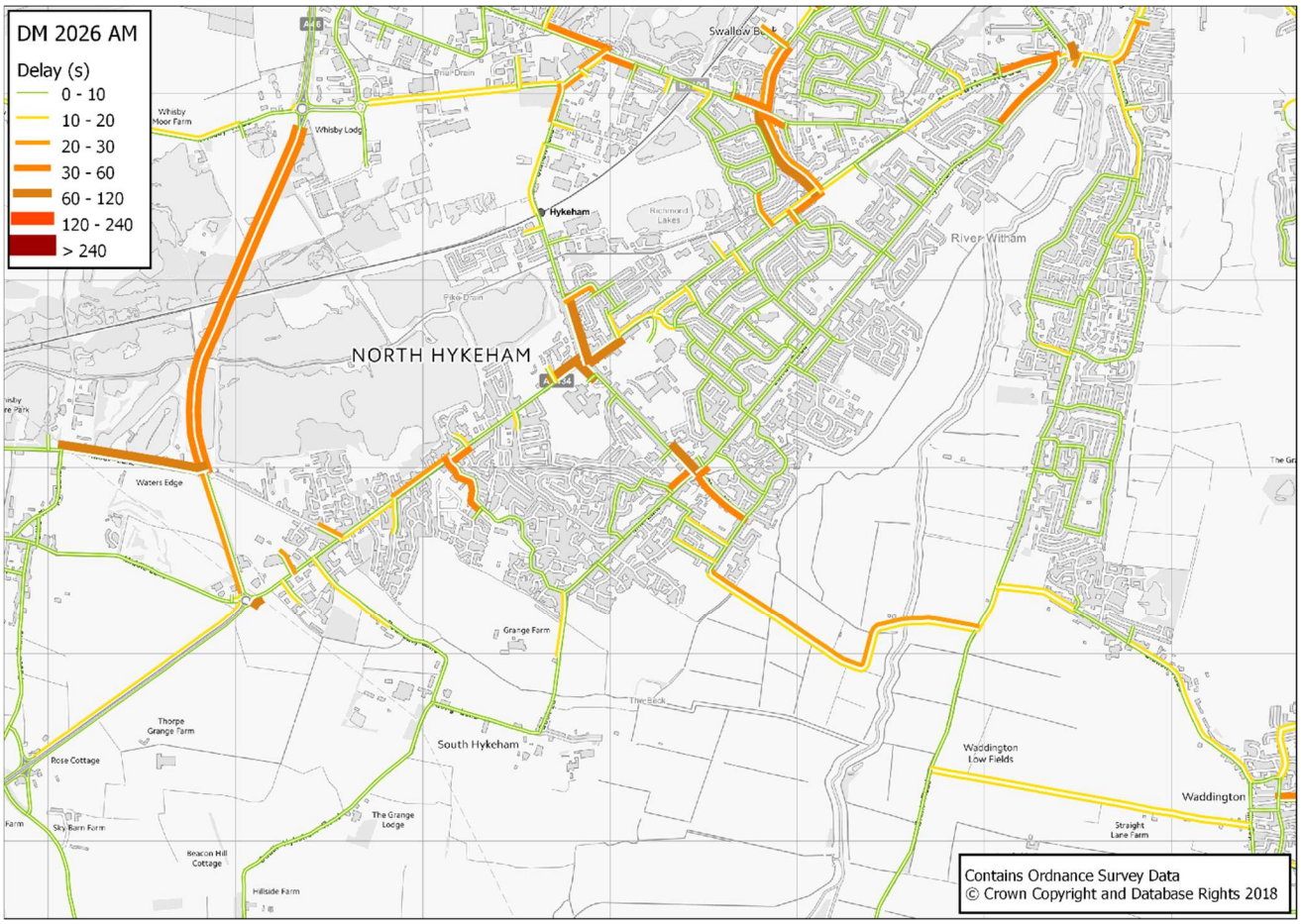


Figure 4-10 Baseline Inter Peak – Delay

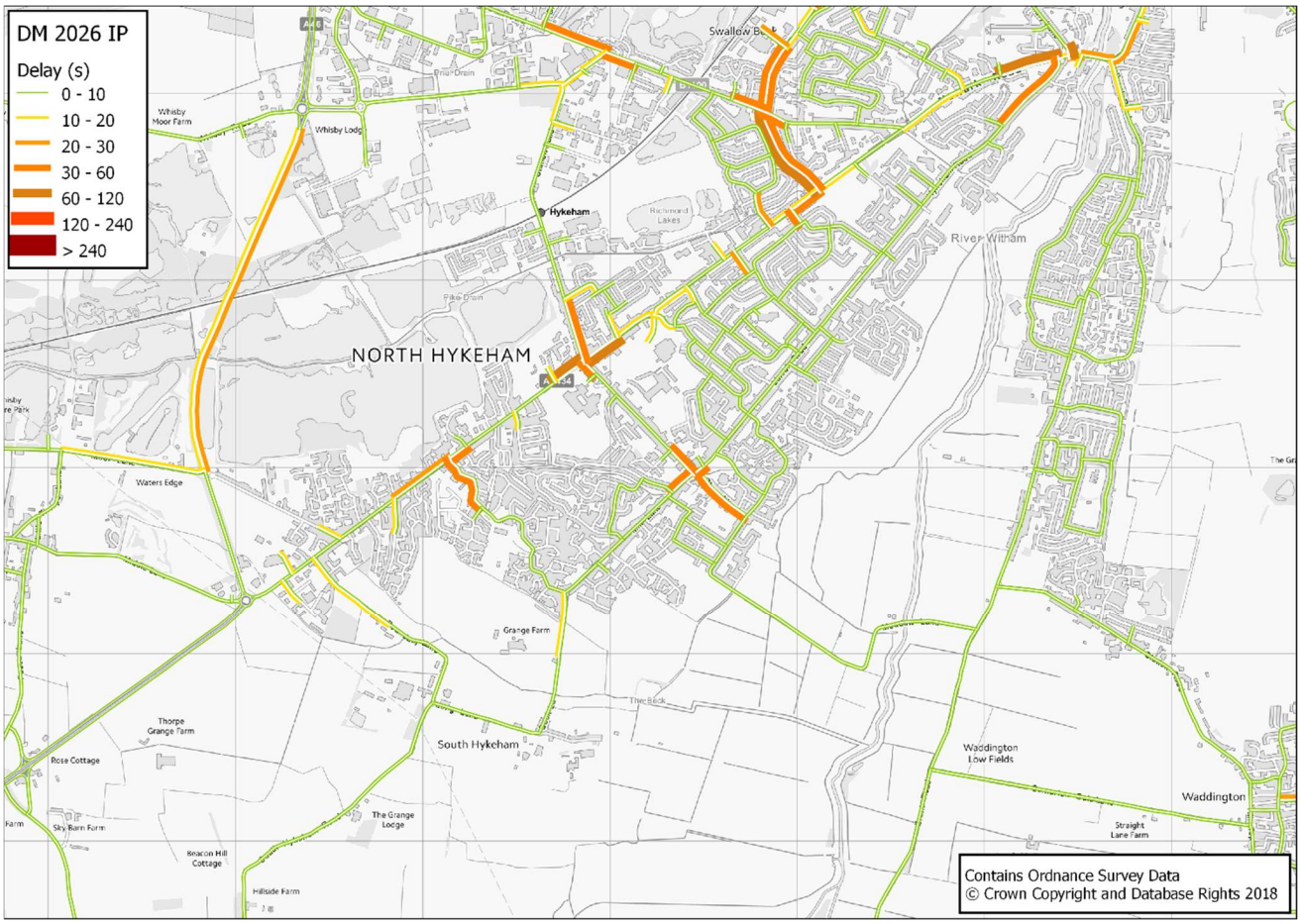
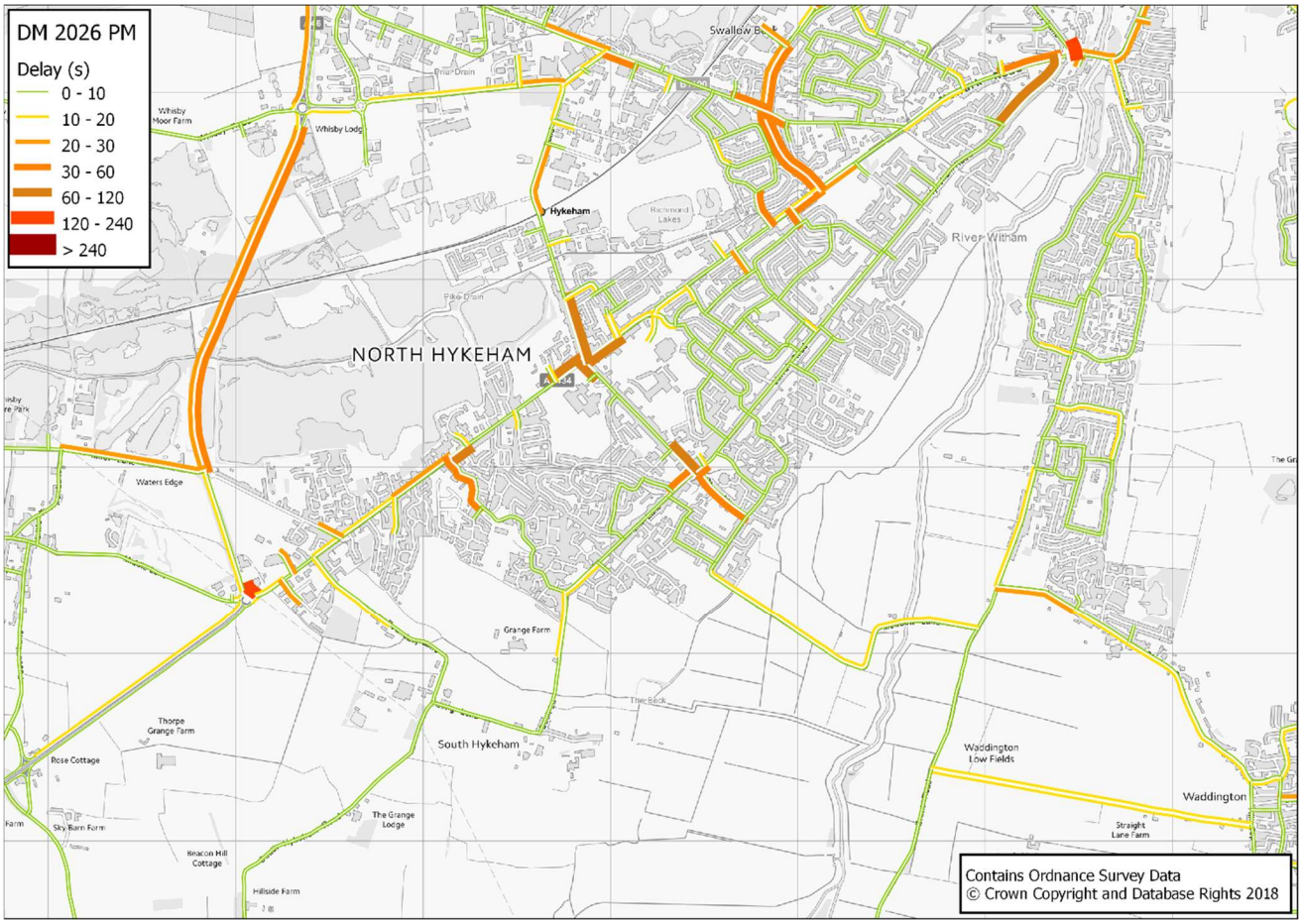


Figure 4-11 Baseline PM Peak – Delay



4.3.3 SENSITIVITY TEST – 200 HOMES

It was concluded in Section 4.3.2 that the Baseline does not provide a reasonable LOS. To follow that, a sensitivity test was undertaken to test the impact of adding 200 dwellings from SWQ to the Baseline with access onto Meadow Lane. This illustrates the impact of a comparatively small number of dwellings in SWQ. This test was informed by phasing and location data from previous modelling of the site traffic impacts undertaken in 2015.

The access point to SWQ on Meadow Lane was previously modelled as a roundabout junction which was agreed based on consideration of the degree of the bend on Meadow Lane at that point. This assumption was retained.

Figures 4-12 and 4-13 illustrate the flow and delay difference in the AM peak between this scenario and the Baseline.

- There is a noticeable delay increase eastbound on Meadow Lane due to the roundabout junction added in for access to SWQ.
- The flow increase on Mill Lane and Boundary Road attributed to development traffic accessing the A46 via Pennell's Roundabout. The A46 is a key strategic link and a proportion of any level of development traffic will want to access the road. The Baseline analysis showed that the A1434

Newark Road entry arm to Pennell's Roundabout was over capacity in the AM peak and this development provides additional demand.

- Small changes in delay, including some decreases, are linked to localised rerouting in the area as a result of the development. This demonstrates route choice is sensitive which is an indicator of congestion in the model.

The impacts are similar in the inter peak and PM peak.

In summary, it was determined that the Baseline scenario does not provide a reasonable LOS and so the full development is dependent. This sensitivity test reaffirms that analysis by showing that a relatively small level of development will exacerbate the key locations and issues that cause a reasonable LOS to be breached. Further incremental tests would see similar impacts but at an increasing magnitude.

Figure 4-12 Flow Difference: SWQ (200 homes) minus Baseline

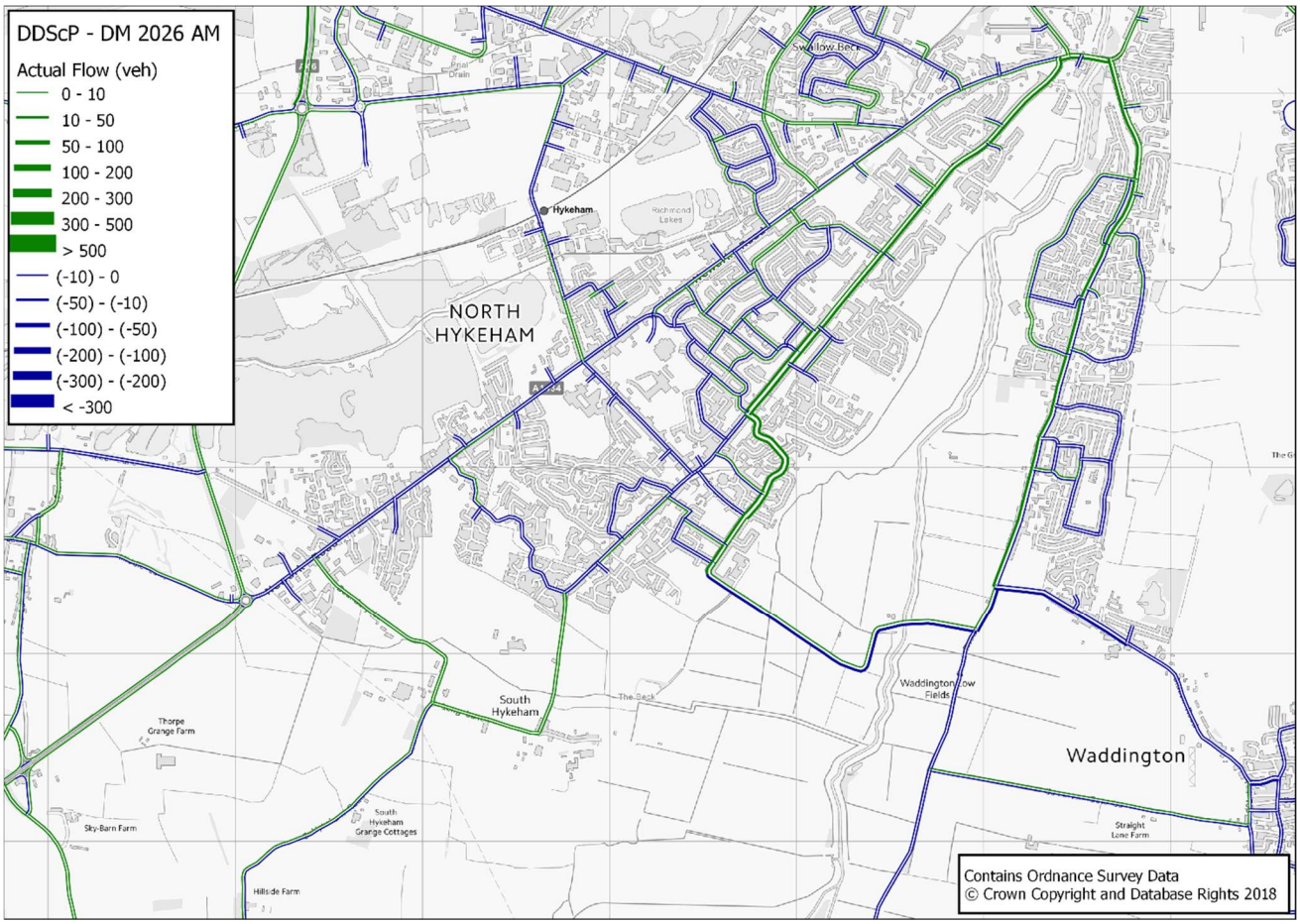
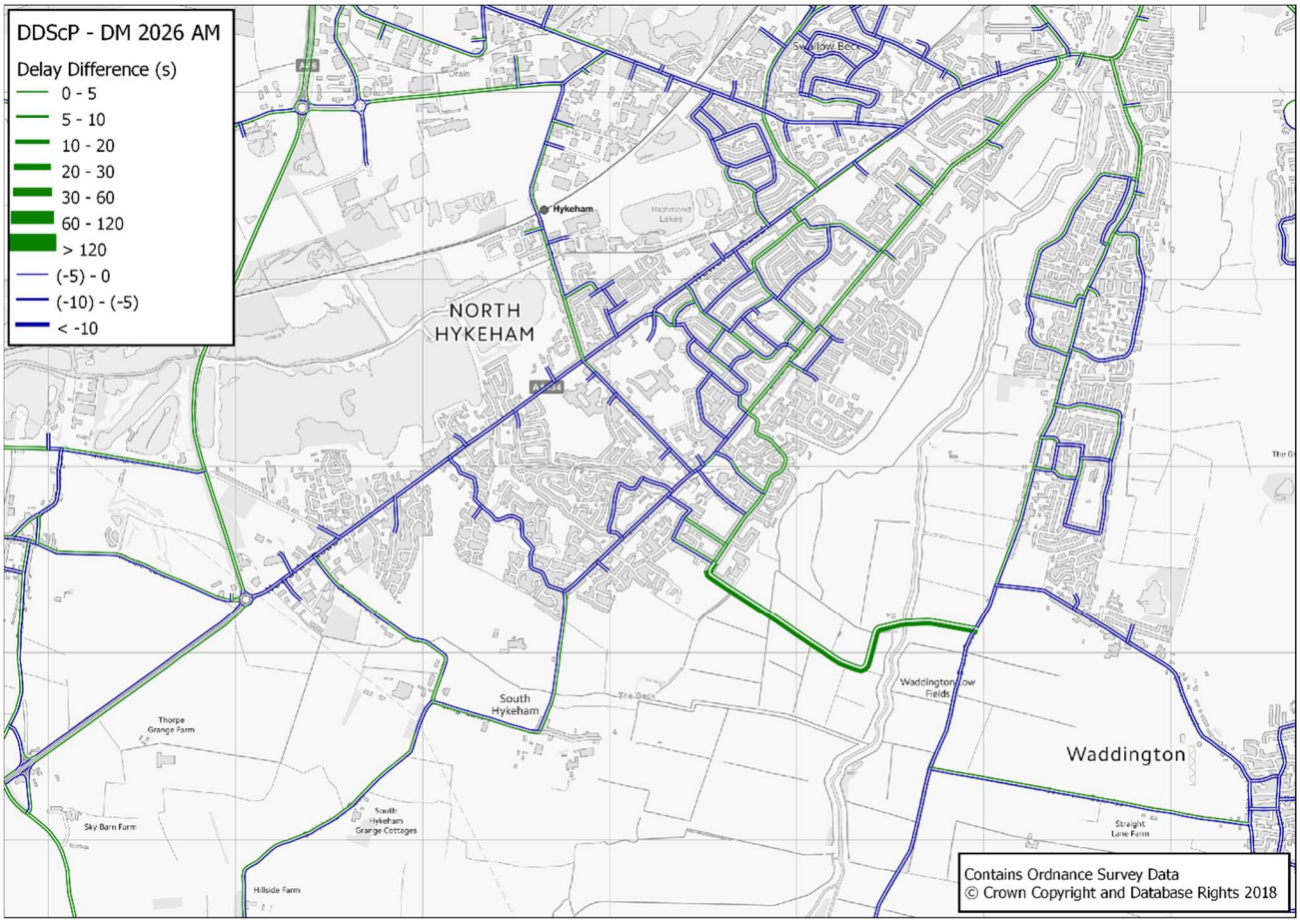


Figure 4-13 Delay Difference: SWQ (200 homes) minus Baseline



4.4 UNLOCKING DEVELOPMENT

An additional scenario is required to be modelled to demonstrate that the dependency under consideration has been resolved.

- **Scenario R:** with full SWQ development and with the scheme.

This was developed using variable demand forecasting for consistency with Scenario Q.

The key impacts of the scheme in relation to the six factors for determining LOS identified in Section 4.3.1 are as follows.

- **(1)** The scheme increases overall capacity at Pennell's Roundabout and adds a fifth arm for the scheme. The scheme provides a more direct route between SWQ and the A46 via the South Hykeham Road junction which relieves additional demand from the development on the A1434 Newark Road entry arm.
- **(2)** The scheme reduces traffic flow and delay on A1434 Newark Road due to the inducing strategic east-west movements from the local network.
- **(3)** The scheme reduces traffic flow and delay on the Lincoln Road / Mill Lane due to the inducing strategic east-west movements from the local network which reduces the level of rat-running in North Hykeham.
- **(4)** The scheme reduces traffic flow on the majority of local roads in the North Hykeham area due to reduced rat-running.

- **(5)** The scheme provides a new high speed link for east-west movements across the River Witham as a more appropriate route than Meadow Lane.
- **(6)** The scheme reduces congestion at Pennell's Roundabout which reduces the need for

On this basis the scheme is determined to resolve dependency.

It is advised in WebTAG A2-2 to analyse whether a lower cost transport scheme would resolve the dependency. The OAR documents the options assessment process which considered two partial variants of the dual carriageway scheme.

- Partial NHRR from A46 to South Hykeham Road; and
- Partial NHRR from A46 to Brant Road.

The options were eliminated in the initial sift since they did not achieve the strategic objectives of the scheme. In the context of resolving the dependency:

- The first variant is a single section of road and effectively a link road to SWQ. This variant does not provide east-west connectivity and leaves Meadow Lane as the only alternative route to cross the River Witham in the area. It does not offer the wider benefits for existing users that the preferred scheme provides in terms of reduced congestion on Newark Road and reducing rat-running on the local network in North Hykeham.
- The second variant is longer and resolves the issue of route choice across the River Witham. However, it stops short of providing a direct connection between the A46 and LEB / A15 which means that the wider strategic impacts of this option are much more limited than the preferred scheme – this was shown in the OAR. In addition to supporting SWQ development traffic it would provide a link for other users that would induce strategic east-west traffic into Waddington village in absence of a direct connection between A46 and LEB / A15.

4.5 SUMMARY OF STAGES 1 AND 2

The whole of the SWQ development has been determined to be dependent on the scheme. The Baseline scenario has established an unacceptable level of service at Pennell's Roundabout and rat-running on local roads adjacent to the site location as the result of congestion. Pennell's Roundabout is a key issue since it provides the primary access from the site to the A46 and from there other strategically important routes. In addition to that there is poor access across the River Witham towards the A15 and LEB in the east. A sensitivity test with only 200 homes showed that additional demand would be induced at key pinch points, including Pennell's Roundabout, which would deteriorate conditions further at those locations. The scheme resolves these key issues by providing additional entry and circulating capacity at Pennell's Roundabout and a direct link to the A15 / LEB.

Stage 3 assesses the benefits of the transport scheme in isolation. In this instance that refers to the scheme Core Scenario economic appraisal which is detailed in the Economic Case.

Chapter 5 continues the assessment to analyse the benefits of dependent development.

5 BENEFITS OF DEPENDENT DEVELOPMENT

5.1 OVERVIEW

This chapter details how the benefits of South West Quadrant as dependent development have been estimated, including:

- Approach to the analysis;
- SWQ land budget allocations;
- SWQ phasing assumptions;
- Land value uplift;
- Transport external costs;
- Other impacts;
- Land amenity value;
- Non-transport complementary interventions;
- Net social value of South West Quadrant; and
- Assessment summary.

This follows from Chapter 4 which detailed the previous stages of the dependent development assessment.

According to WebTAG A2-2, the value to society of a new development is defined by two elements:

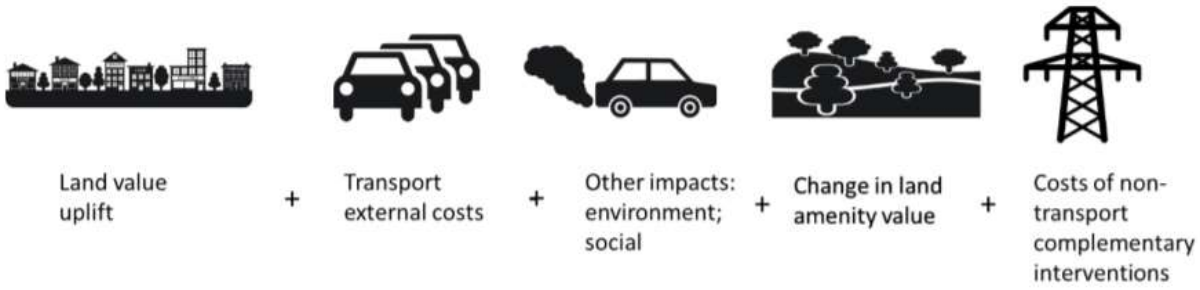
- The private benefit associated with change in land use, typically accrued by landowners; and
- The external impact of the resulting development, including transport related external costs and changes in the amenity value of land.

This is summarised by the formula

$$Net\ Social\ Value\ of\ Development = Ne\ \ Private\ Value\ of\ Development + \quad External\ of\ Development$$

which is illustrated in Figure 5-1.

Figure 5-1 Net Social Value of Development



Source: Capturing Housing Impacts in Transport Appraisal – Case Studies (DfT, 2018)

5.2 APPROACH TO THE ANALYSIS

The analysis has been undertaken to provide consistency of approach with the assessment of impacts used in the cost-benefit reporting of the scheme in the Economic Case.

- Costs and benefits have been assessed over the same 60 year appraisal period.
- Reported values are in present value costs, which includes:
  - Rebasing to the DfT's base year (currently 2010);
  - Discounting to the DfT's base year; and
  - Converting to market prices (where applicable).

Whilst the outturn value from this analysis is not included within the initial or adjusted cost-benefit calculations the outcome will inform the Value for Money Statement which considers the outcomes for all assessed impacts (including non-monetised) and concludes the Economic Case.

5.3 SWQ LAND BUDGET ALLOCATION

A land budget plan for SWQ had been provided by LCC and is attached as Appendix A.

The site area by land use is summarised in Table 5-1. This includes an area of existing employment land which does not change land use and so won't be included in the calculations which account for changes in land use.

Table 5-1 SWQ Land Allocation

Land Use	Area (ha)
Residential	70.196
New Employment	2.717
Education	1.901
Community facilities	0.404
Cemetery	1.479
Open space	34.252
New Roads	5.015
Total – New Land Use	**115.964**
Existing Employment (unchanged)	12.574
Existing Roads (unchanged)	1.936
Existing Woodland (unchanged)	3.105
Total – Existing Land Use (unchanged)	**17.615**
Overall Site Total	**133.579**

5.4 SWQ PHASING ASSUMPTIONS

To apply inflation and discounting the development land budget needed to be profiled by year. The following assumptions have been applied.

- The full development has been determined to be dependent on the scheme (see Section 4.3) and so the construction start year has been assumed to be 2027. This is based on the scheme opening year plus a one year lag.

- The number of dwellings completed per annum is 120 which this is taken from the SWQ Evidence Topic Paper (August 2016).
- There is a one year lag from completion to occupancy.
- New employment land and the other land uses will be delivered in the Central Lincolnshire Local Plan period which goes up to 2036. There was no more detailed phasing information available. On that basis, and given the initial site construction start year is 2027, a construction completion year of 2036 has been assumed for all other land uses.
    - That timescale benchmarks against the most recent phasing plan for Western Growth Corridor which is another sustainable urban extension (and developed further than SWQ) and has the employment and community land uses being delivered in years 9 to 13.

5.5 LAND VALUE UPLIFT

Land Value Uplift (LVU) measures the difference between the price of land in its new and former users. For dependent development, the associated LVU will capture user benefits to new residents. It can capture transport user benefits and potentially other wider economic impacts such as agglomeration or land market distortion.

5.5.1 DATA COLLECTED

The study was not able to obtain land value from local sources.

The most recent values available (May 2017) from the Ministry for Housing, Communities and Local Government (MHCLG) were used, which are "to be used in appraising land projects from a social perspective in line with Green Book principals"[4] and are reported in Table 5-2.

- SWQ is wholly within North Kesteven district and so the North Kesteven value was used for the residential value.
- The value for 'Commercial – Out of Town' was considered the most appropriate definition to use for the commercial value.
- The values for 'Industrial' and 'Commercial – Out of Town' are equivalent so the composition of employment between those land uses would not affect the calculation.

[4] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/710539/Land_Values_2017.pdf

Table 5-2 Land Value Estimates

Land Use	Area	£ per ha
Residential	North Kesteven (Lincs.)	1,045,000
Industrial	Greater Lincolnshire – Lincoln	320,000
Commercial – Out of Town	Greater Lincolnshire – Lincoln	320,000
Agricultural	Greater Lincolnshire	24,000
Not Used		
Residential	Lincoln	910,000
Commercial – Edge of City Centre	Greater Lincolnshire – Lincoln	865,000

5.5.2 ASSESSMENT OF LVU

It is stated in the MCHLG guidance that the LVU occurs in the year when the development is built. The land budget allocations were given in Section 5.3.

The key assumptions used are as follows.

- Land value inflation for all land elements of net social land value uplift is 5% pa – this is taken from Appendix C14 of the MCHLG Appraisal Guide (December 2016)[5].
- The phasing assumptions were detailed in Section 5.4.

Applying the land values in Table 5-2 with the phasing profile described above:

- The overall value of the proposed land is £44.428m through the construction period;
- The overall value of the existing land is £1.688m through the construction period; and
- The outturn land value uplift is £43.265m.

Those figures are in 2010 prices and values.

The calculation of these figures by land use is provided in Table 5-3.

Land value estimates for the other land uses – including the community facilities and open space – could not be sourced. The calculation underestimates the uplift since the proposed land use does not account for those other land uses whereas the calculation of existing land use is based on the full site area for completeness.

5 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/576427/161129_Appraisal_Guidance.pdf

Table 5-3 Land Value Uplift

Year	Residential				Commercial				Other				Agriculture			
	Area Built (ha)	Land Value		LVU	Area Built (ha)	Land Value		LVU	Area Built (ha)	Land Value		LVU	Area Built (ha)	Land Value		LVU
		Future Year Value	2010 Prices and Value			Future Year Value	2010 Prices and Value			Future Year Value	2010 Prices and Value			Future Year Value	2010 Prices and Value	
2026	0.000	£1.621	£0.680	£0.000	0.000	£0.496	£0.208	£0.000	0.000				0.000	£0.037	£0.016	£0.000
2027	0.000	£1.702	£0.675	£0.000	0.000	£0.521	£0.207	£0.000	0.000				0.000	£0.039	£0.016	£0.000
2028	4.212	£1.787	£0.670	£2.823	0.000	£0.547	£0.205	£0.000	4.251				8.463	£0.041	£0.015	£0.130
2029	4.212	£1.877	£0.665	£2.802	0.000	£0.575	£0.204	£0.000	0.000				4.212	£0.043	£0.015	£0.064
2030	4.212	£1.971	£0.660	£2.781	0.000	£0.603	£0.202	£0.000	0.000				4.212	£0.045	£0.015	£0.064
2031	4.212	£2.069	£0.655	£2.761	0.000	£0.634	£0.201	£0.000	0.000				4.212	£0.048	£0.015	£0.063
2032	4.212	£2.172	£0.651	£2.741	0.000	£0.665	£0.199	£0.000	0.000				4.212	£0.050	£0.015	£0.063
2033	4.212	£2.281	£0.646	£2.720	0.000	£0.699	£0.198	£0.000	0.000				4.212	£0.052	£0.015	£0.062
2034	4.212	£2.395	£0.641	£2.700	0.000	£0.733	£0.196	£0.000	0.000				4.212	£0.055	£0.015	£0.062
2035	4.212	£2.515	£0.636	£2.681	0.000	£0.770	£0.195	£0.000	0.000				4.212	£0.058	£0.015	£0.062
2036	4.212	£2.641	£0.632	£2.661	2.717	£0.809	£0.193	£0.526	38.800				45.729	£0.061	£0.015	£0.664
2037	4.212	£2.773	£0.627	£2.641	0.000	£0.849	£0.192	£0.000	0.000				4.212	£0.064	£0.014	£0.061
2038	4.212	£2.911	£0.623	£2.622	0.000	£0.892	£0.191	£0.000	0.000				4.212	£0.067	£0.014	£0.060
2039	4.212	£3.057	£0.618	£2.603	0.000	£0.936	£0.189	£0.000	0.000				4.212	£0.070	£0.014	£0.060
2040	4.212	£3.210	£0.613	£2.584	0.000	£0.983	£0.188	£0.000	0.000				4.212	£0.074	£0.014	£0.059
2041	4.212	£3.370	£0.609	£2.565	0.000	£1.032	£0.186	£0.000	0.000				4.212	£0.077	£0.014	£0.059
2042	4.212	£3.539	£0.604	£2.546	0.000	£1.084	£0.185	£0.000	0.000				4.212	£0.081	£0.014	£0.058
2043	4.212	£3.716	£0.600	£2.527	0.000	£1.138	£0.184	£0.000	0.000				4.212	£0.085	£0.014	£0.058
2044	2.808	£3.901	£0.596	£1.672	0.000	£1.195	£0.182	£0.000	0.000				2.808	£0.090	£0.014	£0.038
2045	0.000	£4.097	£0.591	£0.000	0.000	£1.254	£0.181	£0.000	0.000				0.000	£0.094	£0.014	£0.000
2046	0.000	£4.301	£0.587	£0.000	0.000	£1.317	£0.180	£0.000	0.000				0.000	£0.099	£0.013	£0.000
2047	0.000	£4.516	£0.583	£0.000	0.000	£1.383	£0.178	£0.000	0.000				0.000	£0.104	£0.013	£0.000
2048	0.000	£4.742	£0.578	£0.000	0.000	£1.452	£0.177	£0.000	0.000				0.000	£0.109	£0.013	£0.000
2049	0.000	£4.979	£0.577	£0.000	0.000	£1.525	£0.177	£0.000	0.000				0.000	£0.114	£0.013	£0.000
2050	0.000	£5.228	£0.575	£0.000	0.000	£1.601	£0.176	£0.000	0.000				0.000	£0.120	£0.013	£0.000
2051	0.000	£5.490	£0.574	£0.000	0.000	£1.681	£0.176	£0.000	0.000				0.000	£0.126	£0.013	£0.000
				£44.428				£0.526				£0				£1.688

Not Calculated

Overall Value - New Land Use	£44.954
Overall Value - Existing Land Use	£1.688
Land Value Uplift	£43.266

** All monetary values in millions*

5.6 TRANSPORT EXTERNAL COSTS

Transport external costs (TEC) refer to the costs induced by dependent transport users on other users, such as increased congestion.

The formula, provided in Appendix B of WebTAG A2-2, is given by

$$TEC = \sum_{ij} t_{ij}^{0}(c_{ij}^{1} - c_{ij}^{0})$$

where:

- c_{ij} and t_{ij} are the cost per trip and number of trips, respectively, between zones $\boldsymbol{i}$ and $\boldsymbol{j}$; and
- The superscripts 1 and 0 denotes with and without dependent development forecast scenarios respectively (both with highway scheme).

That is, the change in cost is multiplied by the number of trips in the 'without dependent development' matrix to derive the external costs on those trips. Note that a positive TEC implies a net cost on existing users.

5.6.1 ASSESSMENT OF TEC

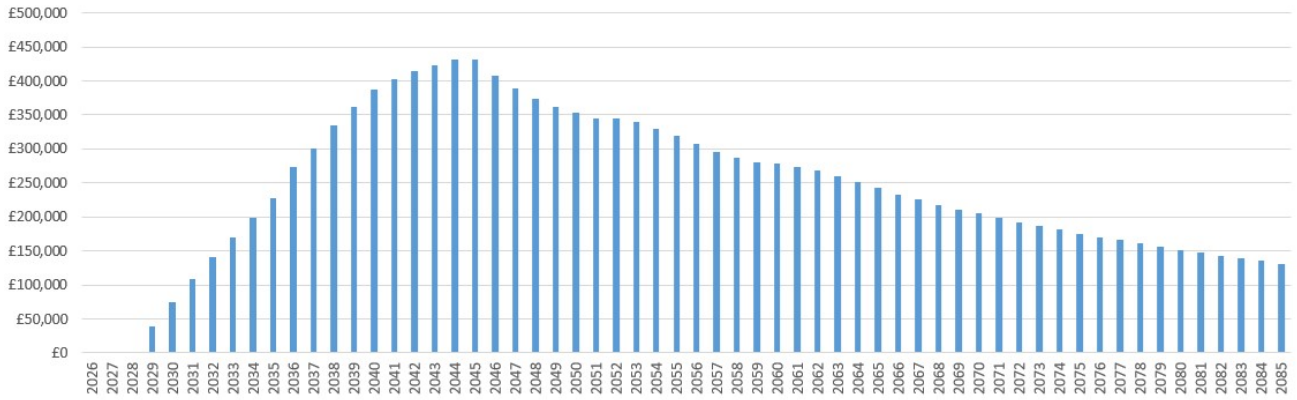
With a matrix substitution the rule of a half used by TUBA can be reformulated into the TEC equation.

On that basis the TEC was calculated using TUBA v1.9.11. This approach gave consistency with the economic parameters and demand segmentations used in the primary economic appraisal.

- The TEC was calculated using TUBA for a single modelled year – 2041 – coinciding with the scheme design year. This included two model runs
  - **With scheme without SWQ:** this is the Core Scenario Do Something forecast model from the main economic appraisal.
  - **With scheme with SWQ:** this forecast model was developed based on the previous one but with SWQ added in – this includes the site highway network access and links plus the site development trip generation. Variable demand modelling was applied consistent with the other forecast models.
- The outturn value of user benefits from TUBA in 2041 was £0.403m in 2010 prices and values.
  - There are no external costs prior to first occupancy assumed to be 2028 (see Section 5.4).
  - The TEC for other years during construction was derived from the modelled year value based on the proportion of build out relative to 2041. This approach does not use two model years but relied on the linear profile of the housing development which is the predominant land use generator of highway trips in the development. However, it is noted the relationship between benefits and build out rate will not follow the exact linear pattern.
  - WebTAG Value of Time Growth parameters were used to adjust for inflation in other years (consistent with the TUBA parameter file) and discounting was also applied.
- The outturn value of user benefits over the 60 year appraisal period was £14.561m in 2010 prices and values.

The profile of benefits is illustrated in Figure 5.2. This is a cost in the overall calculation reported in Section 5.10.

Figure 5-2 Transport External Costs



Monetary figures in 2010 prices and values

5.7 OTHER IMPACTS

The transport scheme may be associated with social or environmental impacts such as air quality or road safety. It is stated in WebTAG A2-2 that these impacts "will arise as a result of dependent users and any changes to the travel behaviour of other users".

The impacts are assessed using two scenarios.

- **Without SWQ and without scheme:** this is the Core Scenario Do Minimum forecast model from the main economic appraisal.
- **With SWQ and with scheme:** this was defined in Section 5.6.

This has not been assessed since no significant change is expected from the Core Scenario.

5.8 LAND AMENITY VALUE

Land Amenity Value (LAV) refers to the 'pleasantness' of an area, distinct from the change in land value. This refers to the external benefits of development land. For example, development on greenfield land becomes less desirable or prohibitive to activities of other users.

As stated in WebTAG A2-2, it is assumed that developed land has no amenity value, such that land use change is associated with a loss of amenity value.

Externality values have been obtained from the WebTAG Valuing Housing Impacts worksheet which are recommended to be assumed for the whole of England by the MHCLG Appraisal Guide[6]. The

[6] Footnote 62, page 63 (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/576427/161129_Appraisal_Guidance.pdf)

existing land is described as “predominantly agricultural land / greenfield with no record of development” in the SWQ Evidence Topic Paper (August 2016).

Based on that, the externality value for agricultural land (intensive) has been used for the whole site area which is replicated in Table 5-4.

Table 5-4 Externality Values

Land Use Category	Description	Present Value per Ha*
Agricultural Land (intensive)	Farmland under intensive agriculture; usually land under food production. May include farm buildings forming a part of the agricultural holdings.	£0.027m

** Monetary figures in 2010 prices perpetuity value*
Source: WebTAG Worksheet ‘Valuing Housing Impacts (January 2014)

The loss of amenity is derived by multiplying the perpetuity value per ha by the area of changed land use. The outturn value is £3.177m in 2010 prices which is shown in Table 5-5. This is a cost in the overall calculation reported in Section 5.10.

Table 5-5 Calculation of Loss of Amenity Value

Existing Land Use	Area (ha)	Present Value per Ha*	Loss of Amenity*
Agricultural Land (intensive)	115.964	£0.027m	£3.177m

** Monetary figures in 2010 prices perpetuity value*

5.9 NON-TRANSPORT COMPLEMENTARY INTERVENTIONS

Non-Transport Complementary Intervention (NTCI) refers to non-transport dependencies for residential development such as provision of schools or local facilities. In these instances, the LVU may not be entirely attributable to the transport scheme.

If the costs of providing such services are known they should be included as a disbenefit of the dependent development (unless accounted for in the estimate of LVU).

Data was provided by LCC which was used to complete the calculation set out in Table 5-6.

- The base cost estimates provided for the primary and secondary schools were £6.256m and £7.418m respectively in 2018 Quarter 3 prices.
- The school construction is assumed to be completed in 2036 – see Section 5.4.
- Construction inflation was applied at 4.1% pa consistent with the value used to derive the scheme costs.

The outturn value is £6.743m in 2010 prices which is shown in Table 5-6. This is a cost in the overall calculation reported in Section 5.10.

According to the Topic Paper, other infrastructure required is provision for health, utilities and community facilities and services. There is no estimated cost provided, however it is stated that the health infrastructure would also be delivered through Section 106 contribution.

Table 5-6 Non-Complementary Transport Interventions

Facility	Base Cost Estimate (2018 prices)	Inflation Adjustment (2036 prices)	2010 Prices and Values
Primary School	£6.256m	£12.864m	£3.085m
Secondary School	£7.418m	£15.290m	£3.658m
Total	**£13.674m**	**£28.184m**	**£6.743m**

5.10 NET SOCIAL VALUE OF SOUTH WEST QUADRANT

The calculation of the estimated net social value of SWQ is summarised in Table 5-7 which uses the values derived in Sections 5.5 to 5.9.

The outturn estimated net social value of SWQ is £18.785m.

This value will be reported in the Economic Case and inform the Value for Money Conclusion within that document.

Table 5-7 Net Social Value of SWQ

Factor	2010 prices and values
Land Value Uplift (4.3)	£43.266m
Transport External Costs (4.4)	(-) £14.561m
Other Impacts (Environment and Social) (4.5)	*
Land Amenity Value (4.6)	(-) £3.177
Non-Complementary Transport Intervention (4.7)	(-) £6.743
Total	**£18.785m**

** not assessed*

6 ASSESSMENT OF EMPLOYMENT EFFECTS

6.1 INTRODUCTION

This chapter documents the assessment of employment impacts from the scheme which were identified in the Economic Narrative, including:

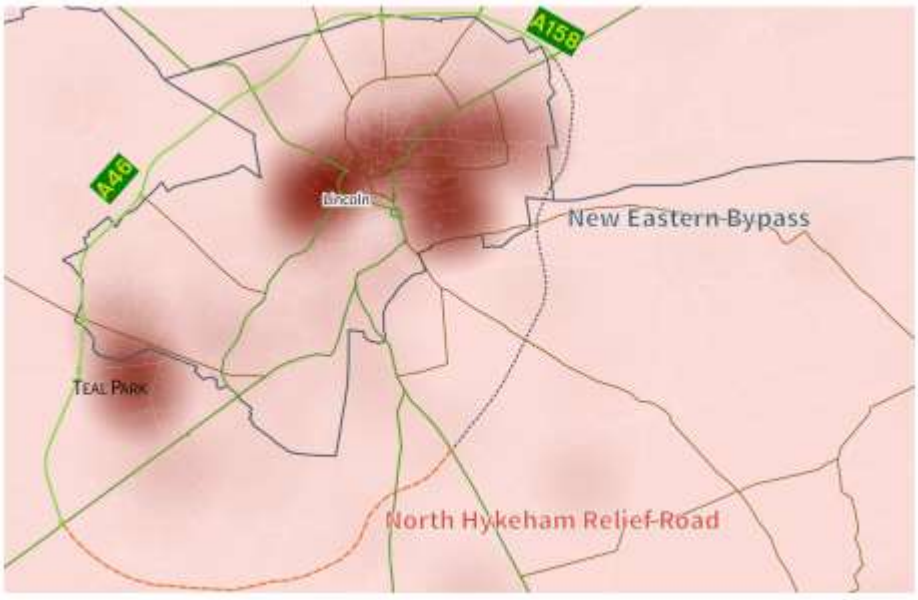
- Employment concentrations;
- Summary of employment effects; and
- Qualitative assessment of impacts.

This is based on, and provides a summary of, the conclusions from the Regeneris report.

6.2 EMPLOYMENT CONCENTRATIONS

The existing employment concentrations within the Lincoln urban area are illustrated in Figure 6-1, taken from the Regeneris report. This was based on data from the Business Register and Employment Survey 2017. It can be seen that the primary concentration is in City Centre and there is another concentration adjacent to the A46 south west of the City Centre including Teal Park.

Figure 6-1 Employment Concentration in Lincoln (Source: Regeneris Report)



Source: Business Register & Employment Survey, 2017

6.3 SUMMARY OF EMPLOYMENT EFFECTS

The Regeneris report[7] identified the following five areas for how the scheme will "overcome barriers and support economic growth":

[7] Sections 7.1 to 7.11

- Supporting priority sectors;
- Improving conditions for business growth;
- Relieving congestion and reducing travel times;
- Unlocking housing land; and
- Improving Lincoln's overall connectivity and supporting its inclusive growth agenda.

The headings were taken directly from that report. The benefits of unlocking housing land as dependent development were discussed in Chapter 5 – this sub-section considers the other four areas.

Table 6-1 provides a summary of the key conclusions taken from the Regeneris report. Each effect has been categorised into the three impacts which were defined in Section 2.3, namely:

- **Labour supply:** where transport is a barrier to employment due to poor connectivity between households and employment centres;
- **Move to more productive jobs:** most likely when accessibility is increased and jobs relocate to high productivity locations; and
- **Productivity:** referring to the 'place based effect' on agglomeration economies where individuals and companies derive productivity benefits through locating near other individuals and companies.

Table 6-1 Summary of Employment Effects

Heading	Regeneris Conclusion	Impact
Supporting priority sectors	"Improvements to the current road network will improve productivity by getting goods to market quicker, helping further strengthen Lincolnshire's position as a leading agri-food location."	Productivity
	"The advanced manufacturing and engineering sector is highly dependent on access to a young and skilled workforce, which is currently a constraint in Lincolnshire. The [scheme] will improve overall access to employment and education opportunities for local residents, whilst also improving transport links and travel time to Lincoln."	Labour supply Productivity
	"The [scheme] will play an important role in strengthening the strategic road network in the region, improving travel times and reducing congestion. Infrastructure improvements will also improve access to a younger and skilled workforce, which is a current challenge within the [low carbon economy] sector."	Labour supply
Improving conditions for business growth	"Reducing congestion means goods, services and labour can move more freely – overall, reducing costs for businesses."	Productivity
	"The [scheme] and upgrading the strategic road network in Lincoln will help improve access to skills and labour across Lincolnshire (i.e. increase businesses' effective catchment areas) – making Lincolnshire a more attractive place to do business."	Labour supply Productivity
	"There are several future employment sites that could be unlocked, as a result of the [scheme]. Increasing the stock of employment land has the potential to attract new business to the area, as well as encouraging existing businesses to expand."	Productivity

Heading	Regeneris Conclusion	Impact
Relieving congestion and reducing travel times	"Reducing travel-time benefits business by improving productivity and reducing operating costs – which inevitably increases productivity. However, there are also travel time benefits for residents, who will spend less time commuting or travelling to their destination, which can have quality of life, as well as health and well-being benefits."	Labour supply (plus social benefits) Productivity
Improving Lincoln's overall connectivity and supporting its inclusive growth agenda	"Inclusive growth, supported by improved connectivity as a result of NHRR and the wider Lincoln ring road, will contribute to addressing the productivity challenge; striving to ensure that education, employment and other vital services are accessible to the communities which are hardest to reach."	Productivity

On the basis of the conclusions presented from the Regeneris report, it is assessed that the scheme has a slight beneficial impact on productivity and labour supply impacts.

7 SUMMARY AND CONCLUSIONS

7.1 SUMMARY

The economic impacts of the North Hykeham Relief Road scheme have been assessed in line with WebTAG guidance.

The initial stage was the development of an Economic Narrative which identified the economic factors which are impacts from the scheme and defined a proportionate approach to analyse each of those impacts.

A dependent development test was undertaken to assess the impact of the scheme from unlocking development land for South West Quadrant. That is a stated objective of the scheme.

Other economic impacts were assessed qualitatively as a proportionate approach at this stage of the study.

7.2 CONCLUSIONS

The scheme provides an overall improvement to the performance and reliability of the local transport network which improves the efficiency of businesses and will promote sustainable economic growth. In particular, this increases businesses' effective catchment areas which has positive benefits for labour supply and new more productive jobs. This falls within Level 2 analysis of wider impacts.

The 'Strategic and Wider Economic Benefits Report' (Regeneris, November 2018) presents the scheme as a vital part of Lincolnshire's plans to support the growth of its priority economic sectors, improve the efficiency of the strategic transport network within the central Lincolnshire area – and in turn the links to the major national and international gateways and support the creation of new housing.

A primary objective of the scheme is to support housing growth. South West Quadrant (SWQ) is a sustainable urban extension located in the south west of the Lincoln urban area, adjacent to Pennell's Roundabout and at the western extent of the scheme.

The whole of the SWQ development was determined to be dependent on the scheme. The baseline scenario established an unacceptable level of service at Pennell's Roundabout and rat-running on local roads adjacent to the site location as the result of congestion. Pennell's Roundabout was a key issue as this junction provides the primary access from the site to the A46 and from there other strategically important routes. There are poor linkages across the River Whitham towards the A15 and LEB in the east. The scheme resolves these key issues by providing additional an entry and wider capacity at Pennell's Roundabout and a direct link to the A15 / LEB.

An assessment of the benefits from unlocking dependent development estimated the monetised value at £18.785m. This value will be reported in the Economic Case and inform the Value for Money Conclusion within that document.

Taking into account the monetised value from the dependent development test and the qualitative assessment of other impacts, the overall impact of wider economic impacts is qualitatively assessed to be moderate beneficial. This will be reported in the Appraisal Summary Table.

Appendix A

SOUTH WEST QUADRANT LAND BUDGET PLAN

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