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## 1. Introduction

Chelmsford City Council (CCC) are currently at the Issues and Options consultation stage of the review of their Local Plan adopted in May 2020. Essex Highways have been commissioned to provide consultancy support through the Local Plan review process, with a specific remit to support development of the transport evidence base. This technical note and accompanying appendices serve as the first in a series of deliverables provided by Essex Highways throughout the review process.

### 1.1 Sustainable Accessibility Appraisal

This technical note documents the methodology, outputs and findings of a sustainable accessibility mapping and appraisal study undertaken by Essex Highways. The study assesses the existing level of sustainable accessibility at 25 'settlement areas' currently identified across five draft Spatial Approaches under consideration by CCC as shown in Table 1 below.

*Table 1: Proposed housing numbers/locations for each Spatial Approach (as set out in the Issues and Options Consultation Document, 2022)*

Location	Approach A: Growing existing strategy	Approach B: Growth in urban areas	Approach C: Wider strategy	Approach D: Growth along transport corridors	Approach E: New settlement
1. Brownfield Sites in Chelmsford Urban Area	1,000	2,500	1,000	1,000	1,000
2. Edge of Chelmsford extension (West Chelmsford; East Chelmsford)	1,500*	1,500*	1,500*	500*	
3. North of South Woodham Ferrers	500	500	500	500	
4. North East Chelmsford	3,500**	3,500**	3,500**	4,500**	3,000**
5. Key Service Settlements (Bicknacre, Boreham, Broomfield, Danbury, Great Leighs)	1,500*		1,000*		
6. Service Settlements (East Hanningfield, Ford End, Great Waltham, Little Waltham, Rettendon Place, Woodham Ferrers)			500*		
7. Settlements with good proximity to transport corridors (Chatham Green, Howe Green, Rettendon Common)				1,500*	
8. New Strategic Settlement/Garden Community (Hammonds Farm)					4,000

\*Split across one or more settlement/locations

\*\*Includes the 2,500 homes to be included in the existing allocation area but not programmed for delivery within the adopted Local Plan period up to 2036

For the purposes of the appraisal, the 25 settlement areas within the Chelmsford Administrative Area (CAA) have been mapped and are shown in Figure 1 below. The six settlement areas that constitute 'Location 1: Brownfield Sites in Chelmsford Urban Area' have been defined as: Chignal/Melbourne (SA 1a), Springfield (SA 1b), City Centre (SA 1c), Moulsham/Tile Kiln (SA 1d), Great Baddow (SA 1e) and SW Chelmsford/Widford (SA 1f).

It was felt important to increase the granularity of Location 1, to help better define the sustainable accessibility characteristics of the various settlement areas within the broader Chelmsford Urban Area. This, it was felt, would better inform the selection of sites to take forward as a preferred Spatial Approach at a latter stage of the Plan review.

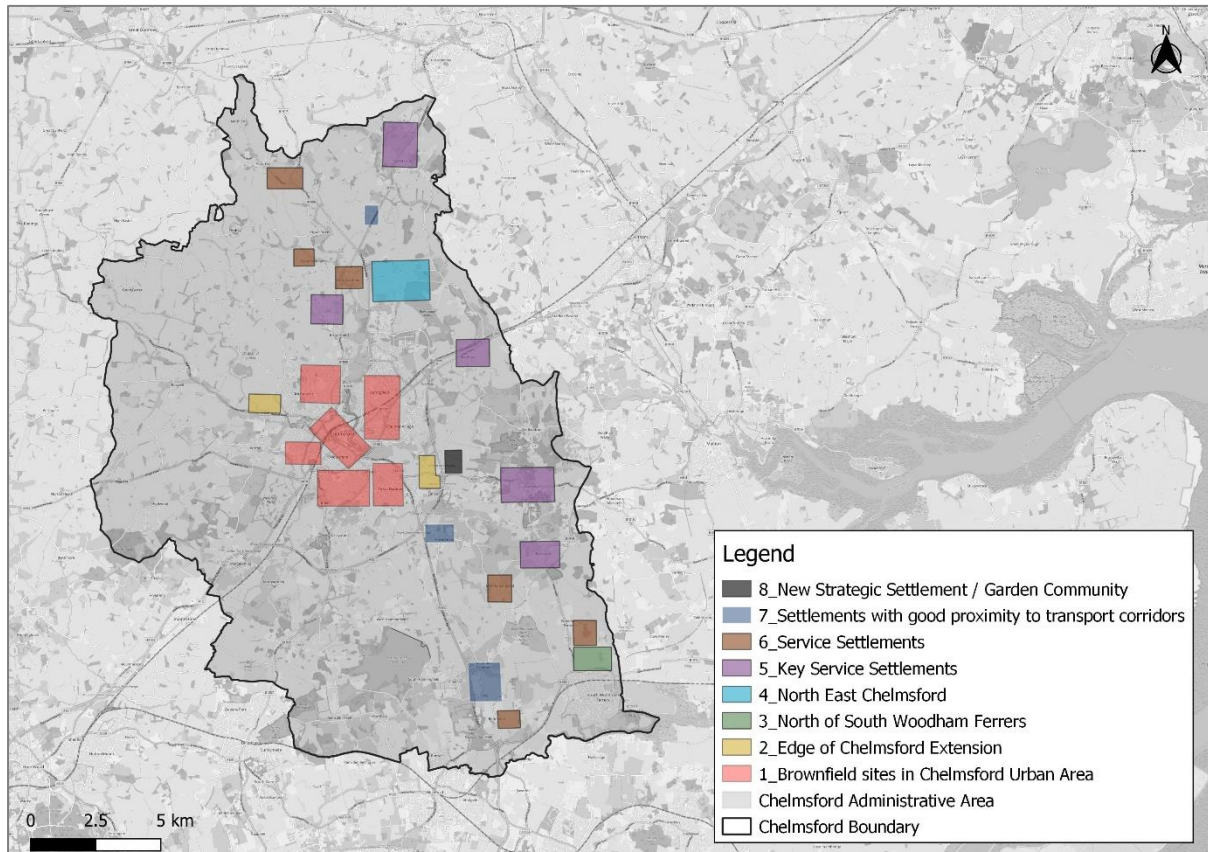


Figure 1: Mapped 'settlement areas' within Chelmsford Administrative Area

It is important to note that the illustrated settlement areas use bespoke boundaries that are not fully defined. In the absence of more detailed site information at this stage of the Local Plan development, the settlement area boundaries have been taken forward for use in the mapping appraisal. Whilst not fully defined, they can be considered commensurate with the high-level nature of the appraisal, and sufficient in determining a broad set of conclusions on overall settlement accessibility.

The purpose of this sustainable accessibility mapping and appraisal exercise is to inform CCC of the most sustainably accessible settlement areas – based predominantly on existing characteristics and infrastructure provision<sup>1</sup> - from which to determine a selection of Spatial

<sup>1</sup> With the exception of North East Chelmsford, which assesses both existing and future levels of sustainable infrastructure provision. This is detailed further in the last paragraph on p13.

Approaches comprising defined Local Plan development sites to take forward for traffic impact modelling appraisal.

The conclusion to this study looks to evaluate the relative level of sustainable accessibility of each of the five Spatial Approaches detailed in Table 1. It should be noted that this appraisal assesses the sustainability of locations for the purposes of accessibility only. This appraisal should be read alongside the findings of CCC's Integrated Impact Assessment.

## 2. Methodology

### 2.1 Sustainable Accessibility Mapping and RAG Analysis

#### 2.1.1 Appraisal Methodology

Settlement areas have been assessed on their level of sustainable connectivity to key urban centres and public facilities via the local transport network. In addition, settlement areas have also been assessed on their level of digital connectivity as an indicator of the ability of residents to work from home, which has been shown to reduce the volume of peak hour journey-to-work trips on the local transport network.

Each settlement has been given a RAG (Red (1 point), Amber (2 points) or Green (3 points)) score for each of the 14 appraisal criteria shown in Table 2 below.

Table 2: Sustainable accessibility appraisal criteria

No.	Criteria	Info Source
1	Walking and cycling connectivity to urban centres	TRACC
2	Public transport connectivity to urban centres	
3	Walking and cycling connectivity to key employment locations	
4	Public transport connectivity to key employment locations	
5	Walking and cycling connectivity to rail stations	
6	Public transport connectivity to rail stations	
7	Walking access to bus stops	
8	Access to high frequency bus services	
9	Access to ultra-fast broadband	OFCOM
10	Car driver mode share for travel to work	Census 2011
11	Access to healthcare	Google Maps
12	Access to nursery schools	
13	Access to primary schools	
14	Access to secondary schools	

The scoring reflects the quality of the connectivity demonstrated by the output maps and tables created for each criterion. Appendix A outlines the RAG criteria used.

Whilst there is no 'standardised' approach to undertaking sustainable accessibility appraisal for Local Plan evidence bases, the methodology adopted for this study follows a similar approach to that developed by Essex Highways in 2016 for the Epping Forest Local Plan<sup>2</sup>.

<sup>2</sup> <https://www.efdclocalplan.org/wp-content/uploads/2018/02/EB500G1.pdf>



The Epping Forest study was, however, focused on the appraisal of development sites rather than settlement areas. For this reason, the mapping and RAG assessment for this study instead follows a broader spatial approach similar to that adopted for the Oxfordshire Plan 2050 and presented in the ITP document: 'Stage 1 Review of Spatial Options'<sup>3</sup>.

The sustainable accessibility of employment locations has not been assessed for this study, which would otherwise require consideration of a different set of accessibility criteria. However, it would be reasonable to assume that employment locations in settlement areas with good access to passenger transport (bus and rail), for example, would score comparatively well.

### 2.1.2 TRACC Software

This study makes use of Visography TRACC 2.0 software to assess the extent of sustainable connectivity attributable to each settlement area. TRACC is the leading multi-modal transport accessibility analysis tool commonly used to model existing public transport connectivity to development sites.

The software uses imported data and built-in algorithms to generate Origin-Destination (O-D) travel times and distances for several modes including: walking, cycling, driving and public transport. The data for this study was imported from Data Cutter. TRACC has the capacity to calculate a large volume of origins and destinations at any one time, making it a good tool to analyse transport accessibility to multiple key trip attractors at a borough or district level.

TRACC's mapping engine enables the creation of contour and thematic maps so users can visually present and analyse their results. The maps display isochrone bands based on the journey time/distance bands set. The reporting functions in TRACC also allow data to be displayed in a more granular, matrix format.

The tables in Appendix B provide more detail on the two TRACC calculations used for this study: 'O-D' and 'Local Accessibility'. The default parameters in TRACC for these calculations are based on recommendations by Department for Transport (DfT). These have mostly been kept the same for this analysis, but any changes made are noted in the appendices.

The following sub-sections detail the methodology and assumptions used to create the mapping and appraisal outputs. Example maps have been presented in this technical note, whilst a complete package of map and table outputs can be found in Appendix C.

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<sup>3</sup> <https://oxfordshireplan.org/wp-content/uploads/2021/08/Transport-Stage-1-Review-of-Spatial-Options.pdf>

### 2.1.3 Connectivity Analysis – Criteria 1 to 7

Analysis of connectivity to key trip attractors such as: urban centres, railway stations and employment locations - both within and in close proximity to the CAA, has been carried out using TRACC software. The key trip attractors were identified as shown in Table 3 below.

*Table 3: Identification of key trip attractors*

Urban Centres	Employment Locations	Rail Stations
<p>Comprising cities and towns in the CAA with access to key public facilities including: banks, post offices and supermarkets.</p> <p>Also comprising urban centres lying outside of the CAA that would generate cross-boundary movements to/from settlement areas located near to the administrative border.</p>	<p>Comprising moderate-to-large sized industrial sites, business parks and service areas located within the CAA.</p> <p>Also comprising employment locations lying outside of the CAA that would generate cross-boundary movements to/from settlement areas located near to the administrative border.</p>	<p>Comprising all mainline and branch line rail stations located within the CAA.</p> <p>Also comprising rail stations lying outside of the CAA that would generate cross-boundary movements to/from settlement areas located near to the administrative border.</p>

Mapping outputs have been produced for public transport, cycling and walking accessibility to key trip attractors.

The public transport networks used in the TRACC analysis cover both buses and National Rail with the latter understandably excluded when creating outputs for public transport accessibility to rail stations. Appendix B outlines additional detail regarding the TRACC parameters, assumptions and a list of the urban centres, employment locations and railway stations mapped.

The isochrone maps include 5, 10 and 15 minute bands for cycling and walking accessibility to reflect the '15 minute neighbourhoods' or 'walkable cities' concept. Where people can access key locations and services via active modes in 15 minutes, they are more likely to travel sustainably. For the public transport outputs, the isochrone bands have been expanded to 15, 30, 45 and 60 minutes to reflect the longer journey time tolerances associated with this mode. An example of the public transport TRACC mapped output is shown in Figure 2 overleaf.

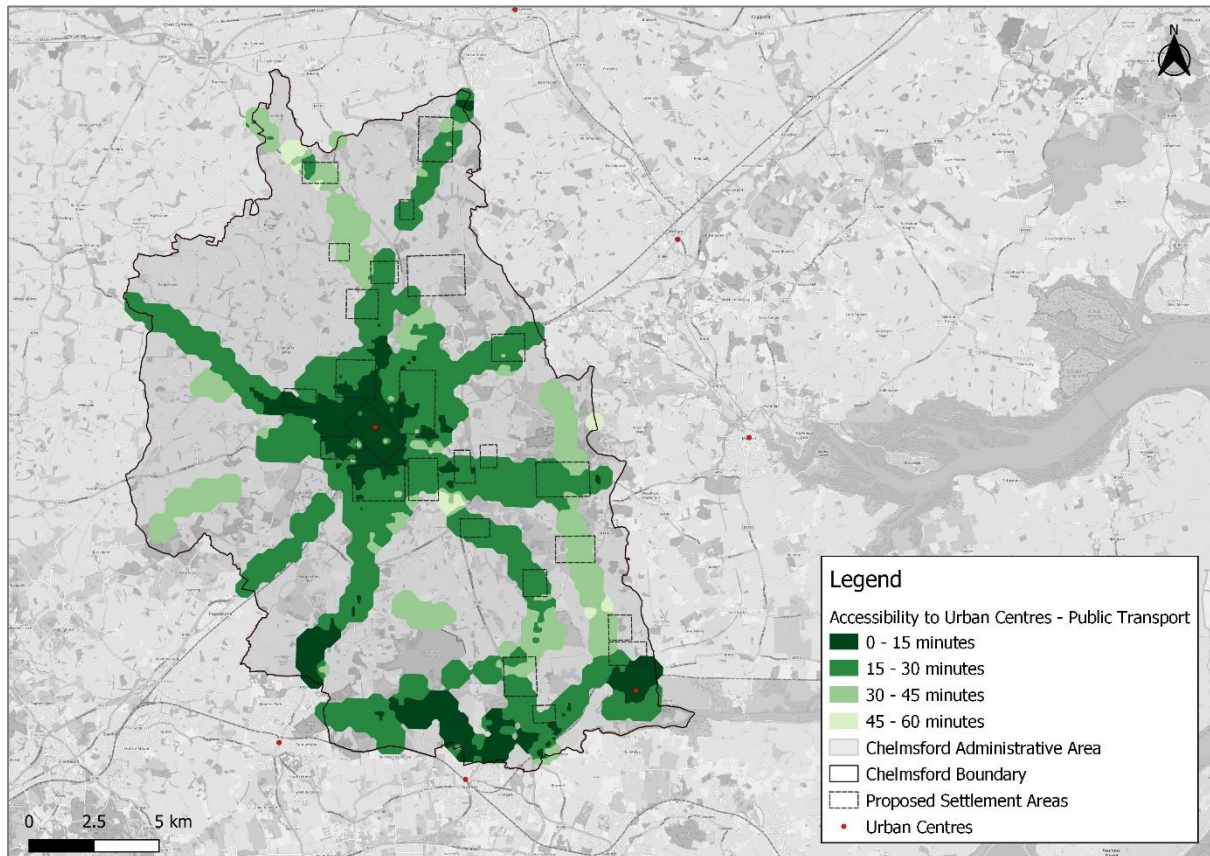


Figure 2: TRACC mapped output illustrating accessibility to urban centres by public transport

TRACC software has also been used to calculate local accessibility to bus stops with a service frequency of one or more buses per hour. The tables in Appendix B outline the parameters for this calculation, whilst the mapped output is presented in Figure 3 overleaf. The isochrone map includes distance bands of 200m, 400m, 600m and 800m which indicate the walking distance to the nearest bus stop. Any bus stops not included in the TRACC output are most likely those with infrequent services (not every hour) or where services do not operate within TRACC's default time period (Monday, 7-9AM).

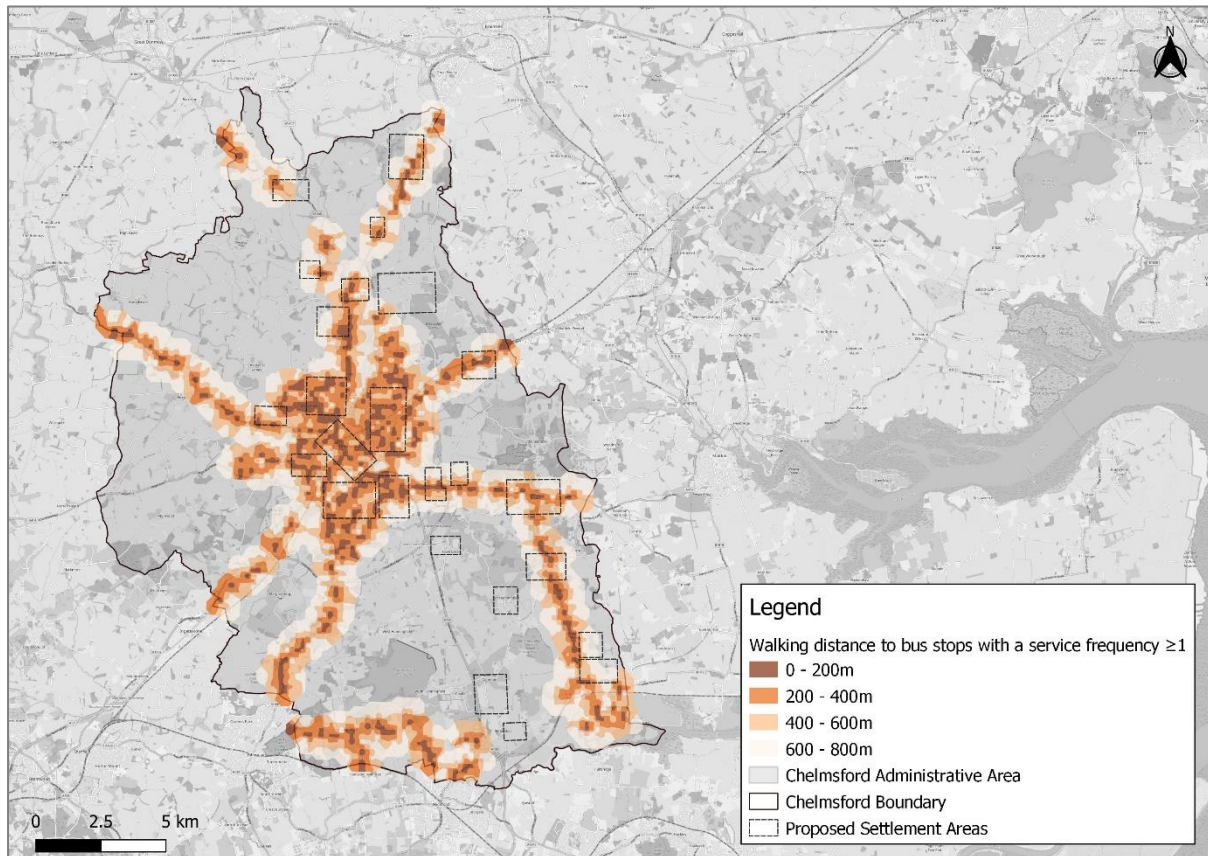


Figure 3: TRACC mapped output illustrating walking distance to bus stops with more than 1 service per hour

Table 4 below summarises the RAG scoring used for each criterion covering accessibility to key trip attractors.

Table 4: RAG scoring for accessibility to key trip attractors as set out in Appendix A

RAG Criteria	Green (3)	Amber (2)	Red (1)
Accessibility to urban centres	Settlement area within a 15 minute walk or cycle journey to an urban centre	Settlement area within a 30 minutes public transport journey to an urban centre	Settlement area greater than a 30 minute public transport journey to an existing urban centre
Accessibility to employment locations	Settlement area within a 15 minute walk or cycle journey to an employment location	Settlement area within a 30 minutes public transport journey to an employment location	Settlement area greater than a 30 minute public transport journey to an employment location
Accessibility to rail stations (walking and cycling)	Settlement area within a 15 minute walk or cycle journey to a rail station with >1 service in each direction (7-9am weekdays)	Settlement area within a 15 minute walk or cycle journey to a rail station with any peak time rail service	Settlement area greater than a 15 minute walk or cycle journey to a rail station
Accessibility to rail stations (public transport)	Settlement area within a 30 minute public transport journey to a rail station with >1 service in each direction (7-9am weekdays)	Settlement area within a 30 minute public transport journey to a rail station with any peak time rail service	Settlement area greater than a 30 minute public transport journey to a rail station
Walking access to bus stops	Settlement area within 400m of a bus stop	Settlement area within 800m of a bus stop	Settlement area over 800m from a bus stop

#### 2.1.4 Access to high frequency bus services – Criteria 8

The latest available bus route frequency data provided by ECC's Integrated Passenger Transport Unit (IPTU) was for the week commencing November 15<sup>th</sup>, 2021. Traveline data has



been used where data was not available from ECC. Whilst some routes and timetables would have still been affected by Covid-19 at this time, not all bus routes have since returned to their pre-pandemic state due to passenger numbers remaining low. Therefore, this data still provides an adequate representation of current bus route frequencies. However, it is worth noting that First Essex Routes in Chelmsford were due to be realigned from April 17<sup>th</sup>, 2022. Consequently, the data used in this study is subject to current and future changes.

Map outputs have been created to distinguish between routes with a high, medium, low, and limited frequency. The frequency criteria defined by ECC's bus enhanced partnership team is outlined in Appendix D. Individual maps have been created for the AM (0700-1100), Inter-Peak (IP) (1100-1600), PM (1600-2200) and night-time (NI) (2000-0700) periods for Weekdays, Saturdays, and Sundays. These maps can be found in Appendix C, whilst an example is shown in Figure 4 below.

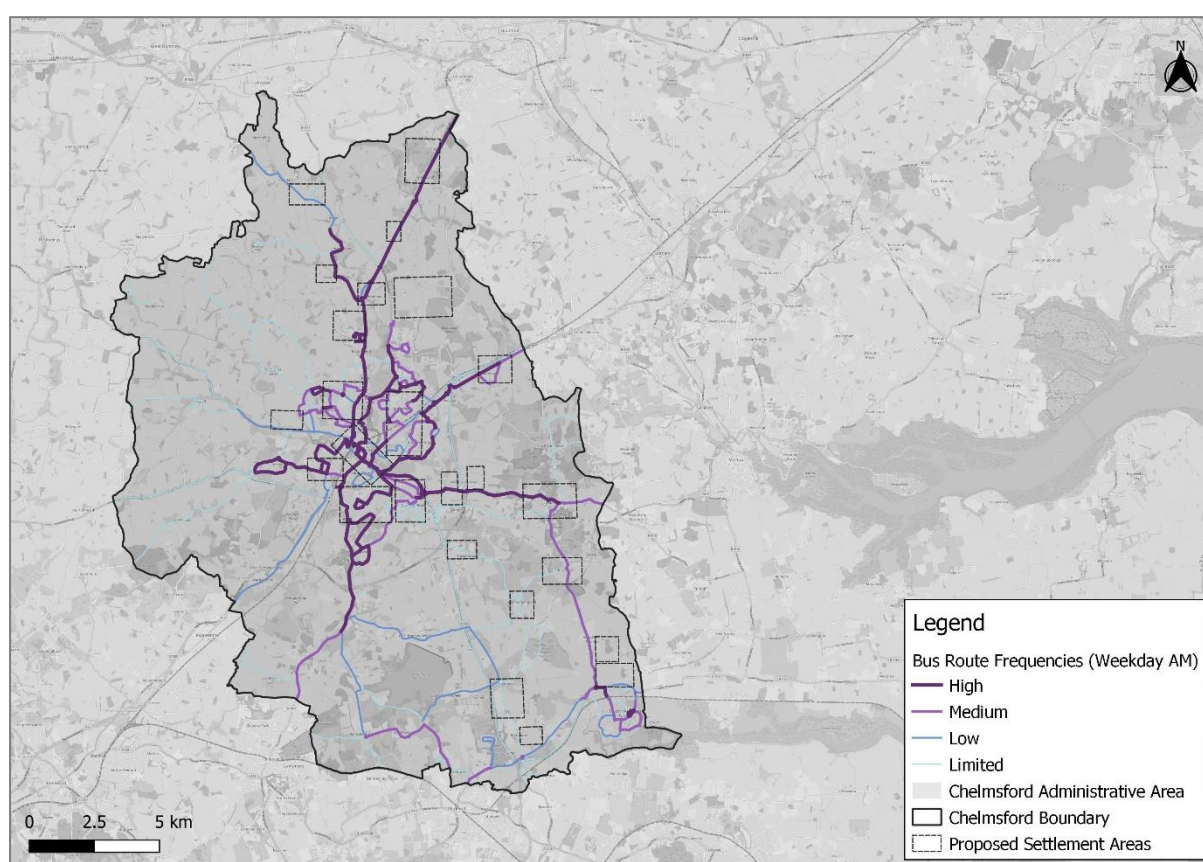


Figure 4: Mapped output illustrating access to bus services in Chelmsford for the Weekday AM peak

The settlement areas have been given a RAG score based on their walking distance to good weekday services (IP, AM, PM), Saturday services (AM, IP, PM) and out-of-hours services (Sunday AM, IP, PM and all NI periods). Settlements score highly if a high frequency bus service falls within the settlement area or within a 500m crow-fly distance from the settlement area's mapped centre point. Table 5 overleaf summarises the RAG scoring used for each criterion covering accessibility to bus services.



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Table 5: RAG scoring for access to high frequency bus services as set out in Appendix A

RAG Criteria	Green (3)	Amber (2)	Red (1)
Weekday bus services and frequency	High frequency bus service within the settlement area or settlement area within 500m of a high frequency bus service	Medium frequency bus service within the settlement area or settlement area within 500m of a medium frequency bus service	Low/limited frequency bus service within the settlement area or settlement area within 500m of a low/limited frequency bus service
Saturday bus services and frequency	High frequency bus service within the settlement area or settlement area within 500m of a high frequency bus service	Medium frequency bus service within the settlement area or settlement area within 500m of a medium frequency bus service	Low/limited frequency bus service within the settlement area or settlement area within 500m of a low/limited frequency bus service
Sunday and night (out of hours) bus services and frequency	High frequency bus service within the settlement area or settlement area within 500m of a high frequency bus service	Medium frequency bus service within the settlement area or settlement area within 500m of a medium frequency bus service	Low/limited frequency bus service within the settlement area or settlement area within 500m of a low/limited frequency bus service

### 2.1.5 Broadband connectivity – Criteria 9

Access to ultra-fast broadband (UFB) is based on OFCOM data from Summer 2021 which has been displayed at an Output Area scale as shown in Figure 5 below.

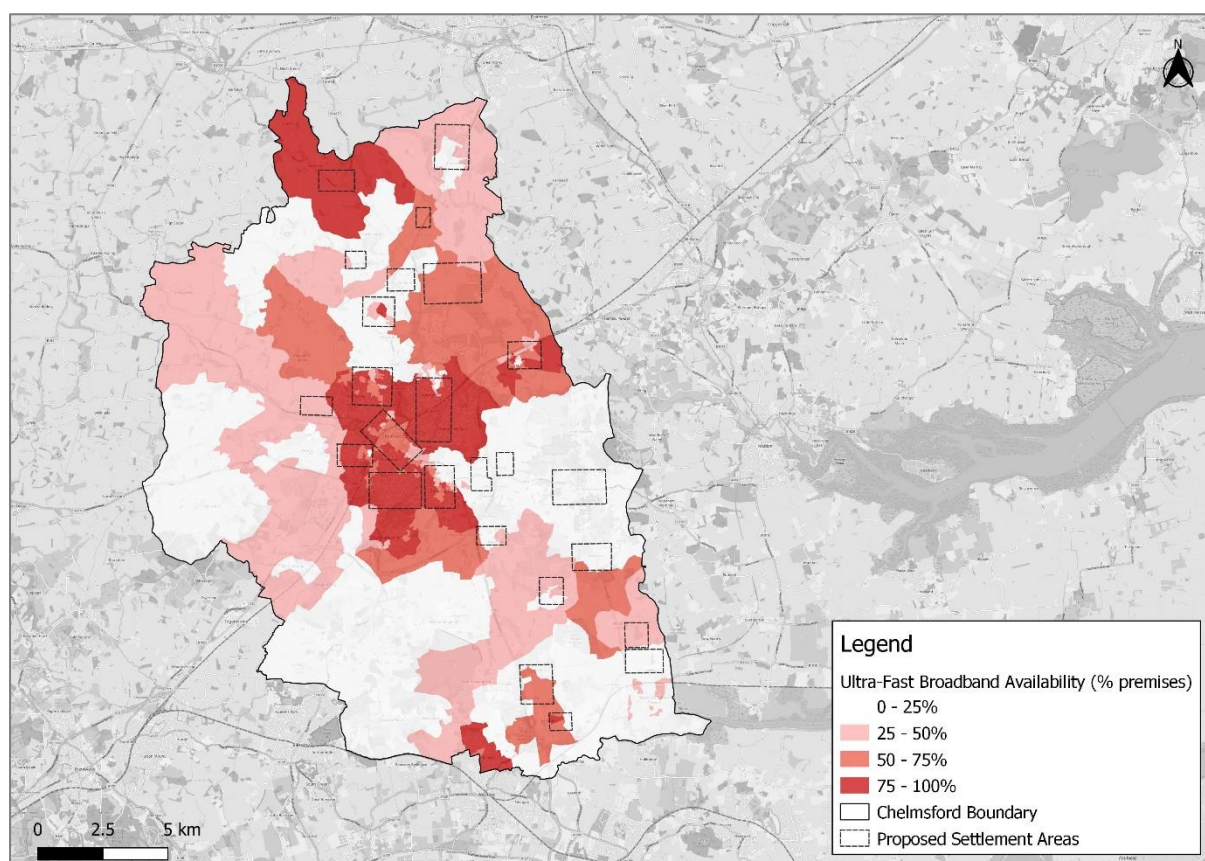


Figure 5: Mapped output illustrating the percentage of premises with access to ultra-fast broadband.

Table 6 overleaf summarises the RAG scoring used for accessibility to broadband. The proposed Local Plan settlement areas often span several output areas with different levels of broadband coverage. The given RAG score therefore reflects the level of broadband coverage that is visually more prominent in the settlement area. This has increased the level of subjectivity involved in the RAG scoring, although it should still be of sufficient robustness for the wider appraisal.

Table 6: RAG scoring for connectivity to broadband as set out in Appendix A

RAG Criteria	Green (3)	Amber (2)	Red (1)
UFBB internet connectivity	Settlement area contains at least 75% of premises that are able to receive UFBB	Settlement area contains at least 50% of premises that are able to receive UFBB	Settlement area contains less than 50% of premises that are able to receive UFBB

### 2.1.6 Car Driver Mode Share for Travel to Work – Criteria 10

Car driver mode share has been assessed using the 2011 census method of travel to work data. The 2011 dataset was chosen because it is the industry standard for transport assessments. As traffic is now back to pre-pandemic levels, the 2011 census is considered likely to provide a better reflection of car driver mode share for travel to work than the pandemic-impacted 2021 census.

Data has been extracted for the individual Lower Super Output Areas (LSOAs) that cover each settlement area. Data has therefore been reused where LSOAs cover more than one settlement area. The categories: 'Work mainly at or from home' and 'Not in Employment' have been removed from the dataset as this analysis is focused on those using the transport network only. The proportion of those 'Driving a car or van' has been calculated for each settlement area and given a RAG score based on the criterion outlined in Table 7 below. Appendix C4 shows the outcomes of this analysis.

Table 7: RAG scoring for car driver mode share as set out in Appendix A

RAG Criteria	Green (3)	Amber (2)	Red (1)
Car driver mode share	Settlement area has a car driver mode share of 50% or lower	Settlement area has a car driver mode share between 50-65%	Settlement area has a car driver mode share of above 65%

### 2.1.7 Access to Health and Education – Criteria 11 to 14

The locations of healthcare and education facilities within the CAA have been plotted using Google Maps and overlaid onto a map of the settlement areas to assess their level of sustainable access. General practices and hospitals have been mapped for healthcare; however, specialist clinics have not been included due to their niche clientele.

Access to nurseries, primary schools (infants and juniors) and secondary schools has been assessed individually. Schools for students with learning difficulties and complex needs have not been included in the assessment as they account for a very small percentage of the student demographic.

For the purpose of this assessment no distinction has been made between public and private healthcare facilities, nor between public or private schools. Settlement areas score highly if a facility is located within the settlement area or within a set distance from its mapped centre point.

Table 8 overleaf outlines the walking distance criteria used to assess each settlement area's accessibility. The walking distance has been increased for secondary schools to reflect their larger catchment areas and the longer commutes that students might typically make.

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Table 8: RAG scoring for access to healthcare and education as set out in Appendix A

RAG Criteria	Green (3)	Amber (2)	Red (1)
Accessibility to healthcare	Healthcare facility within the settlement area or settlement area within 1km of a healthcare facility	Settlement area within 1-4km of a healthcare facility	Settlement area further than 4km from a healthcare facility
Accessibility to nurseries	Nursery within the settlement area or settlement area within 400m of a nursery	Settlement area within 400m - 1km of a nursery	Settlement area further than 1km from a nursery
Accessibility to primary schools	Primary school within the settlement area or settlement area within 400m of a primary school	Settlement area within 400m - 1km of a primary school	Settlement area further than 1km from a primary school
Accessibility to secondary schools	Secondary school within the settlement area or settlement area within 400m of a secondary school	Settlement area within 400m - 1.5km of a secondary school	Settlement area further than 1.5km from a secondary school

## 2.2 Sustainable Accessibility RAG Scoring Summary

An average RAG score across all 14 appraisal criteria has been calculated for each individual settlement area. No weightings have been applied to the criteria.

An average RAG score has then been calculated from the individual settlement areas within each of the eight locations specified in Table 1. The scores are summarised in Table 9 below and detailed in Appendix E.

Table 9: Average RAG score for each development 'location' as set out in Appendix E

Location	Av. Score
1. Brownfield sites in Chelmsford Urban Area*	2.81
2. Edge of Chelmsford extension (West Chelmsford; East Chelmsford)	2.04
3. North of South Woodham Ferrers	2.14
4. North East Chelmsford	2.57
5. Key Service Settlements (Bicknacre, Boreham, Broomfield, Danbury, Great Leighs)	1.94
6. Service Settlements (East Hanningfield, Ford End, Great Waltham, Little Waltham, Rettendon Place, Woodham Ferrers)	1.68
7. Settlements with good proximity to transport corridors (Chatham Green, Howe Green, Rettendon Common)	1.45
8. New Strategic Settlement/Garden Community (Hammonds Farm)	1.64

\*This location is made up of six settlement areas, outlined in Section 1.1 of this report and illustrated in Figure 1.

Understandably, the six sites within the Chelmsford Urban Area (Location 1), particularly the city centre are shown to have 'good' overall levels of sustainable accessibility, performing well across the various criteria considered. These sites are invariably located within walking or cycling distance to key trip attractors and close to high frequency bus services. With the extent

of sustainable transport provision planned for North East Chelmsford, including bus rapid transit and a new rail station at Beaulieu Park, as well as the development of employment areas and education facilities, there is an expectation that the settlement area comprising the Chelmsford Garden Community should offer 'good' levels of sustainable accessibility beyond the current Plan period.

Other developments located on the edge of Chelmsford as well as within the key service settlements in the CAA would be expected to have 'average' levels of sustainable accessibility. These developments are shown to have a mixture of good accessibility in certain criteria, and limited accessibility in others.

Developments located within smaller service settlements, and on the proposed Hammonds Farm site are also assessed as having 'average' levels of sustainable accessibility based on existing provision. However, by having a comparatively lower RAG score, such developments are shown to have more limited sustainable accessibility across the criteria assessed.

It is important to note that the RAG assessment of the Hammonds Farm site has been based on the existing provision of public transport and active mode infrastructure and services in the vicinity. With a sizeable development located on the site, there would be an expectation that public transport and active mode infrastructure would be introduced to boost overall levels of sustainable accessibility both within the site and its connectivity to wider destinations. In addition, development at this scale would also be required to provide significant on-site provision of employment, services, neighbourhood centres and education, all of which should be designed to encourage sustainable trips as the primary mode of travel.

Settlement areas in more isolated, rural locations such as Chatham Green, Howe Green and Rettendon Common are shown to have 'limited' overall levels of sustainable accessibility. This is perhaps understandable given their distance from key trip attractors, the limited availability of bus services and the greater reliance on car use amongst the current population.

Two averages have been calculated for the North East Chelmsford location – one that reflects the existing level of sustainable infrastructure provision in the area and one that considers planned future infrastructure. The Chelmsford Garden Community development is being designed to reflect the TCPA<sup>4</sup> Garden City Principles whereby walking, cycling and passenger transport are being designed to be the most attractive form of local transport. The score shown in Table 9 reflects the scenario with planned infrastructure in line with Local Plan proposals. This has been integrated into the overall evaluation of the five Spatial Approaches. The alternative score reflective of the existing level of infrastructure provision can be found in Appendix E alongside the detail of the RAG scoring for the other settlement areas.

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<sup>4</sup> Town and Country Planning Association

### 3. Conclusion

#### 3.1 Evaluation of Spatial Approaches

To evaluate the level of sustainable accessibility for each Spatial Approach, the average score for each location in Table 9 has been multiplied by the number of dwellings proposed in each location. The scores have then been summed and factored (for ease of reference) to create a 'sustainable accessibility score' for each Spatial Approach.

Table 10 below provides a summary of the sustainable accessibility scores for the five Spatial Approaches assessed. Details of the calculations used to determine the scores can be found in Appendix E2.

It is important to note, that these scores are not a RAG measure of sustainable accessibility, but rather a measure of the relative sustainable accessibility for each Spatial Approach against the others.

*Table 10: Sustainable accessibility scores and rankings for each Spatial Approach*

	<b>Approach A</b>	<b>Approach B</b>	<b>Approach C</b>	<b>Approach D</b>	<b>Approach E</b>
Score	1.88	2.01	1.87	1.86	1.71
Rank	2	1	3	4	5

With a focus on housing development in the Chelmsford Urban Area and North East Chelmsford, Approach B is shown to make the most of the good levels of sustainable accessibility in these locations and therefore ranks a clear first in the comparison of Spatial Approaches.

Approach A and C have near identical scores, ranking second and third respectively, with the difference brought about by the allocation of housing proposed in the smaller service settlements for Approach C.

Approach D ranks fourth due to the allocation of housing in more rural settlement areas with limited sustainable accessibility. However, the score is not dissimilar to Spatial Approaches A and C, owing to the larger number of dwellings proposed in North East Chelmsford.

Finally, Approach E ranks fifth in this assessment given the focus of housing on the proposed Hammonds Farm site. However, it should be noted that this is an appraisal of the current position, and it is likely that potential strategic scale development at the Hammonds Farm site would introduce a good level of public transport and active mode provision to the area which would significantly improve its sustainable accessibility. In addition, development at this scale would also be required to provide significant on-site provision of employment, services, neighbourhood centres and education, all of which should be designed to encourage sustainable trips as the primary mode of travel.



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## Appendices

### Appendix A – RAG Assessment Criteria

Indicator	Data Source	RAG Measure	Green	Amber	Red
Accessibility to urban centres	Three TRACC runs using cycling, walking and 2022 PT Data to determine journey times to urban centres	Settlement area within a reasonable walk, cycle or PT journey time to existing urban centres	Settlement area within a 15 minute walk or cycle journey to an urban centre	Settlement area within a 30 minutes public transport journey to an urban centre	Settlement area greater than a 30 minute public transport journey to an existing urban centre
Accessibility to employment locations	Three TRACC runs using cycling, walking and 2022 PT Data to determine journey times to employment centres	Settlement area within a reasonable walk, cycle or PT journey time to employment centres	Settlement area within a 15 minute walk or cycle journey to an employment location	Settlement area within a 30 minutes public transport journey to an employment location	Settlement area greater than a 30 minute public transport journey to an employment location
Accessibility to rail stations (walking and cycling)	Two TRACC runs using cycling and walking to determine journey times to rail stations	Settlement area within a reasonable walk or cycle journey time to rail stations	Settlement area within a 15 minute walk or cycle journey to a rail station with >1 service in each direction (7-9am weekdays)	Settlement area within a 15 minute walk or cycle journey to a rail station with any peak time rail service	Settlement area greater than a 15 minute walk or cycle journey to a rail station
Accessibility to rail stations (public transport)	One TRACC run using 2022 PT to determine journey times to rail stations	Settlement area within a reasonable public transport journey time to a rail station	Settlement area within a 30 minute public transport journey to a rail station with >1 service in each direction (7-9am weekdays)	Settlement area within a 30 minute public transport journey to a rail station with any peak time rail service	Settlement area greater than a 30 minute public transport journey to a rail station
Walking access to bus stops	One TRACC run using 2022 walking data to determine distances to bus stops	Settlement area within a reasonable walking distance to nearest bus stop.	Settlement area within 400m of a bus stop	Settlement area within 800m of a bus stop	Settlement area over 800m from a bus stop

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Mapping bus services and frequency	Essex County Council	Settlement area within 500m of a high frequency bus service (86+ a week).	High frequency bus service within the settlement area <i>or</i> settlement area within 500m* of a high frequency bus service	Medium frequency bus service within the settlement area <i>or</i> settlement area within 500m of a medium frequency bus service	Low/limited frequency bus service within the settlement area <i>or</i> settlement area within 500m of a low/limited frequency bus service
UFBB internet connectivity	Ofcom broadband data (2021)	Settlement area able to access UFBB	Settlement area contains at least 75% of premises that are able to receive UFBB	Settlement area contains at least 50% of premises that are able to receive UFBB	Settlement area contains less than 50% of premises that are able to receive UFBB
Car driver mode share	2011 Census Data (QS701EW Method of Travel to Work)	Settlement area where there is a low car driver mode share, signifying existing higher sustainable travel rates.	Settlement area has a car driver mode share of 50% or lower	Settlement area has a car driver mode share between 50-65%	Settlement area has a car driver mode share of above 65%
Accessibility to healthcare	Google Maps	Settlement area within a reasonable distance to a healthcare facility (GP, drop-in, hospital)	Healthcare facility within the settlement area <i>or</i> settlement area within 1km* of a healthcare facility	Settlement area within 1-4km of a healthcare facility	Settlement area further than 4km from a healthcare facility
Accessibility to nurseries	Google Maps	Settlement area within a reasonable distance to a nursery school	Nursery within the settlement area <i>or</i> settlement area within 400m* of a nursery	Settlement area within 400m - 1km of a nursery	Settlement area further than 1km from a nursery
Accessibility to primary schools	Google Maps	Settlement area within a reasonable distance to a primary school	Primary school within the settlement area <i>or</i> settlement area within 400m* of a primary school	Settlement area within 400m - 1km of a primary school	Settlement area further than 1km from a primary school

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Accessibility to secondary schools	Google Maps	Settlement area within a reasonable distance to a secondary school	Secondary school within the settlement area <i>or</i> settlement area within 400m* of a secondary school	Settlement area within 400m - 1.5km of a secondary school	Settlement area further than 1.5km from a secondary school
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\*Distance measured from the settlement area's centroid (centre point).

## Appendix B – TRACC parameters

Table B.1 – A list of urban centres, employment locations and rail stations used in the TRACC analysis.

Urban Centres	Employment Locations	Rail Stations
<p>Comprising cities and towns in the CAA with access to key public facilities including banks, post offices and supermarkets.</p> <p>Also comprising urban centres lying outside of the CAA that would generate cross-boundary movements to/from settlement areas located near to the administrative border.</p>	<p>Comprising moderate-to-large sized industrial sites, business parks and service areas located within the CAA.</p> <p>Also comprising employment locations lying outside of the CAA that would generate cross-boundary movements to/from settlement areas located near to the administrative border.</p>	<p>Comprising all mainline and branch line rail stations located within the CAA.</p> <p>Also comprising rail stations lying outside of the CAA that would generate cross-boundary movements to/from settlement areas located near to the administrative border.</p>
<p>Chelmsford City Centre</p> <p>South Woodham Ferrers</p> <p>Witham</p> <p>Maldon</p> <p>Wickford</p> <p>Billericay</p> <p>Basildon</p> <p>Braintree</p>	<p>County Council Offices</p> <p>Widford Industrial Estate</p> <p>Duke's Park Industrial Estate</p> <p>Anglia Ruskin University</p> <p>Broomfield Hospital</p> <p>Writtle University College</p> <p>Springfield Business Park</p> <p>Business Park/Industrial Estate SWF</p> <p>Burnt Mills Industrial Estate</p> <p>Great Notley/A120 Industrial Estate</p> <p>Heybridge Industrial Estate</p> <p>Gardiners Way, Basildon Industrial Area</p> <p>Dunton Campus</p>	<p>Chelmsford Rail Station</p> <p>South Woodham Ferrers Rail Station</p> <p>Wickford Rail Station</p> <p>Hatfield Peverel Rail Station</p> <p>Ingatestone Rail Station</p>



Table B.2 – TRACC Methodologies.

Metric	Methodology	Data Source
Walking connectivity to Urban Centres / Rail Stations / Employment Locations	Calculated using the O-D calculation which provided travel times from an origin point on a defined grid of Chelmsford (where origin points are 200m apart) to the defined destination points. It calculates the fastest route using the activated Open Roads network links. Any trips beyond 15 minutes were returned as inaccessible. The parameters used for this calculation are outlined in Table 3.2.	OS Open Roads Data produced by Ordnance Survey. Downloaded from <a href="#">DataCutter</a> .  ATCO.CIF Public Transport dataset in CIF format, covering the first quarter of 2022 (Jan-Mar). Downloaded from <a href="#">DataCutter</a> .
Cycling connectivity to Urban Centres / Rail Stations / Employment Locations	Calculated using the O-D calculation which provided travel times from an origin point on a defined grid of Chelmsford (where origin points are 200m apart) to the defined destination points. It calculates the fastest route using the activated Open Roads network links. Any trips beyond 15 minutes were returned as inaccessible. The parameters used for this calculation are outlined in Table 3.2.	
Public transport connectivity to Urban Centres / Rail Stations / Employment Locations	Calculated using the O-D calculation which provided travel times from an origin point on a defined grid of Chelmsford (where origin points are 200m apart) to the defined destination points. It uses the activated Open Roads and Public Transport network links. Any trips beyond 60 minutes were returned as inaccessible. The parameters used for this calculation are outlined in Table 3.2.	
Accessibility to bus stops	Calculated using the Local Accessibility Calculation which has no set destinations but calculates accessibility from the origin points to the surrounding public transport network. It provided a walking distance to the nearest bus stop with a frequency of service greater than 1 per hour. Any trips further than 1km were returned as inaccessible. The parameters used for this calculation are outlined in Table 3.3.	

Table B.3 – TRACC model settings for the ‘Origin-Destination’ calculations (walking, cycling and PT access to urban centres/rail stations/employment locations).

TRACC Parameter	Walking	Cycling	Public Transport
Origin Grid Spacing	200m between each origin point*	200m between each origin point*	200m between each origin point*
Day/Time Period(s)	Monday – 07:00-09:00	Monday – 07:00-09:00	Monday – 07:00-09:00
Direction	Outbound (Origin points to destination)	Outbound (Origin points to destination)	Outbound
Calculation Type	Fastest Path	Fastest Path	N/a
<b>Walk Parameters</b>			
Walk Speed	4.8Km/h	4.8Km/h	4.8Km/h
Walk Variance (When not on Network)	1.2	1.2	1.2
Max O/D Distance (Crow Flies)	100km	100Km	100Km
Max External Connection Distance	400m**	400m**	400m**
<b>PT Parameters</b>			
Max Internal Connection Distance	N/a	N/a	500m
In Vehicle and Walk Interchange Penalty	N/a	N/a	5 minutes
Max. Connection Distance to First Stop	N/a	N/a	400m**

\*Changed from the default to 200m as this spacing is recommended for an origin grid that is at district level.

\*\* Decreased from the default to meet our criterion for walking distances outlined in Appendix A.

Table B.4 – TRACC model settings for the ‘Local Accessibility’ calculations (walking access to bus stops).

TRACC Parameter	Walking
Origin Grid Spacing	200m between each origin point*
Day/Time Period(s)	Monday – 07:00-09:00
Set Frequency (Frequency of bus services)	Combined Frequency (total frequency for all services) set as $\geq 1$ per hour**
Road Option (Crow Flies/Use Road Network)	Road Network
<b>Walk Parameters</b>	
Walk Speed (Not on Network)	4.8Km/h
Walk Variance (Not on Network)	1.2
Max Walk Distance	800m

\* Changed from the default to 200m as this spacing is recommended for an origin grid that is at district level.

\*\* Frequency changed from the default to 1 per hour to capture all regular services in the district.

## Appendix C – Map and Table Outputs of the Sustainable Accessibility Analysis

### C.1 – TRACC Mapped Outputs. (Created using TRACC software, displayed in QGIS)

*Figure C.1.1. TRACC mapped output illustrating accessibility to urban centres – walking.*

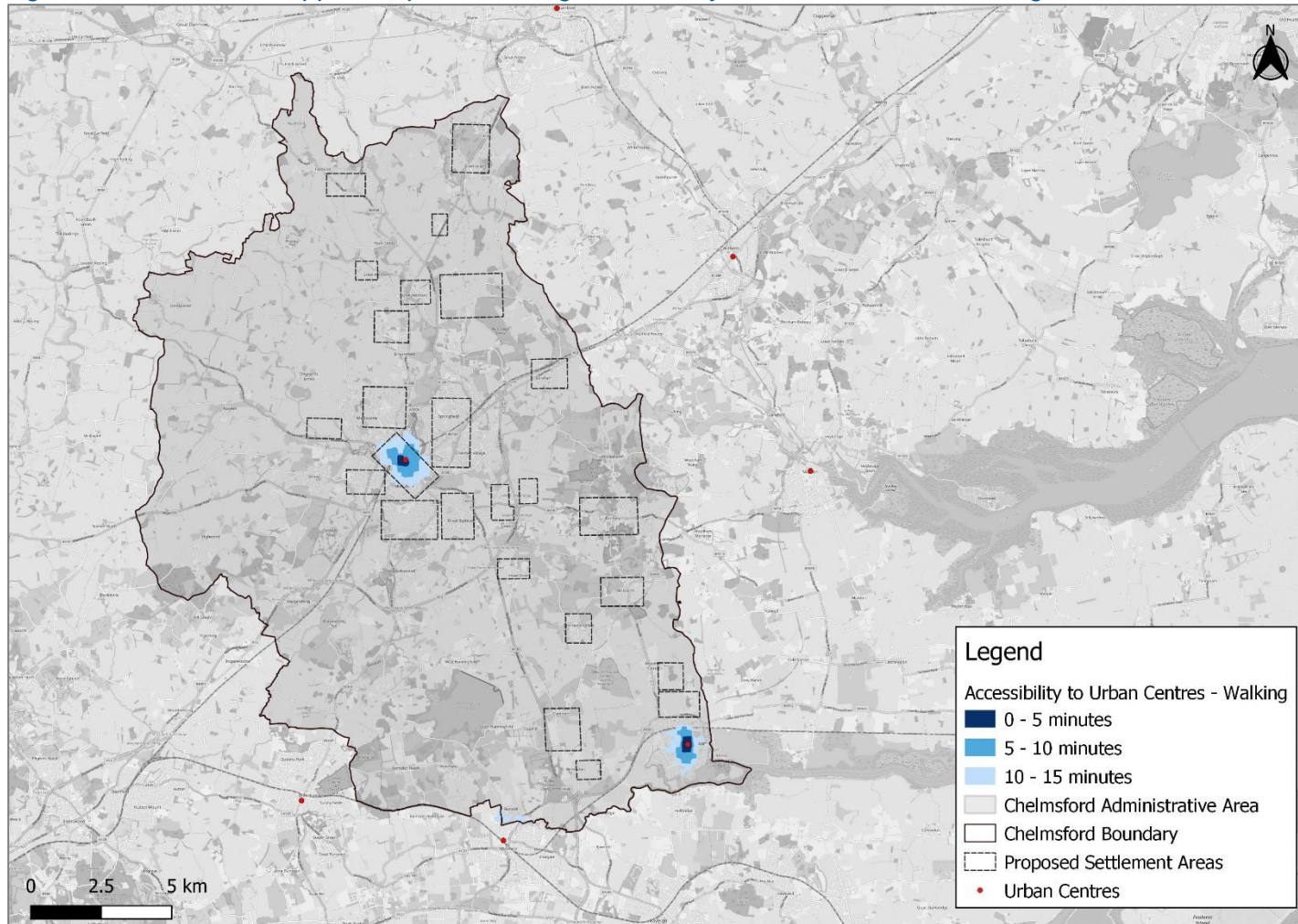




Figure C.1.2. TRACC mapped output illustrating accessibility to urban centres – cycling.

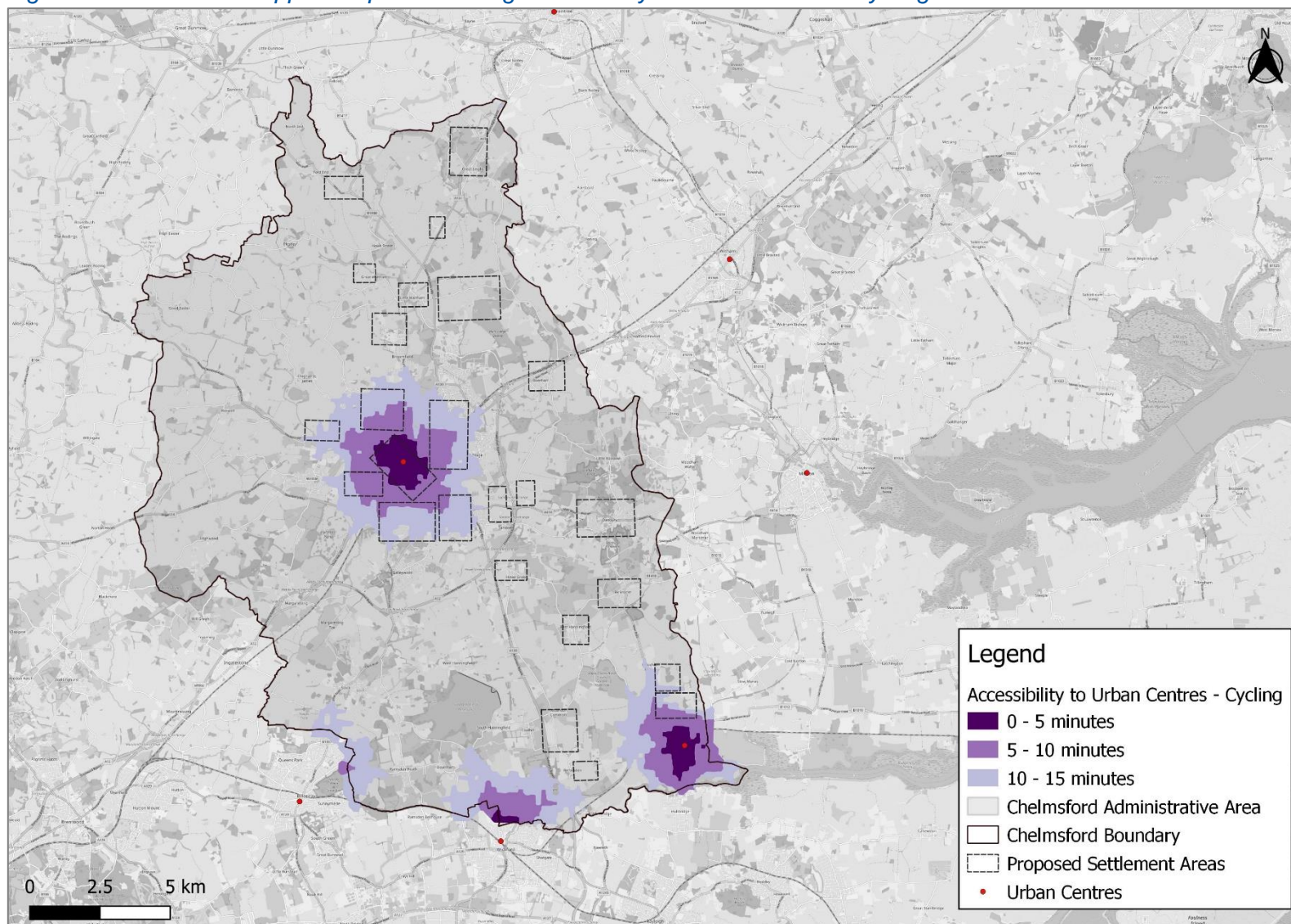




Figure C.1.3. TRACC mapped output illustrating accessibility to urban centres – public transport.

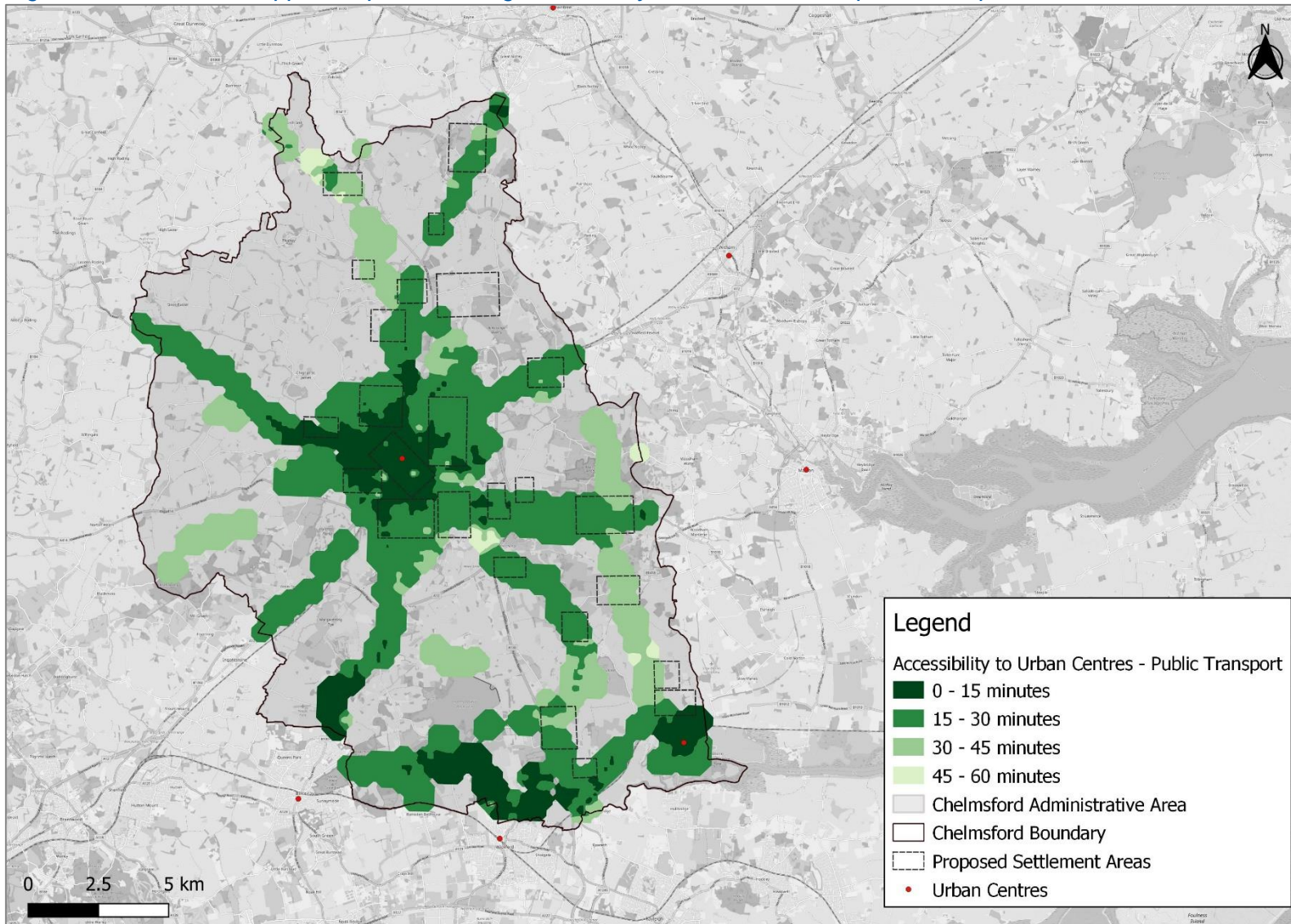


Figure C.1.4. A map showing accessibility to employment locations – walking.

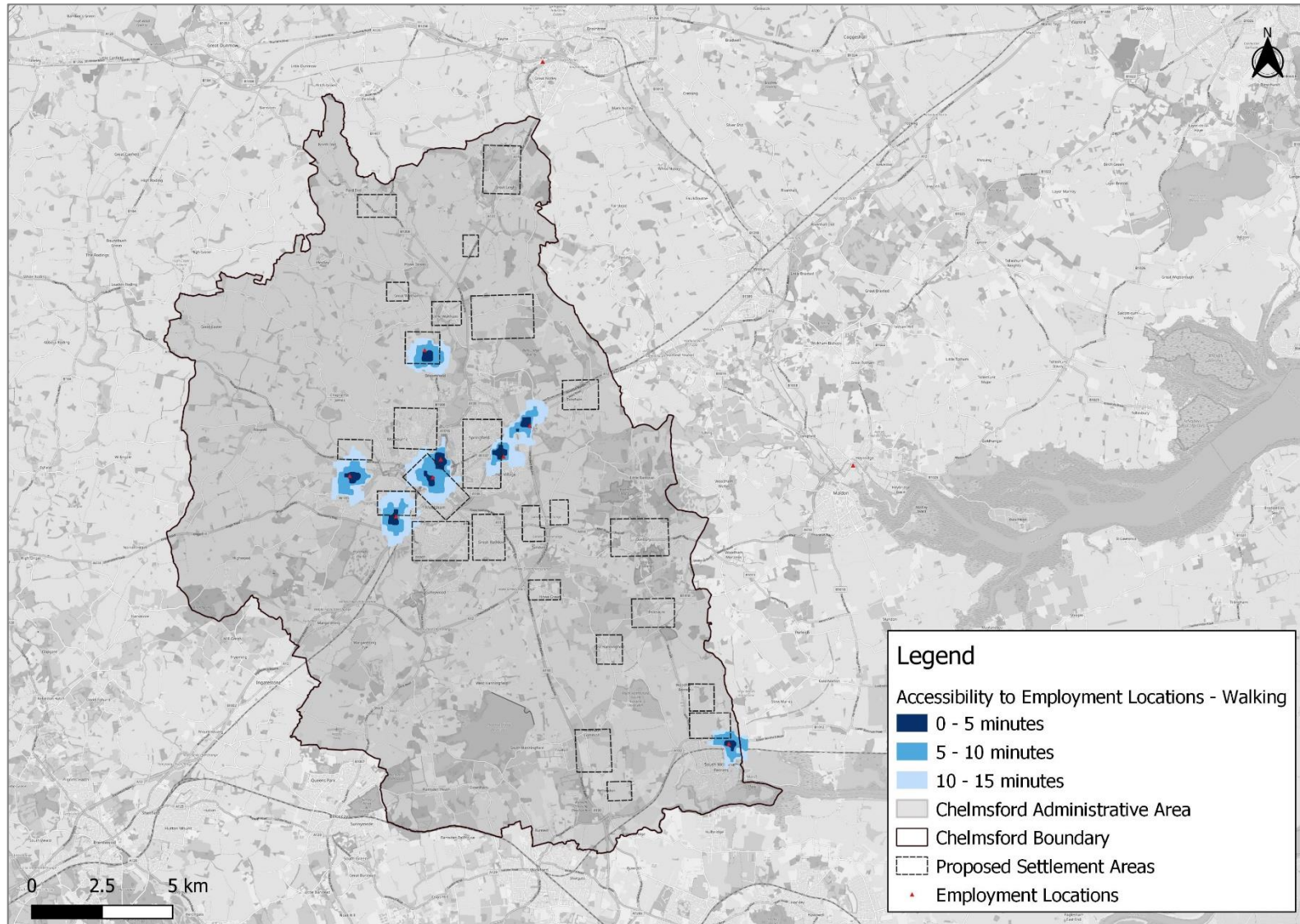




Figure C.1.5 TRACC mapped output illustrating accessibility to employment locations – cycling.

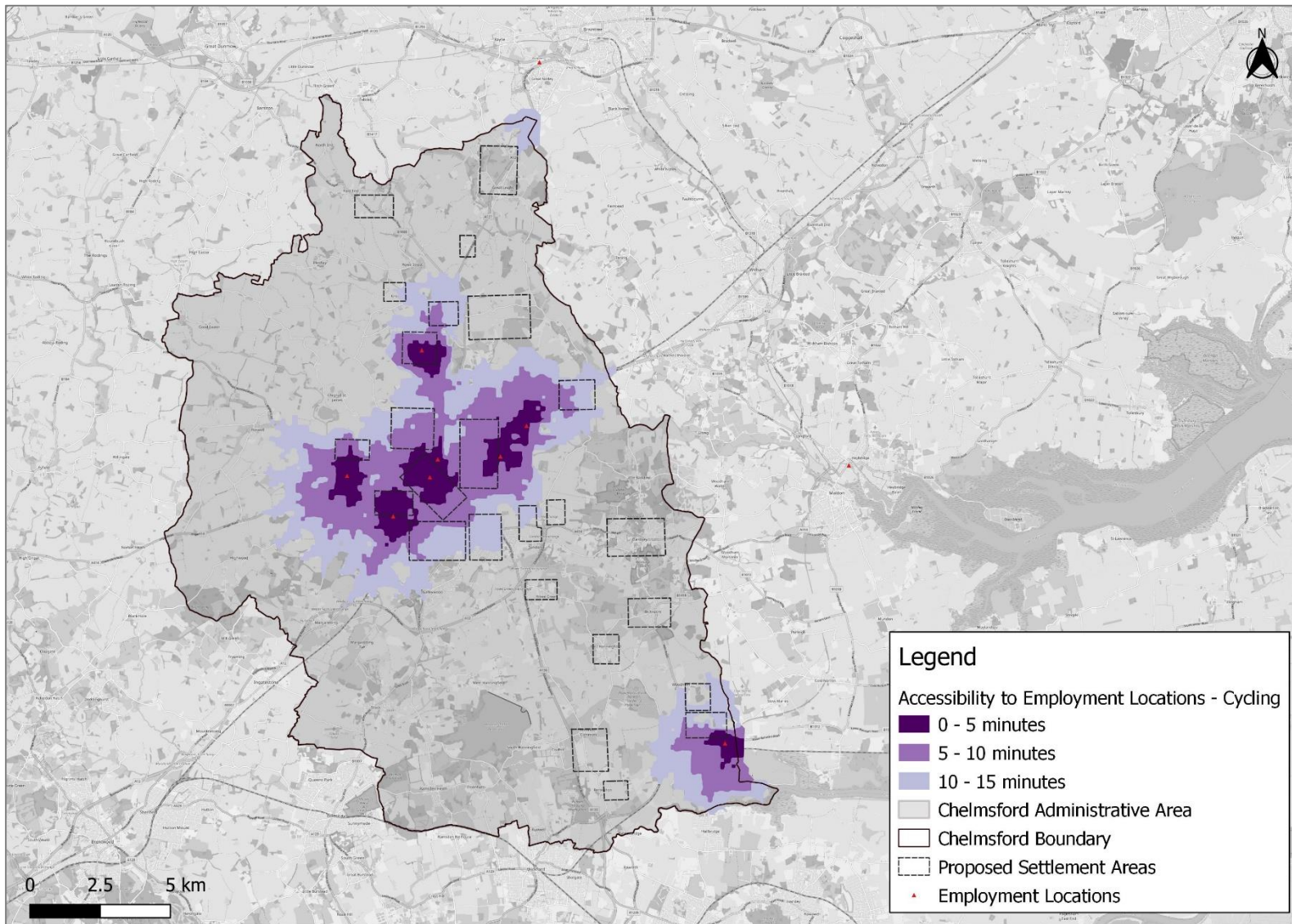


Figure C.1.6. TRACC mapped output illustrating accessibility to employment locations – public transport.

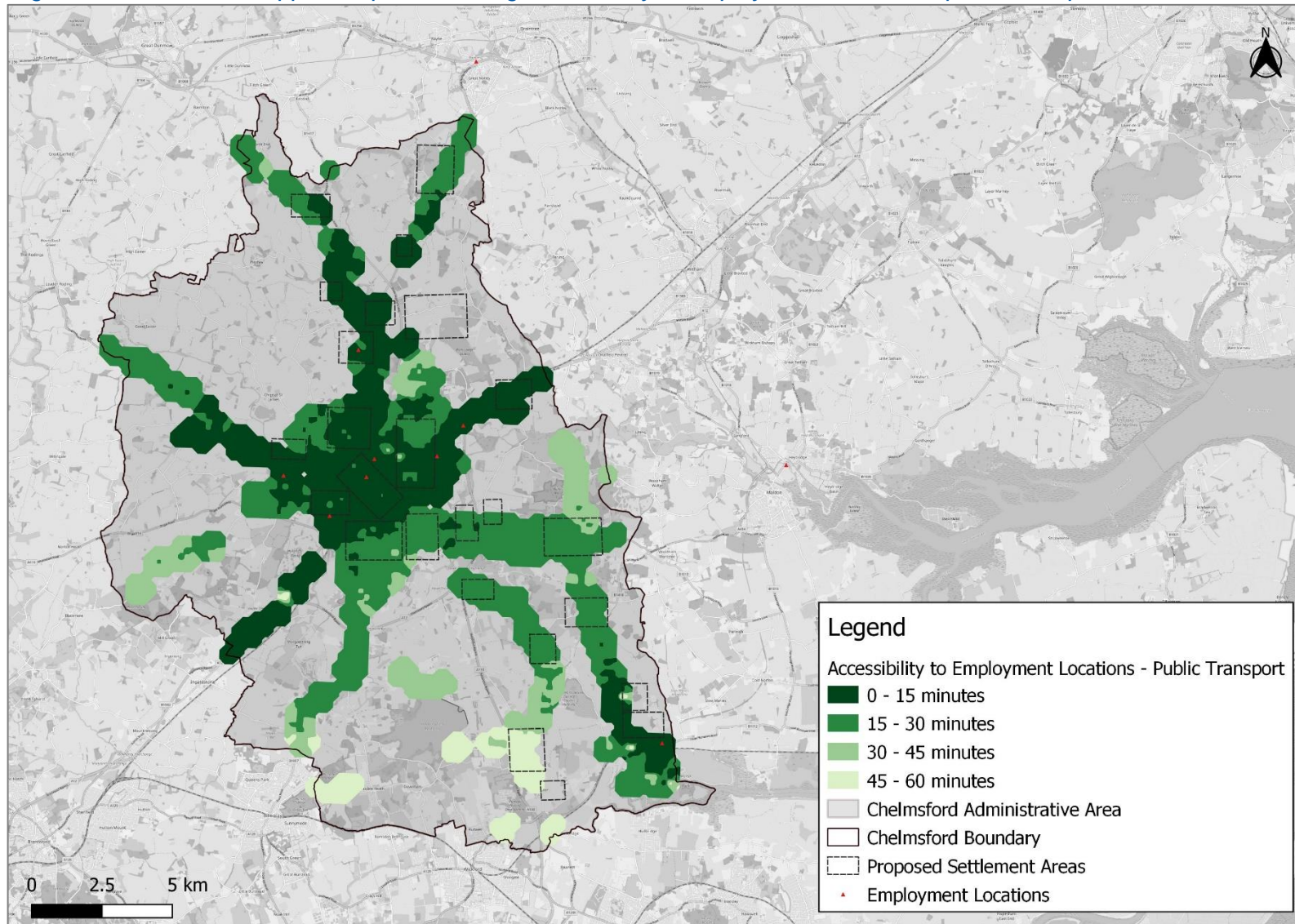




Figure C.1.7. TRACC mapped output illustrating accessibility to rail stations – walking.

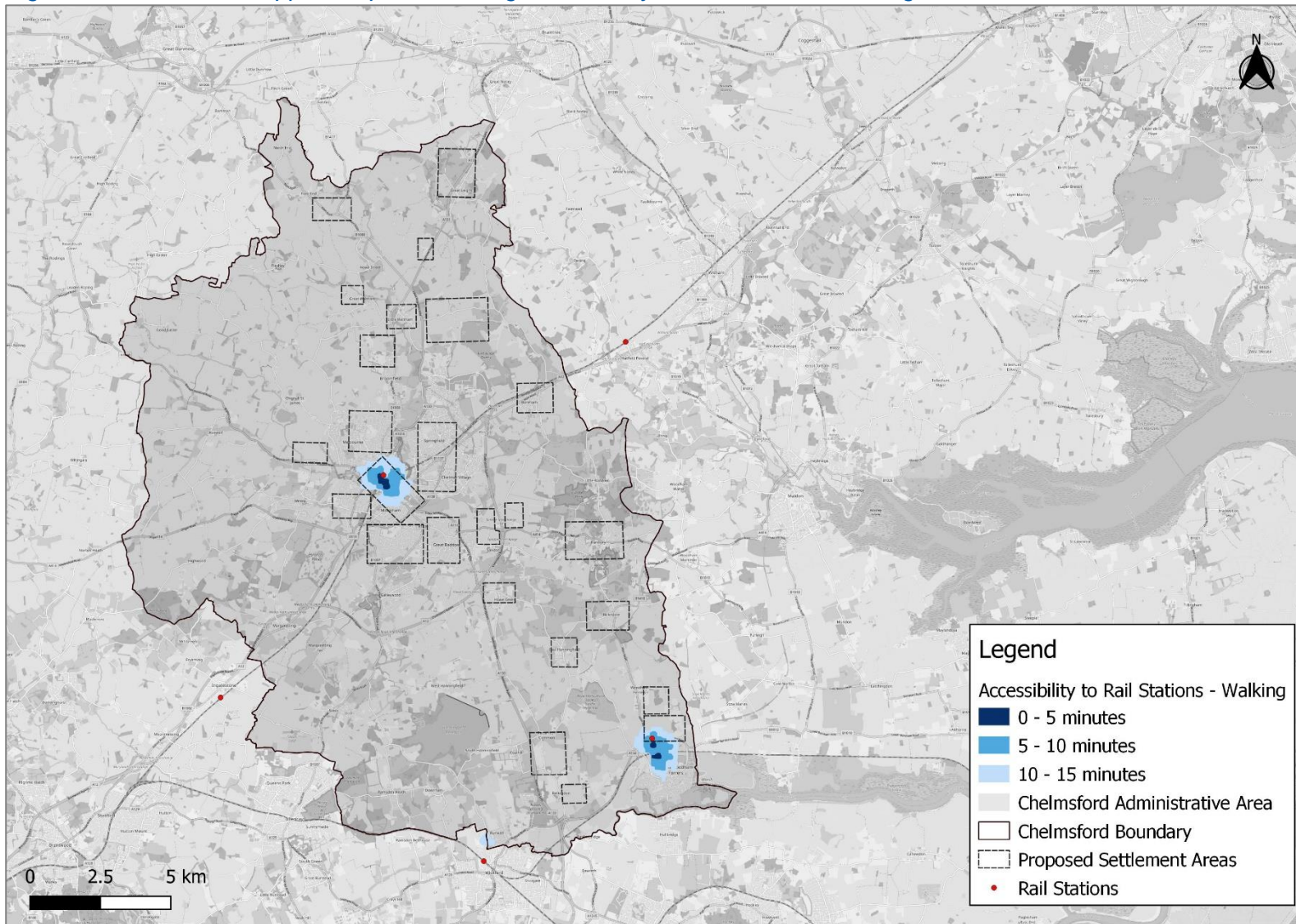
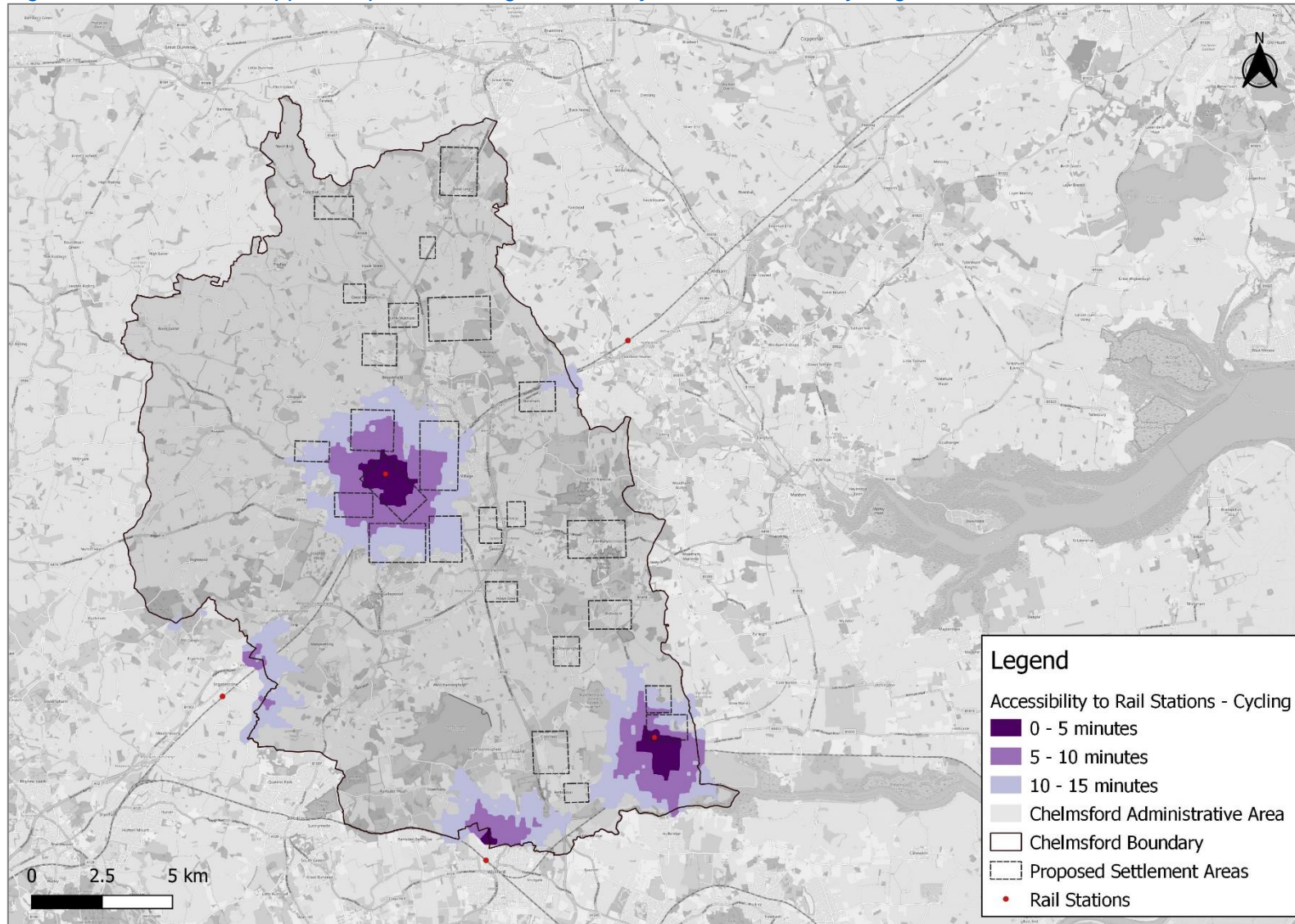




Figure C.1.8. TRACC mapped output illustrating accessibility to rail stations – cycling.



*Figure C.1.9. TRACC mapped output illustrating accessibility to rail stations – public transport.*

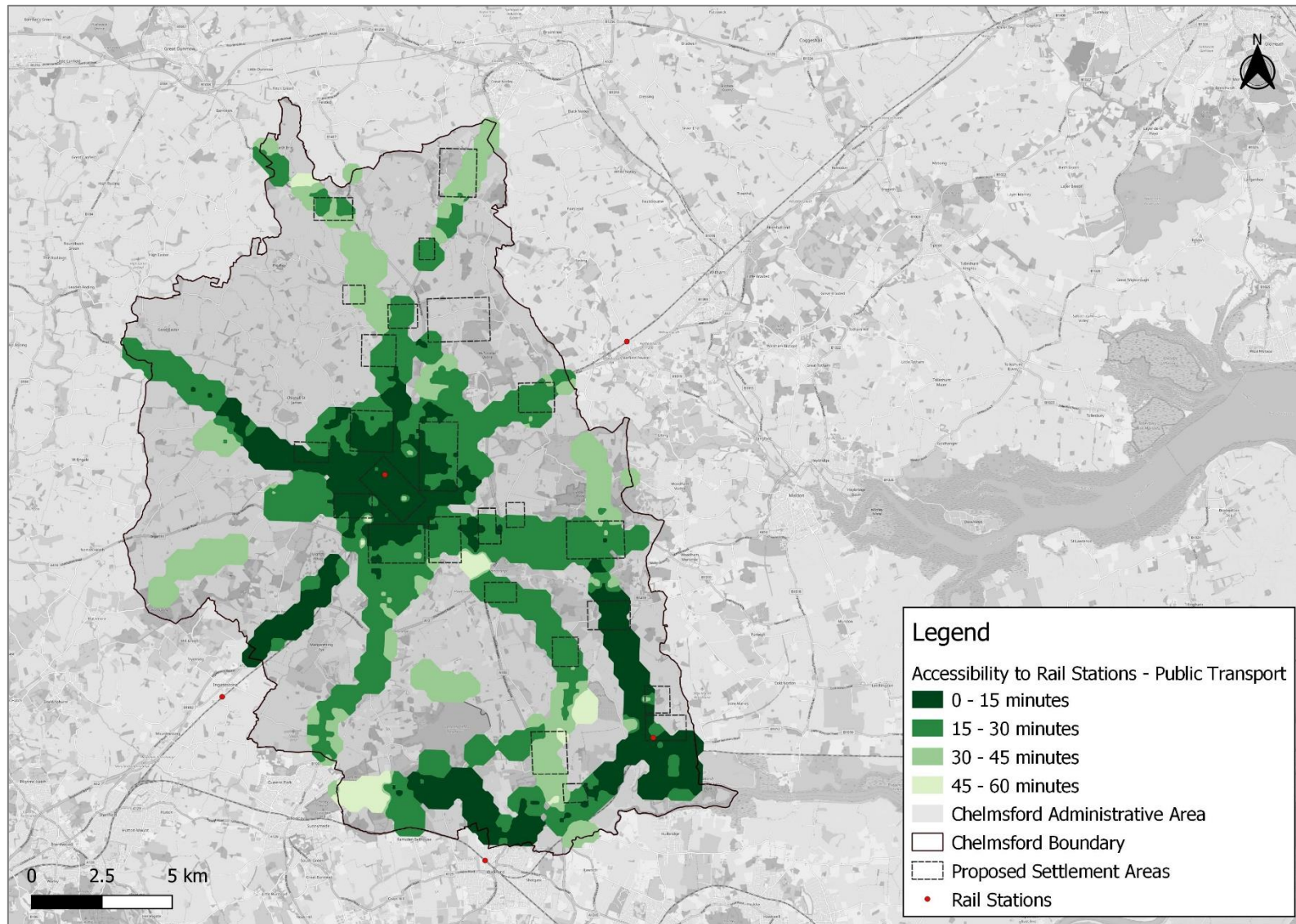
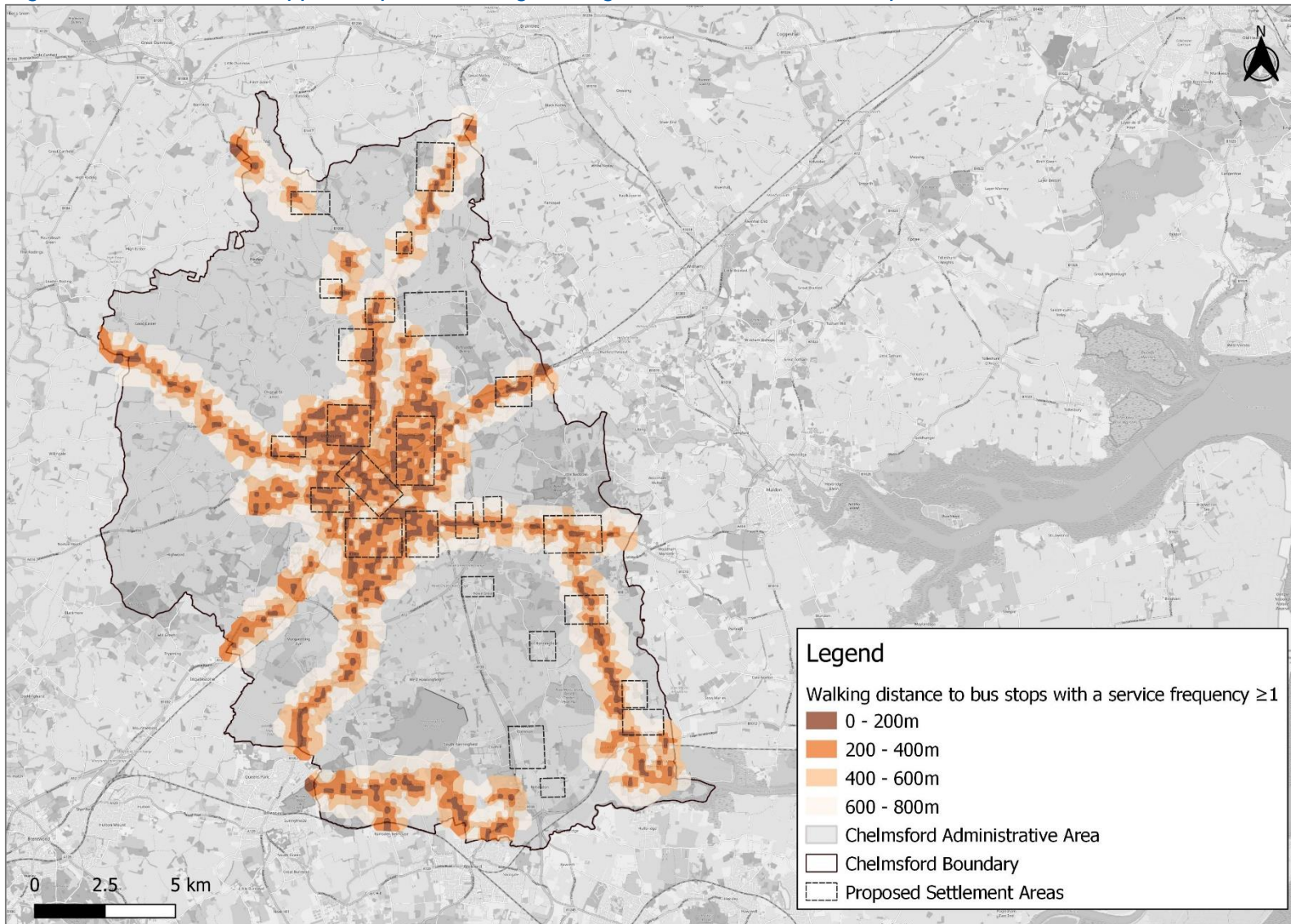




Figure C.1.10. TRACC mapped output illustrating walking distances to local bus stops.



C.2 – Bus Frequency Mapped Outputs. (Created using Bus Frequency information provided by ECC's IPTU. Displayed using QGIS)

Figure C.2.1. Access to weekday bus services – AM (07:00 – 11:00)

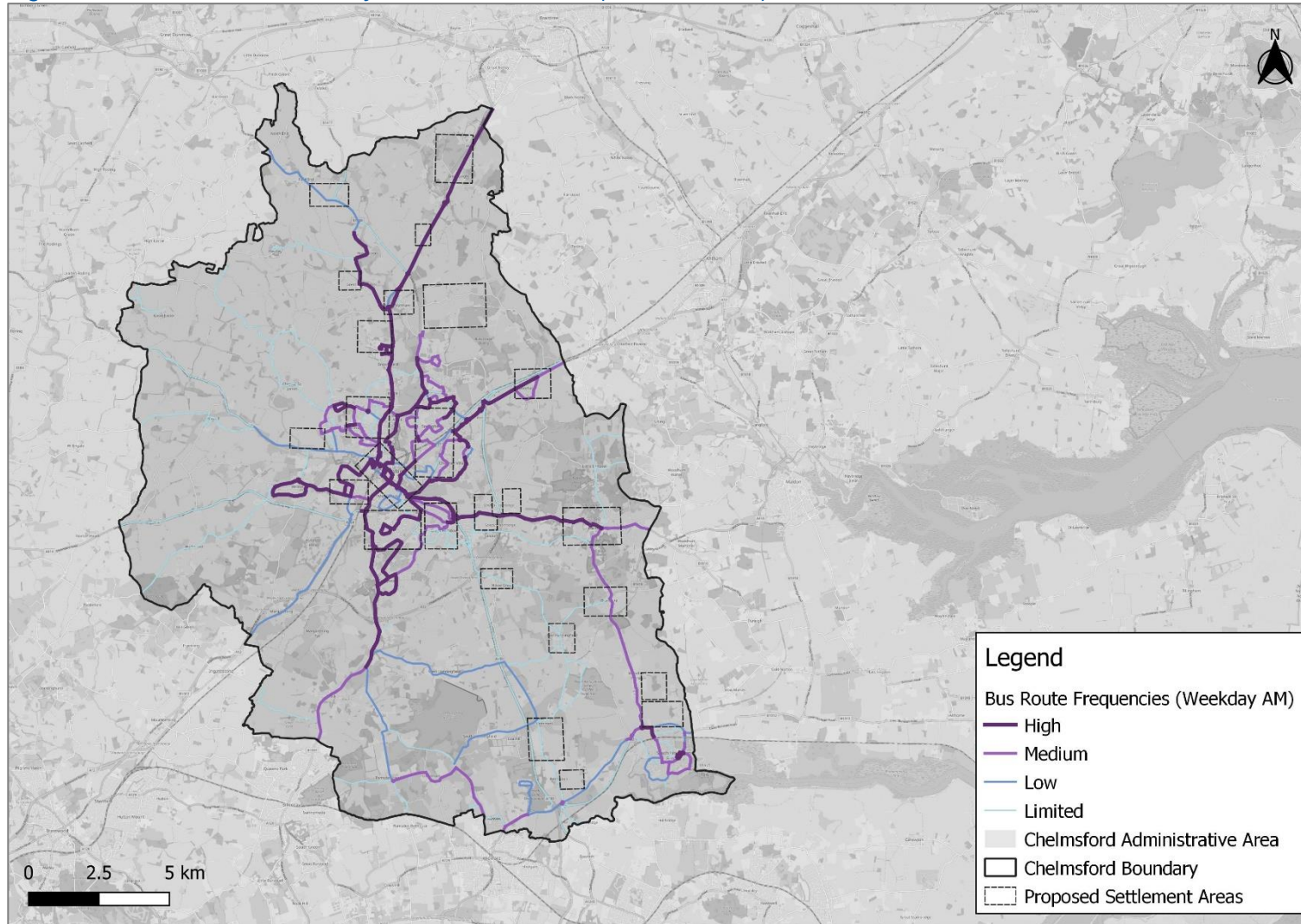




Figure C.2.2. Access to weekday bus services – IP (11:00 – 16:00)

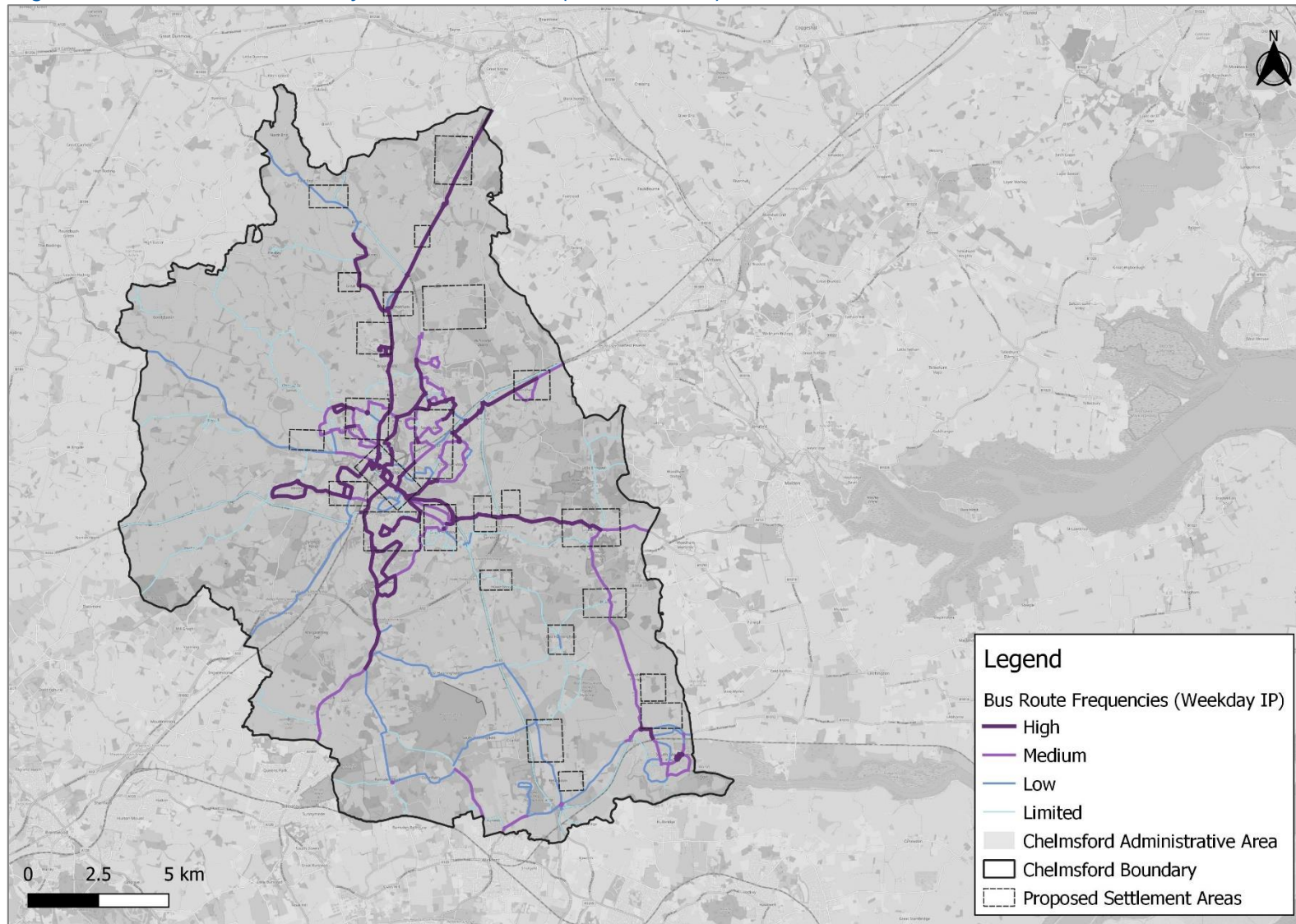




Figure C.2.3. Access to weekday bus services – PM (16:00 – 20:00)

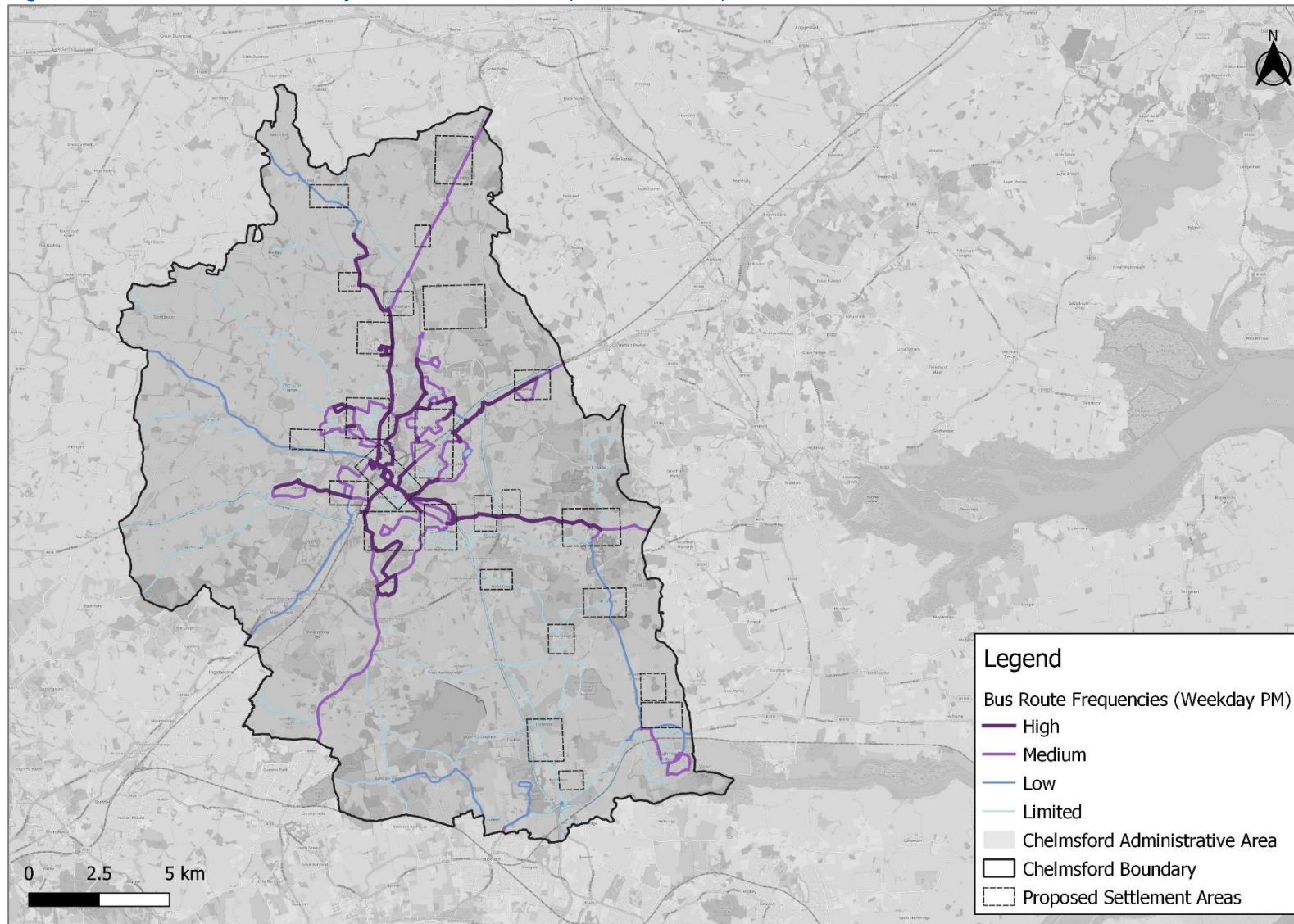


Figure C.2.4. Access to weekday bus services – NI (20:00 – 07:00)

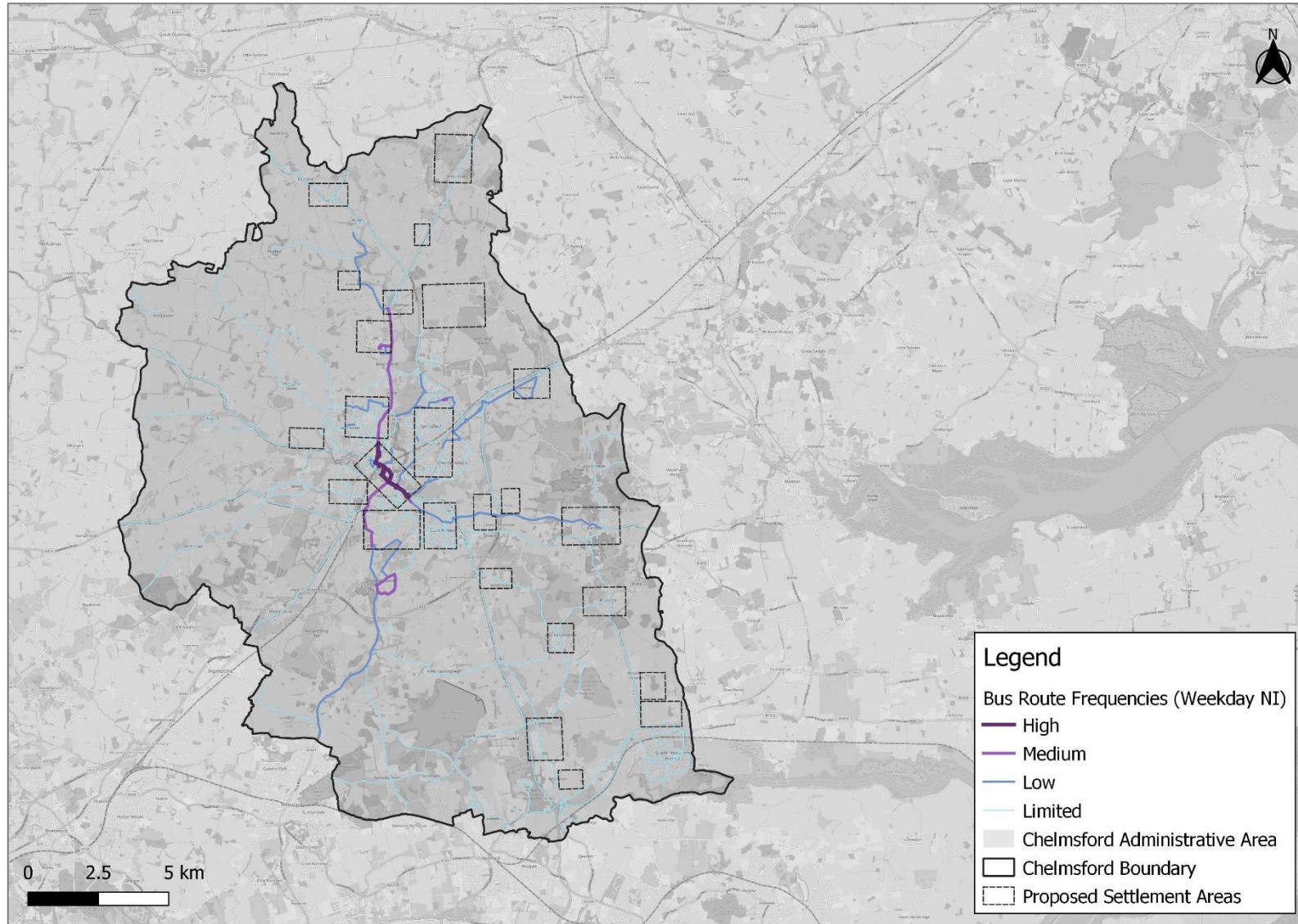




Figure C.2.5. Access to Saturday bus services – AM (07:00 – 11:00)

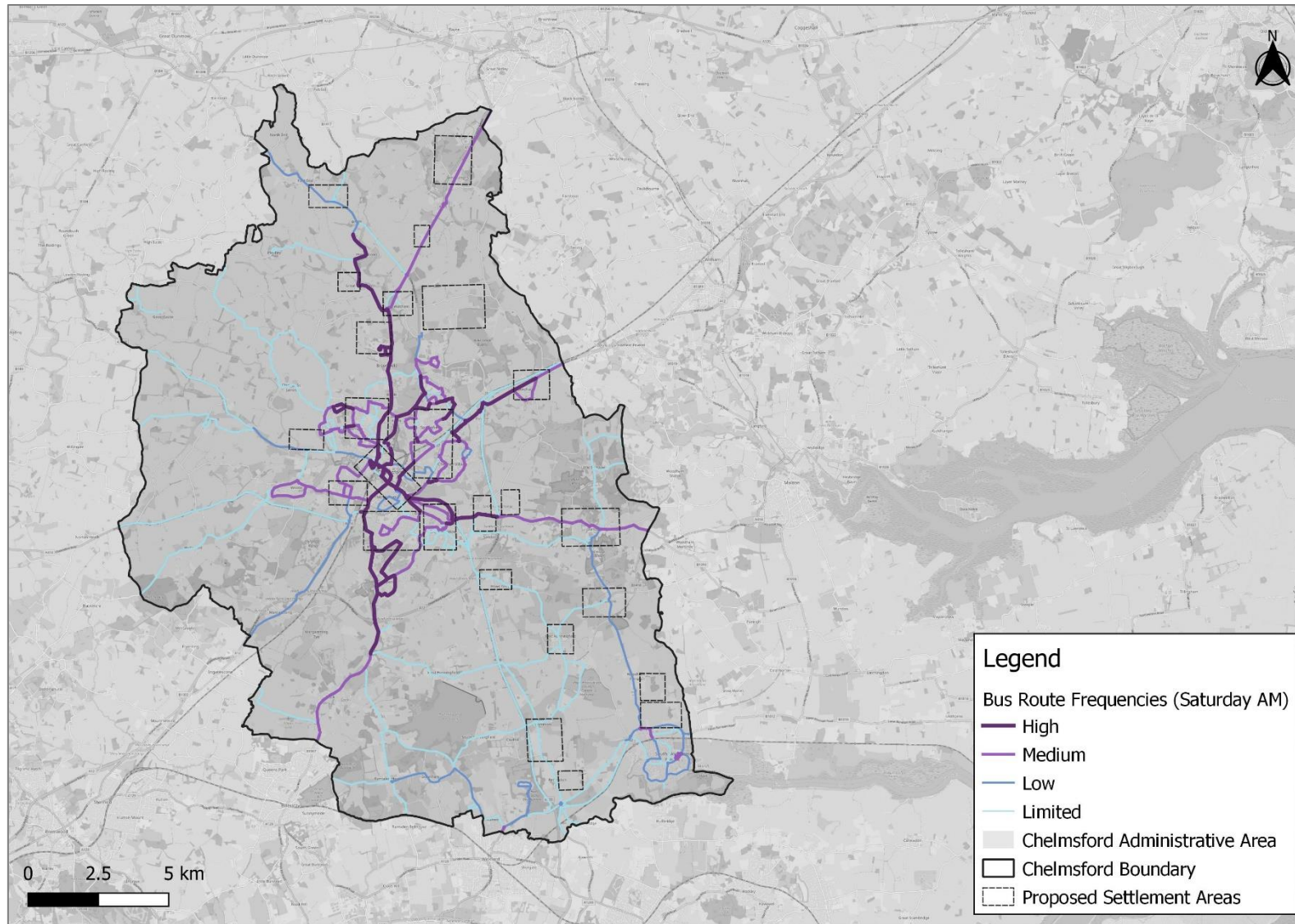


Figure C.2.6. Access to Saturday bus services – IP (11:00 – 16:00)

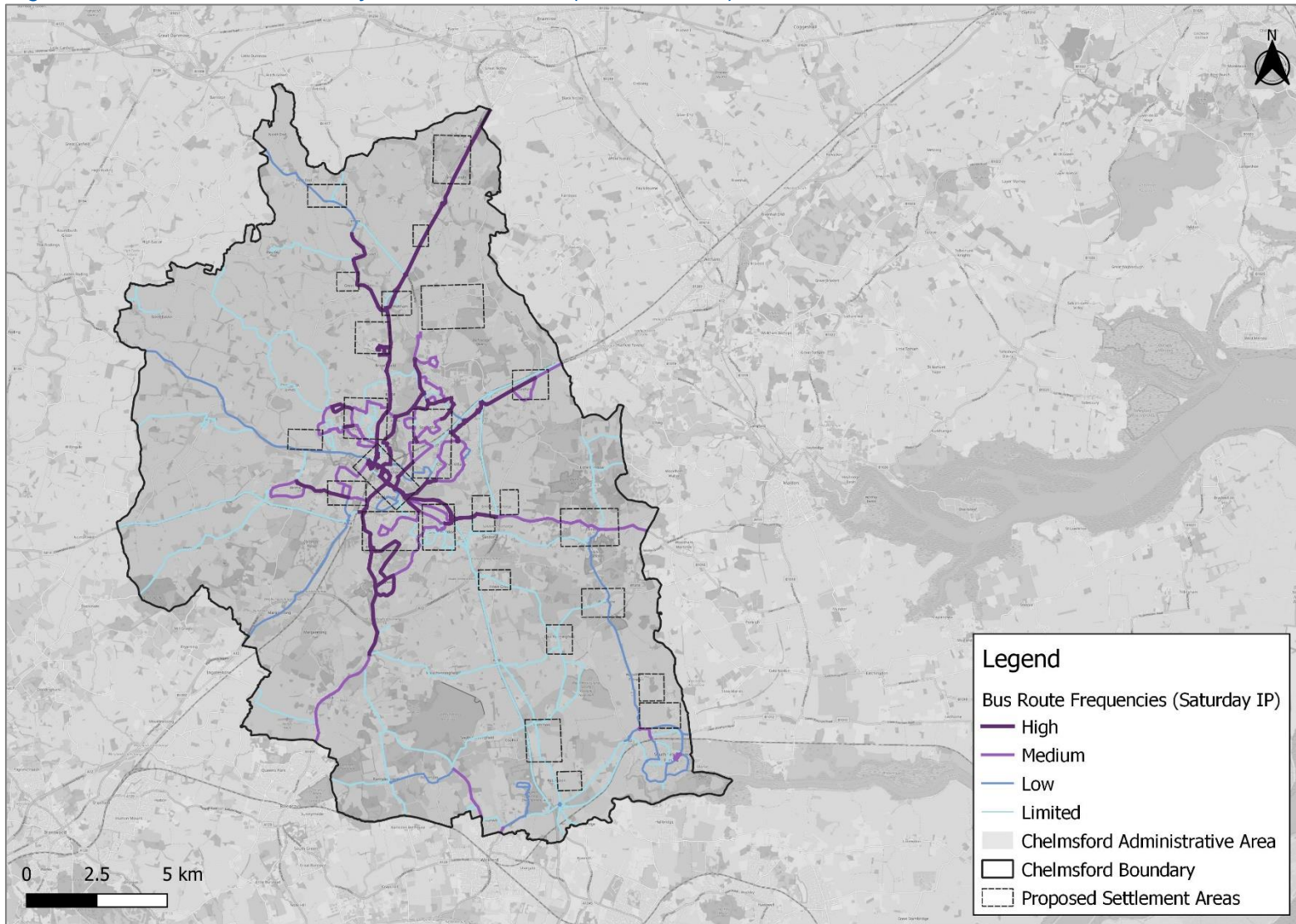




Figure C.2.7. Access to Saturday bus services – PM (16:00 – 20:00)

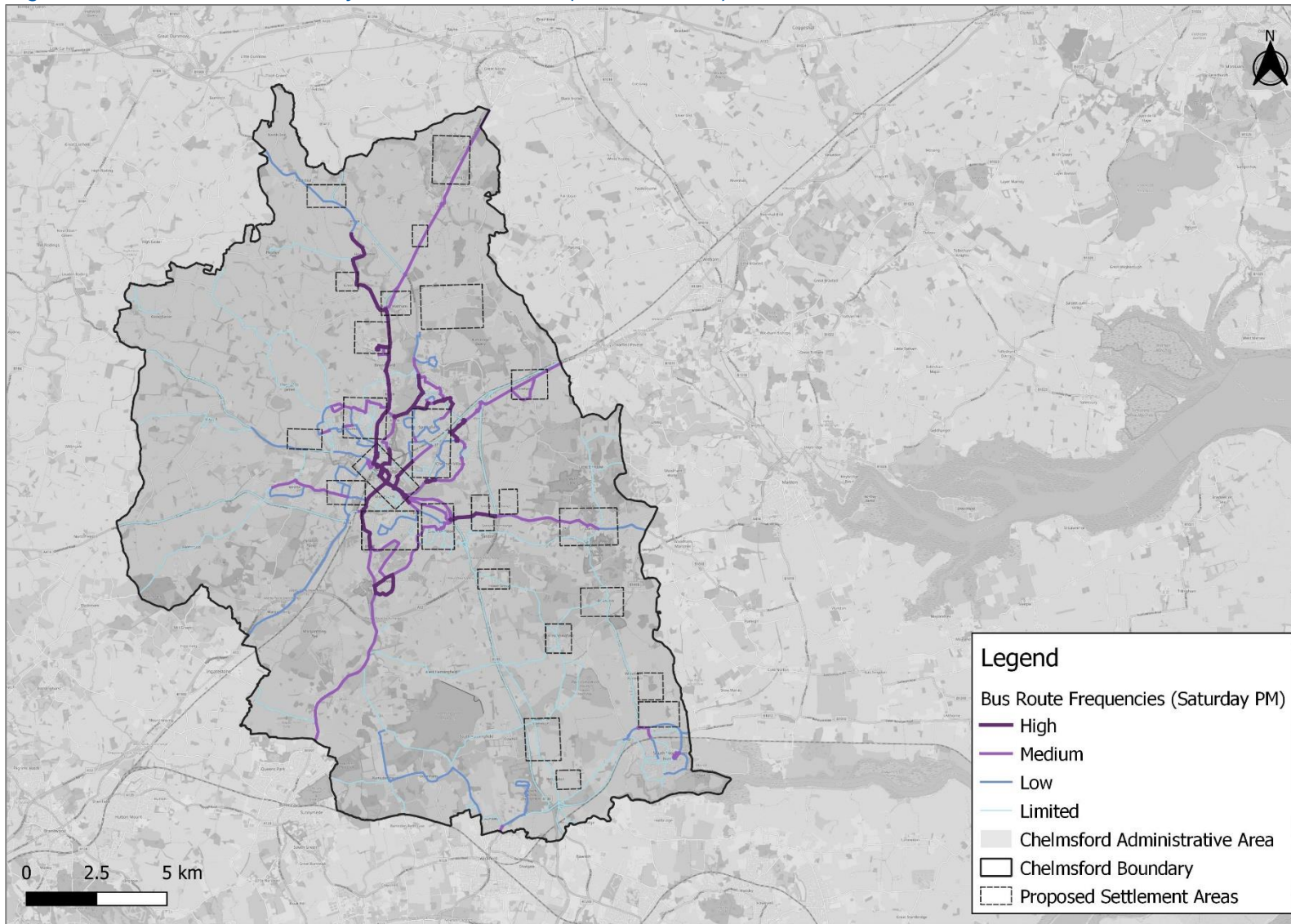
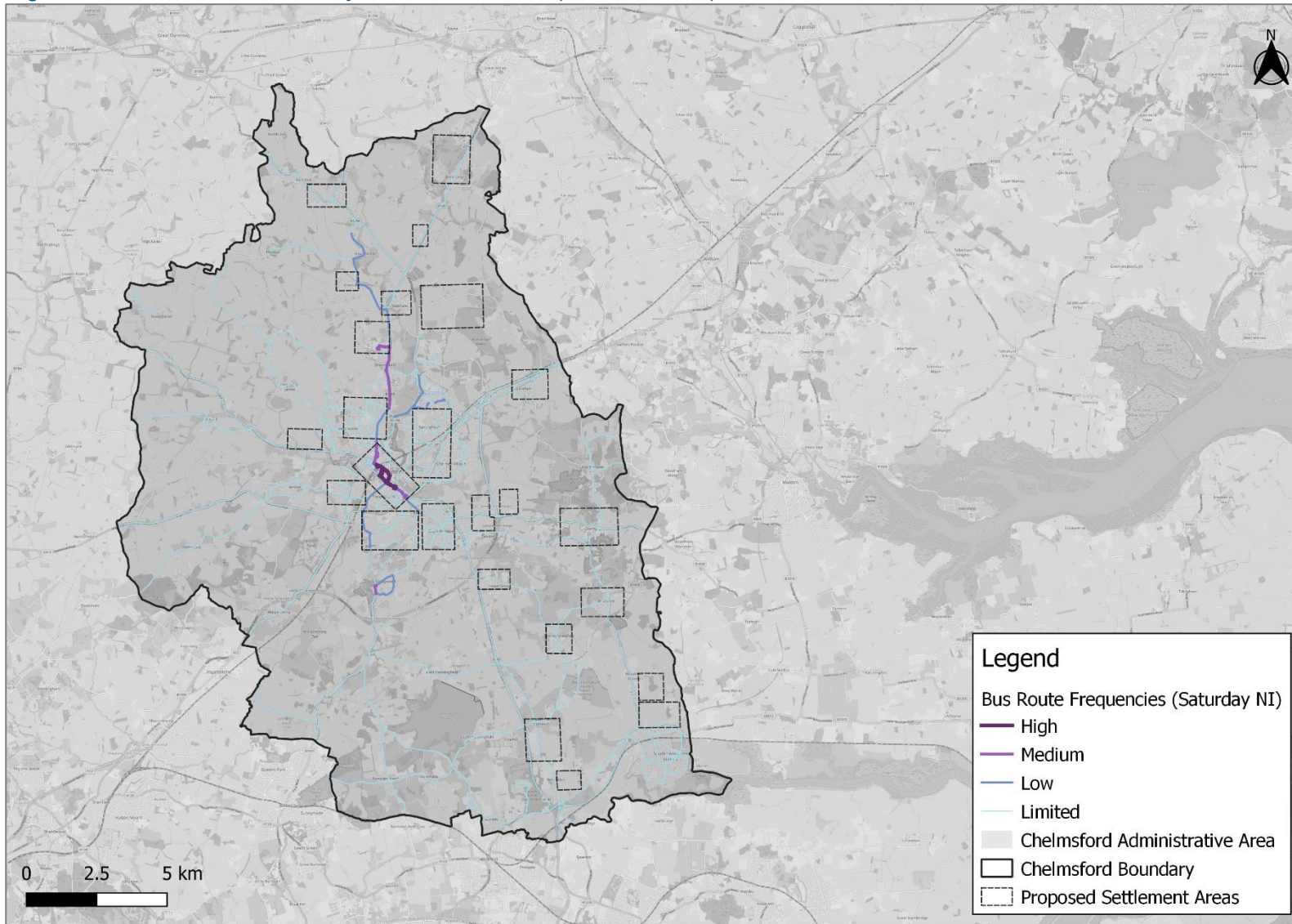




Figure C.2.8. Access to Saturday bus services – NI (20:00 – 07:00)



*Figure C.2.9. Access to Sunday bus services – AM (07:00 – 11:00)*

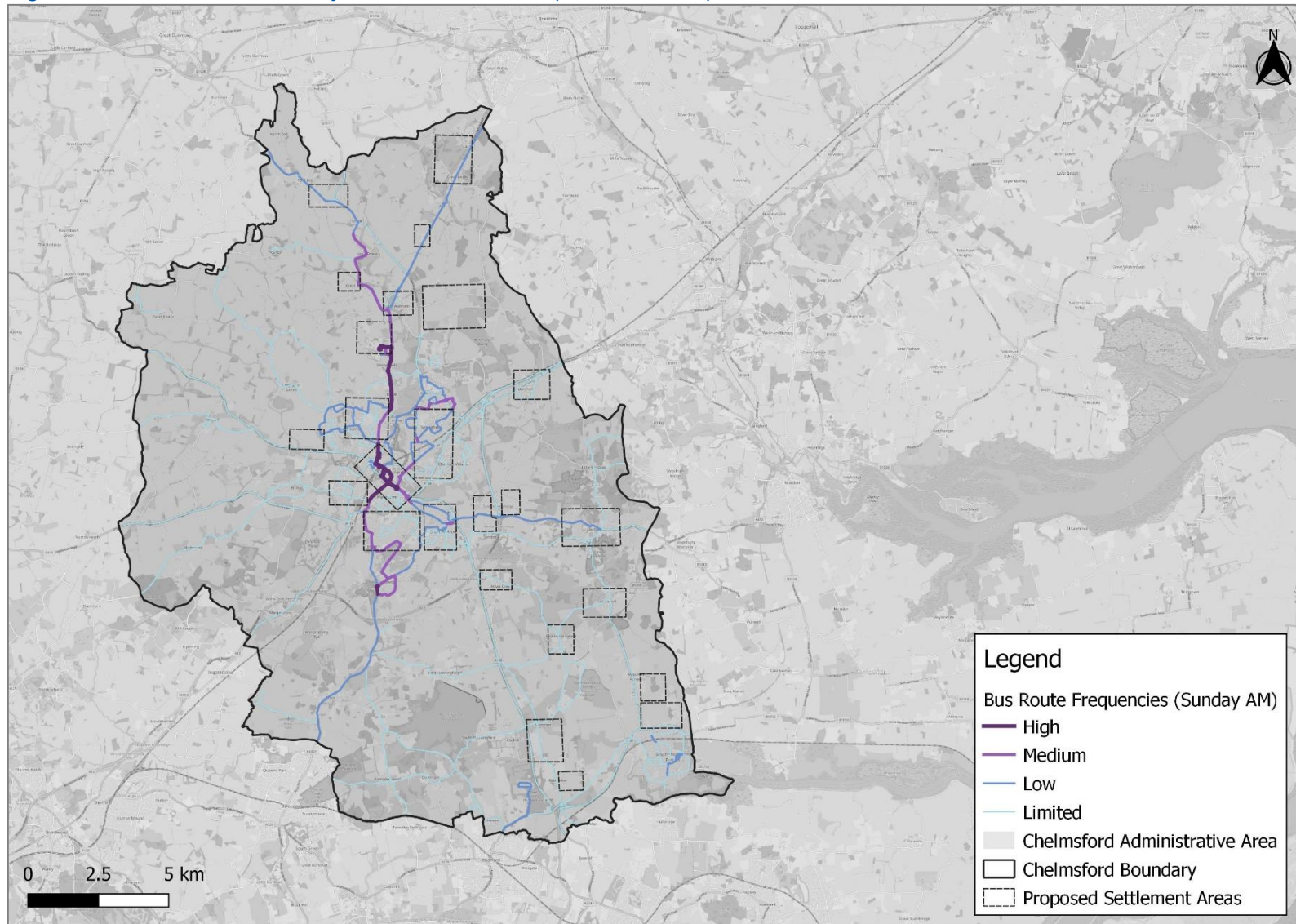




Figure C.2.10. Access to Sunday bus services – IP (11:00 – 16:00)

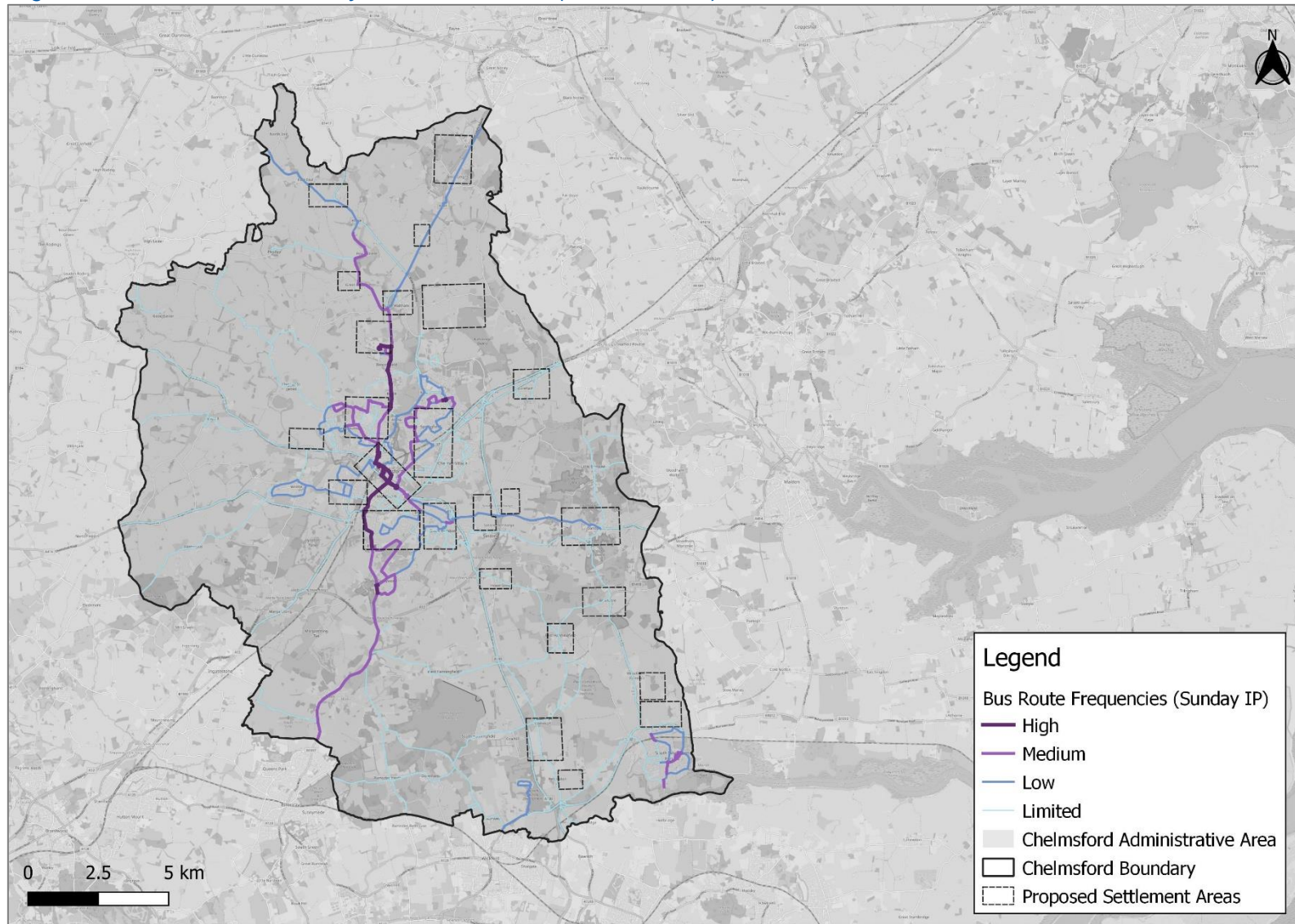


Figure C.2.11. Access to Sunday bus services – PM (16:00 – 20:00)

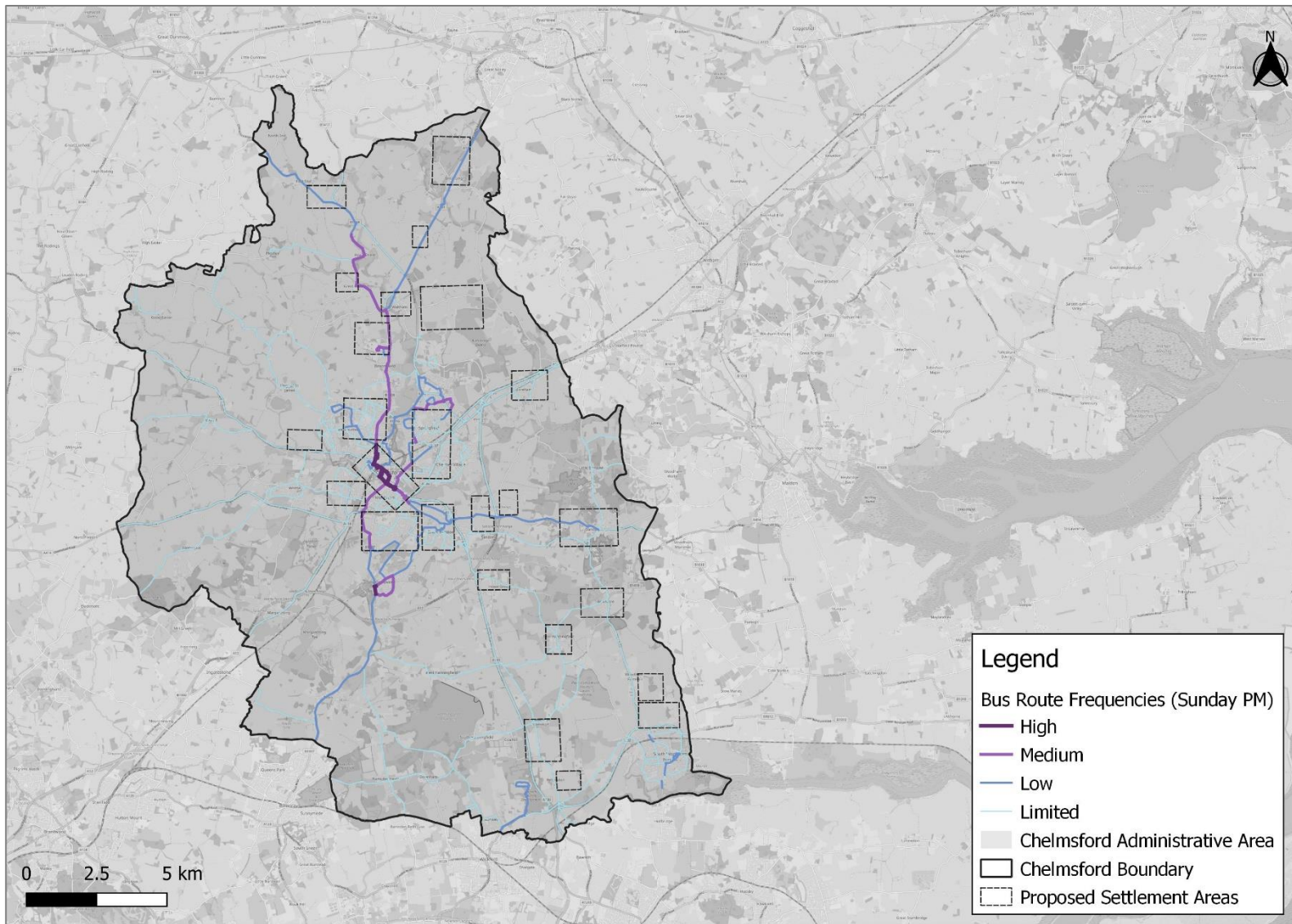
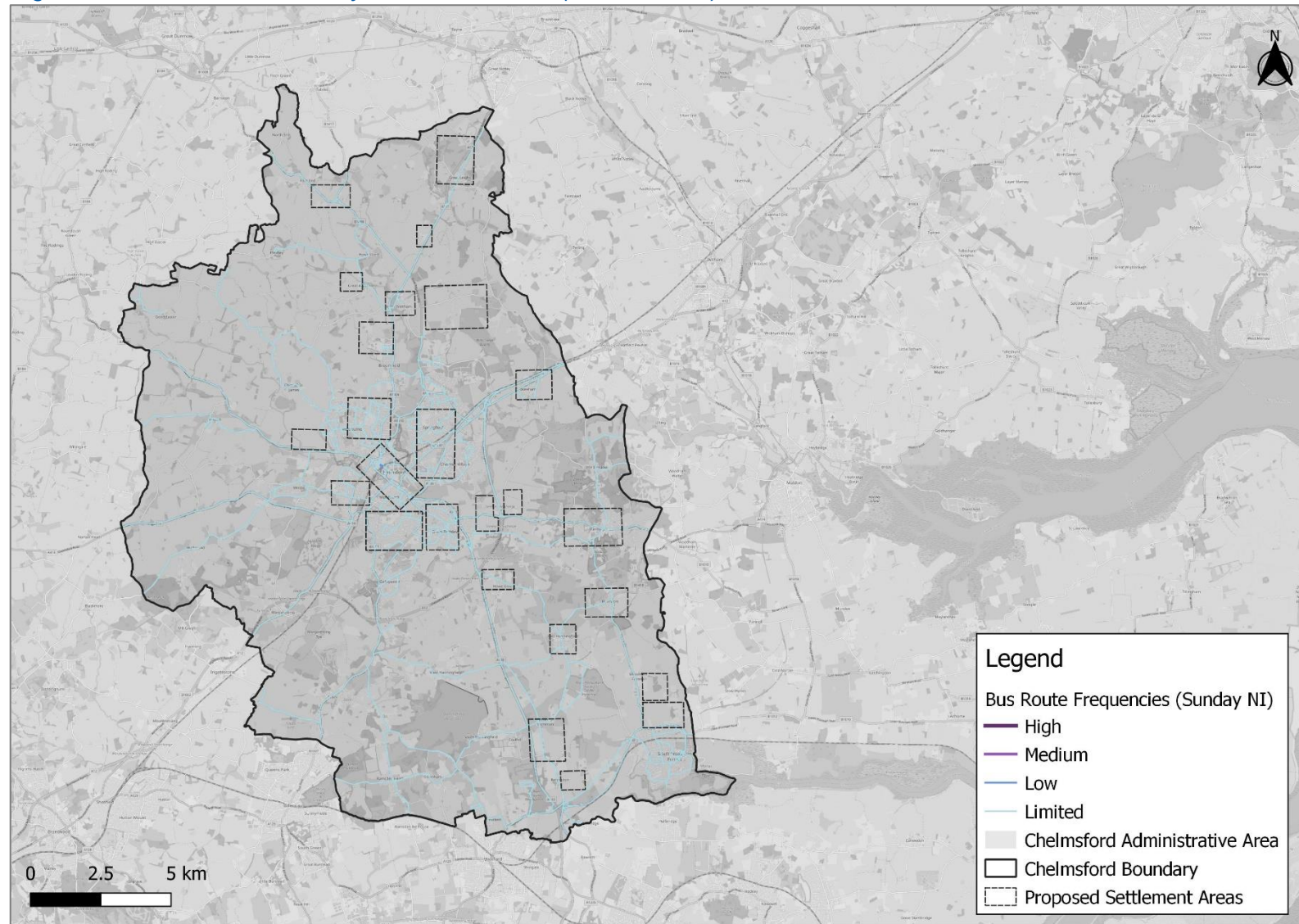


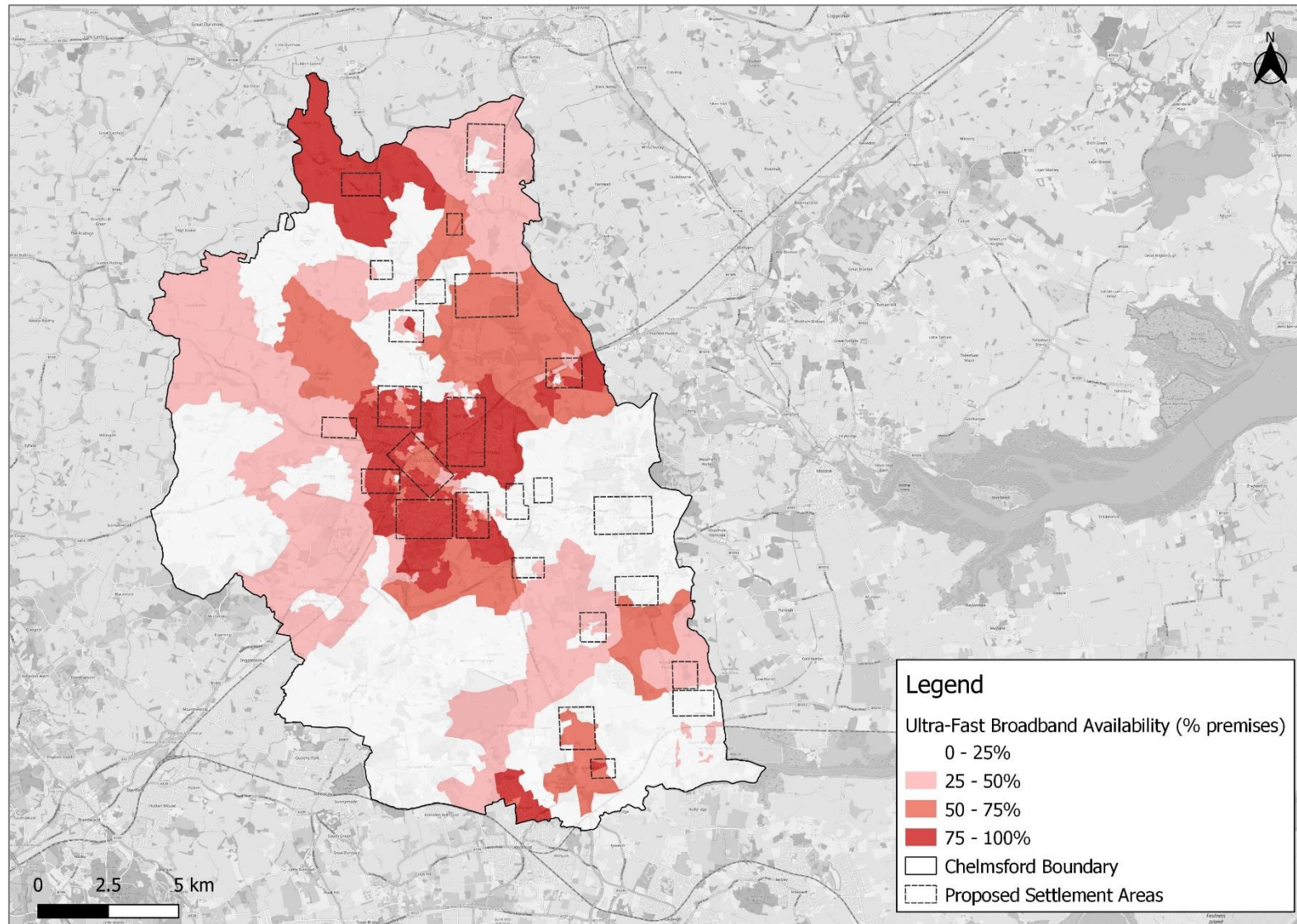


Figure C.2.12. Access to Sunday bus services – NI (20:00 - 07:00)





C.3 – Local coverage of broadband (Created using 2021 OFCOM data at OA level. Displayed using QGIS)



## C.4 – Summary table showing the car modal share for the proposed settlement areas (SAs) (Created using 2011 Census Data at LSOA level)

Location	Total 'All method of travel to work'	Total 'Driving a car or van'	% Driving a car or van	RAG
SA 1a. Chignal / Melbourne	6,079	3,458	57%	2
SA 1b. Springfield	10,140	6,143	61%	2
SA 1c. City Centre	7,914	3,263	41%	3
SA 1d. Moulsham / Tile Kiln	7,818	4,676	60%	2
SA 1e. Great Baddow	5,252	3,301	63%	2
SA 1f. SW Chelmsford / Widford	3,246	1,710	53%	2
SA 2a. West Chelmsford	2,036	1,299	64%	2
SA 2b. East Chelmsford	677	485	72%	1
SA 3. North of South Woodham Ferrers	1,686	1,141	68%	1
SA 4. NE Chelmsford	744	513	69%	1
SA 5a. Bicknacre	1,124	886	79%	1
SA 5b. Boreham	1,717	1,271	74%	1
SA 5c. Broomfield	1,559	930	60%	2
SA 5d. Danbury	2,068	1,460	71%	1
SA 5e. Great Leighs	1,302	995	76%	1
SA 6a. East Hanningfield	806	600	74%	1
SA 6b. Ford End	549	412	75%	1
SA 6c. Great Waltham	549	412	75%	1
SA 6d. Little Waltham	1,341	883	66%	1
SA 6e. Rettendon Place	758	556	73%	1
SA 6f. Woodham Ferrers	806	600	74%	1
SA 7a. Chatham Green	744	513	69%	1
SA 7b. Howe Green	677	485	72%	1
SA 7c. Rettendon Common	758	556	73%	1
SA 8. Hammonds Farm	677	485	72%	1

## Appendix D – Bus frequency criteria (provided by ECC’s bus enhanced partnership team)

Bus Frequency Criteria		Methodology	Data Source
High frequency	≥8 two-way buses average per hour.	<p>Bus frequency data was provided for all routes in the area for Weekdays, Saturdays, and Sundays for the following periods:</p> <ul style="list-style-type: none"> <li>• AM – 07:00 – 11:00</li> <li>• IP – 11:00 – 16:00</li> <li>• PM – 16:00 – 20:00</li> <li>• NI – 20:00 – 07:00</li> </ul> <p>The data was then split into 4 categories using the criteria on the left and displayed onto maps.</p>	<p>Data was provided by ECC (Essex County Council) for the week commencing November 15<sup>th</sup>, 2021. Traveline was used when data was not available from ECC.</p> <p>It is noted that some routes will have been affected by Covid-19 at the time this data was sourced. However, many of these routes have not changed back due to passenger levels not returning to pre-pandemic levels. Therefore, this data still provides a fair representation of current bus frequencies.</p>
Medium frequency	≥4 two-way buses average per hour.		
Limited frequency	≥2 two-way average buses per hour.		
Low frequency	<2 two-way average buses per hour.		



## Appendix E – Results of the RAG assessment

Table E.1 – RAG assessment for each proposed settlement area (SA).

	SA 1a. Chignal/Melbourne	SA 1b. Springfield	SA 1c. City Centre	SA 1d. Moulsham/Tile Kiln	SA 1e. Great Baddow	SA 1f. SW Chelmsford/Widford	SA 2a. West Chelmsford	SA 2b. East Chelmsford	SA 3. North of South Woodham Ferrers	SA 4. NE Chelmsford - Existing	SA 4. NE Chelmsford - Potential	SA 5a. Bicknacre	SA 5b. Boreham	SA 5c. Broomfield	SA 5d. Danbury	SA 5e. Great leighs	SA 6a. East Hanningfield	SA 6b. Ford End	SA 6c. Great Waltham	SA 6d. Little Waltham	SA 6e. Rettendon Place	SA 6f. Woodham Ferrers	SA 7a. Chatham Green	SA 7b. Howe Green	SA 7c. Rettendon Common	SA 8. Hammonds Farm
Accessibility to urban centres	3	3	3	3	3	3	3	2	3	1	1	1	2	2	2	2	2	1	1	2	2	1	2	2	2	2
Accessibility to employment locations	3	3	3	3	3	3	3	3	3	1	3	2	3	3	2	2	2	2	2	3	1	2	2	2	1	2
Accessibility to rail stations (walking and cycling)	3	3	3	3	3	3	3	1	2	1	3	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1
Accessibility to rail stations (public transport)	3	3	3	3	3	3	3	3	2	1	3	2	3	3	3	1	3	3	1	3	2	2	3	3	1	3
Weekday bus services and frequency	3	3	3	3	3	3	2	3	3	1	3	2	3	3	3	3	1	1	3	3	1	1	3	1	1	3
Saturday bus services and fq	3	3	3	3	3	2	2	3	1	1	3	1	3	3	2	2	1	1	3	3	1	1	2	1	1	2
Sunday and night (OoH) fq	2	2	3	2	1	1	1	1	1	1	2	1	1	2	1	1	1	1	2	2	1	1	1	1	1	1
Walking access to bus stops	3	3	3	3	3	3	2	3	2	1	3	2	2	2	2	2	1	2	2	3	1	1	2	1	1	2

	SA 1a. Chignal/Melbourne	SA 1b. Springfield	SA 1c. City Centre	SA 1d. Moulsham/Tile Kiln	SA 1e. Great Baddow	SA 1f. SW Chelmsford/Widford	SA 2a. West Chelmsford	SA 2b. East Chelmsford	SA 3. North of South Woodham Ferrers	SA 4. NE Chelmsford - Existing	SA 4. NE Chelmsford - Potential	SA 5a. Bicknacre	SA 5b. Boreham	SA 5c. Broomfield	SA 5d. Danbury	SA 5e. Great leighs	SA 6a. East Hanningfield	SA 6b. Ford End	SA 6c. Great Waltham	SA 6d. Little Waltham	SA 6e. Rettendon Place	SA 6f. Woodham Ferrers	SA 7a. Chatham Green	SA 7b. Howe Green	SA 7c. Rettendon Common	SA 8. Hammonds Farm
UFBB internet connectivity	3	3	3	3	3	3	1	1	1	2	2	1	2	1	1	1	1	3	1	1	2	1	3	1	2	1
Car driver mode share	2	2	3	2	2	2	2	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1
Accessibility to healthcare	3	3	3	3	3	3	2	2	3	2	3	3	3	3	3	1	2	1	2	3	2	2	2	2	2	2
Accessibility to nurseries	3	3	3	3	3	2	2	1	3	1	3	3	3	3	3	1	3	1	3	3	2	1	1	1	1	1
Accessibility to primary schools	3	3	3	3	3	2	2	1	3	1	3	2	3	1	3	3	1	3	3	2	2	2	1	1	1	1
Accessibility to secondary schools	3	3	3	3	2	3	1	3	2	1	3	1	1	3	1	1	1	1	1	2	1	1	1	1	1	1
Site average RAG score	2.86	2.86	3.00	2.86	2.71	2.57	2.07	2.00	2.14	1.14	2.57	1.64	2.21	2.29	2.00	1.57	1.50	1.57	1.86	2.36	1.43	1.36	1.79	1.36	1.21	1.64
Location average RAG score	2.81						2.04		2.14	1.14	2.57	1.94					1.68						1.45			1.64

## E.2. Calculation of relative sustainable accessibility for each Spatial Approach

Location	Location Average	Approach A Dwellings (No. of Dwellings)	Approach A Score (Location Avg x No. of Dwellings)	Approach B Dwellings (No. of Dwellings)	Approach B Score (Location Avg x No. of Dwellings)	Approach C Dwellings (No. of Dwellings)	Approach C Score (Location Avg x No. of Dwellings)	Approach D Dwellings (No. of Dwellings)	Approach D Score (Location Avg x No. of Dwellings)	Approach E Dwellings (No. of Dwellings)	Approach E Score (Location Avg x No. of Dwellings)
Location 1	2.81	1,000	2809.52	2,500	7023.81	1,000	2809.52	1,000	2809.52	1,000	2809.52
Location 2	2.04	1,500	3053.57	1,500	3053.57	1,500	3053.57	500	1017.86	0	0
Location 3	2.14	500	1071.43	500	1071.43	500	1071.43	500	1071.43	0	0
Location 4	2.57	3,500	9000.00	3,500	9000.00	3,500	9000.00	4,500	11571.43	3,000	7714.29
Location 5	1.94	1,500	2914.29	0	0	1,000	1942.86	0	0	0	0
Location 6	1.68	0	0.00	0	0	500	839.29	0	0	0	0
Location 7	1.45	0	0.00	0	0	0	0	1,500	2178.57	0	0
Location 8	1.64	0	0.00	0	0	0	0	0	0	4,000	6571.43
Total Score	-	-	18848.81	-	20148.81	-	18716.67	-	18648.81	-	17095.24
Display Score (Total/10,000)	-	-	1.88	-	2.01	-	1.87	-	1.86	-	1.71
Ranking of Approaches (Highest to lowest score)			2		1		3		4		5