
NIC
Cambridge, Milton
Keynes and Oxford
Future Planning
Options Project

FINAL REPORT
FEBRUARY 2018 - REV A

**5th
studio**

SQW

NATIONAL INFRASTRUCTURE COMMISSION

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EXECUTIVE
SUMMARY



INTRODUCTION

The Oxford-Milton Keynes-Cambridge corridor encompasses a line of towns and cities some 50 miles out from London, each with an unusually productive economy. The corridor is bookended by two world-class universities, and contains a fine grain of research locations and educational institutions, as well as 9 of the UK's top 100 high growth tech firms. Each of those places is established on the strong radial transport network emanating from the capital, the strength of which has eclipsed effective concentric connectivity. Currently experienced, links between these places are weak: the corridor is not a functional one in terms of east-west interrelationships.

Yet obscured by the awkwardness of transitioning between these places are strong latent continuities, and not only in terms of economic orientation and growth. To a geologist this landscape really is a corridor, united by a common clay watershed substrata which has brought similar influences to the settlements within it, each shaped and defined by the major rivers flowing through the territory.

Competing on a global stage, the knowledge-driven economy of this collection of cities is impressive, but its future economic health is threatened by a lack of suitable and affordable housing, and the appropriate connective infrastructure to support 'good growth'. The congestion caused by inward commuting threatens the environment, and the productivity of Oxford and Cambridge in particular. The question of housing has been delegated to the market, which, left to its own devices, is failing to deliver adequate numbers and is also making poor use of finite resources. The diagrams on **page 22** illustrate the scarce nature of available land on which to build in the corridor. To paraphrase Mark Twain "land - they ain't making it any more". It is critical that this resource is used to its full potential in support of a regional-scaled vision for accommodating growth.

This study implicitly explores the potential that could emerge from making the corridor more functional, using road and rail infrastructure to link existing economic clusters in a way that creates more than the sum of its parts. A more connected corridor would establish a stronger sense of unity, but it is essential that this is achieved in a way that reinforces the diversity and different contributions of the places along the way.

OVERARCHING OBJECTIVE

The Chancellor of the Exchequer asked that the National Infrastructure Commission (NIC):

"make recommendations to maximize the potential of the Cambridge – Milton Keynes – Oxford corridor as a single, knowledge intensive cluster that competes on the global stage, whilst protecting the area's high quality environment and securing the homes and jobs the area needs. The commission will look at the priority infrastructure improvements needed and assess the economic case for which investments would generate the most growth."

In support of this inquiry, 5th Studio were appointed to:

"reach conclusions and make recommendations for the forms of housing development that best fit the needs of the corridor, meeting housing need and supporting jobs and growth."

This report is the conclusion of that investigation, examining where development could occur to maximise the value of planned and committed infrastructure investments.

INTERIM REPORT FINDINGS

The NIC published an Interim Report on the corridor in late 2016.

The Commission's central finding was that a lack of sufficient and suitable housing presents a fundamental risk to the success of the area. Without a joined-up plan for housing, jobs and infrastructure across the corridor, it will be left behind by its international competitors. By providing the foundations for such a strategy, new east-west transport links present a once-in-a-generation opportunity to secure the area's future success.

The Cambridge-Milton Keynes-Oxford corridor faces a chronic under-supply of homes, made worse by poor east-west transport connectivity. Two of the least affordable cities in the UK lie within the corridor, and the area as a whole has consistently failed to build the number of homes it needs.

SCALE OF THE CHALLENGE

Savills' report for the NIC, *The Property Market in the Corridor* (2016), established three potential housing growth scenarios reflecting different levels of housing delivery within the corridor (see **page 9** for further discussion).

For the purpose of this report, this study explores a transformational scenario which supposes a rate of delivery of 23,000 homes per year, which, with a time horizon to 2050, equates to a population increase of 1.4 million people within the area defined by the Savills study. As evidenced in Chapter 1, this matches the average rate of population growth of the last century.

With the addition of a share of London's housing need (that might not be able to be met within its own boundary) these figures would increase to 30,000 homes per year and a 1.9 million total population increase to 2050.

While it would certainly be possible to build fewer homes, or take longer to deliver them, this scenario seems to best illustrate the spatial challenges in the corridor.

This study illustrates what this scale of growth looks like, beginning from the coarse grain representation, and ultimately refining that into an illustrative spatial scenario.

NEW PLACES

It is unlikely that the 'transformational' (or indeed the lower 'incremental') levels of growth can be sustained if focussed exclusively around existing towns and cities, given the constraints of their contexts and limitations on the expansion of their existing infrastructure. A wider range of approaches therefore need to be considered, including the development of wholly new settlements, in order to reach those projections.

East West Rail and the Expressway, if routed and specified correctly, could enable substantial opportunities for the growth of new settlements between Bicester and Bletchley, in Marston Vale, at Sandy, and between Sandy and Cambridge.

CASE STUDIES

Having established that a spectrum of forms of housing may be useful in delivering the corridor's needs, this study went on to examine a wide range of settlement typologies in further detail – from the scale of a small village up to city the size of Milton Keynes, and embodying radically different approaches.

This investigation was conducted through a series of nine speculative case studies. Each case study involved applying a given typology to an appropriate real world site - allowing an understanding of their strengths and weakness, their suitability in different situations and contexts, and the particular conditions or qualities needed for the success and sustainability of a particular typology to be explored and illustrated.

The list of typologies investigated in detail is as follows:

1. Town Centre Intensification
2. Suburban Intensification
3. Edge Intensification
4. Strong Edge + Satellite
5. Urban Extension
6. New Small Settlement (i.e. new village)
7. New Town
8. String City
9. New City

These case studies are presented in detail in Chapter 3, and the findings from each has informed the conclusions and recommendations of this report as set out on the following page, and in more detail in Chapter 4

SINGULAR AND DIVERSE

While we believe that a stronger singular identity for the corridor has the potential to unlock a series of benefits to support economic resilience, greater coherence needs to be balanced by a strengthening of the identity of each place.

The “high quality environments” that make the settlements in the corridor attractive are threatened by generic approaches to development which do not recognise and celebrate the particular qualities and contexts of each location.

APPROPRIATE RESPONSES

Appropriate Responses

5th Studio was asked to consider the appropriateness of a number of typologies to accommodate growth, from intensification of existing places through to completely new settlements. It is clear through the findings of this report that no single approach provides the “right answer”, and a diverse range of responses will be necessary. The critical challenge is that each approach is appropriate to the particular context, and that it is done well.

This study concludes that the appropriate form or typology of development is contingent on the specific location (particularly in relation to the existing physical, economic and infrastructural context) as well as the qualitative terms in which that typology is deployed.

MAKING SUCCESSFUL PLACES

Distinctive new settlements will relate well to the particular context in which they sit, forging strong relationships with existing landscapes and built fabric.

The basis of this inquiry is the reinforcement of strong economic growth through the creation of attractive and resilient places. Implied in a number of the illustrated typologies is the integration of both living, working and leisure in support of this overarching aim, avoiding the creating of mono-cultures or dormitories.

Development in the corridor at this scale will need to address environmental sustainability, and provide real mobility choices, making it as easy as possible to avoid use of the car and prioritising walking and cycling and the use of efficient public transport.

BEST PRACTICE EXAMPLES

To illustrate the potential of particular typologies, this report draws upon exemplars from both the UK and abroad of world class urban design and architecture.

The study commenced with a thorough review of best practice examples and the creation of a series of case studies which informed the development of typologies. Relevant themes drawn from these exemplars include:

- Neighbourhoods should be organised around local facilities and access to high quality public transport.
- Medium to high levels of density should be achieved to support shorter travel distances to, and higher patronage of, local facilities and public transport services.
- The distribution of open space should be used to encourage a compact urban form.
- Built development should go hand-in-hand with the creation of diverse and ecologically rich landscapes.
- Places should accommodate a mix of uses with local services.
- Extensions to existing places should integrate well with adjacent areas.
- Generic responses should be avoided.
- Larger-scale settlements will require careful seeding and nurturing of their economic and institutional foundations.
- Development of all types should minimise the load imposed on wider water, energy and waste networks.

INTEGRATED SPATIAL & TRANSPORT PLANNING

Public transport access should underpin growth in the corridor, and this study highlights a missing scale of infrastructure planning and expertise at the level of the metropolitan network. This “missing scale” of connectivity - which might be light rail, tram or bus services - is critical in resolving city congestion issues and “final 5 mile” connectivity, but, with the exception of London, has not been part of local area planning and delivery for some time: the repercussions of which are evident.

Metropolitan networks complement national infrastructure and will be critical in ensuring that national-scale infrastructure such as East-West Rail resolves the congestion issues apparent in cities like Oxford and Cambridge.

Infrastructure investments that are co-ordinated across scales, and planned in concert with existing and new urban development, will be the most cost-effective and sustainable, and will therefore make the most efficient use of the available funding. A coordinated transport and development plan would allow for investment in infrastructure to be optimised, and help to avoid the creation of new development in areas that do not have the infrastructure in place to support such development in a viable and sustainable way.

While this report does not make recommendations on route alignments for East-West Rail and the Oxford-Cambridge Expressway, it does highlight the importance of considering the broader implications of different route options and the need for them to play complementary roles:

- The final routing of the East-West Rail line needs to be developed to support “good growth” in an optimal way, and integrate well with local transport networks. This is particularly important around Bedford and the new section of rail line eastwards to Cambridge.
- The Oxford-Cambridge Expressway routing in the west of the corridor needs to be planned in an integrated way to ensure that, as well as fulfilling its role in improving the utility of the national network, it also maximises its potential to support new development. This factor therefore needs to be weighted and appraised alongside all other factors relevant in the process of selecting the final route.

GOVERNANCE & NEXT STEPS

Anything approaching the scale of growth required will demand strong political leadership and democratic support.

This study is intended as a starting point for planning authorities to develop a co-ordinated corridor-wide vision, within which their own plans can be related. It identifies three types of sub-regional spatial planning, nested within the overall framework:

1. Oxford and Cambridge City Regions
2. Two new compact cities
3. Three East-West development corridors

In each case a local or metropolitan-scale public transport network is the key infrastructure required to spread the benefit of the improved east-west connectivity that East-West Rail would provide.

The conclusions and other substantive outputs of this report (the Spatial Framework, Case Studies, and Illustrative Spatial Scenario) are intended as a starting point - a provocation - for further work.

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**CHAPTER 1:
INTRODUCTION**



INTRODUCTION

5th Studio, supported by SQW, were commissioned to identify and assess the different types of development that could deliver significant new housing across the corridor, drawing on domestic and international examples and best practice. This assessment was also to draw conclusions and make recommendations regarding the most appropriate forms of housing development that best fit the needs of the corridor, meeting housing need and supporting jobs and growth.

The study geography was defined as follows in the brief:

“Towns, cities and their hinterlands referred to in the terms of reference, including key economic relationships with surrounding places.”

The terms of reference refer explicitly to Oxford, Milton Keynes and Cambridge, but also state that “together with Northampton, the area contains four of the UK’s fastest growing, and most productive, places.” While Northampton is not in the main east-west infrastructure corridor associated with East West Rail and the Oxford to

Cambridge Expressway, it is nonetheless included within the broad corridor definition, along with a number of other towns/cities within the arc. The various geographical definitions of the corridor are discussed further in this chapter.

This report summarises the findings from an initial (non-exhaustive) infrastructure and landscape-based opportunity assessment and mapping across the full corridor, to identify a representative spectrum of potential opportunity sites most appropriate to particular development/settlement typologies. This was undertaken in parallel with development of a range of typologies and the case studies bring together these two strands of thinking, and provide a means of assessing the issues/opportunities of the various approaches in the context of the corridor.

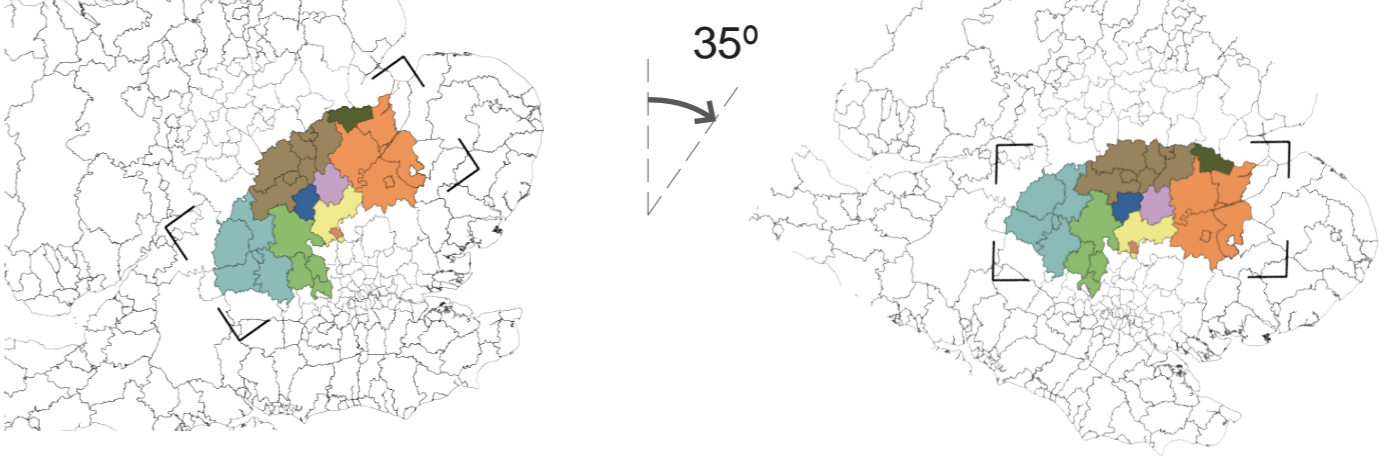
This report is therefore intended as an exposition of a range of potential approaches and the issues, pros and cons of each, to inform future initiatives and more detailed examination of specific sites or infrastructure interventions in due course.

A NOTE ON DRAWING ORIENTATION

Many of the map-based drawings in this report are not presented in the conventional “north is up” orientation, but are instead rotated by 35 degrees in order to:

- Maximise scale/coverage within the confines of conventional paper sizes;
- Enable the key east-west infrastructure corridors to be presented orthogonally - running legibly as a horizontal

- axis across the page;
- To provide a degree of unfamiliarity, enabling the viewer to see the territory afresh.



THE BRIEF

Overarching Objective:

“make recommendations to maximize the potential of the Cambridge – Milton Keynes – Oxford corridor as a **single, knowledge intensive cluster** that competes on the global stage, whilst protecting the area’s **high quality environment and securing the homes and jobs the area needs**. The commission will look at the priority infrastructure improvements needed and assess the economic case for which investments would generate the most growth.”

Chancellor of the Exchequer, 2016

This report is informed by:

- The National Infrastructure Commission (NIC)'s Interim Report;
- A high level review of information submitted to the NIC's Call for Evidence;
- A review of the outcomes of the four thematic workstreams commissioned by the NIC in 2016, covering the property market, transport, finance and investment and economics.

A full list of these sources, as well as other academic sources used to inform the context of this study is included in **Appendix E**.



To inform this, 5th Studio were asked to:

“reach conclusions and make recommendations for the forms of housing development that best fit the needs of the corridor, meeting housing need and supporting jobs and growth.”

The previous property market, transport, finance and investment and economics reports examined a number of different scenarios as summarised in the table alongside.

The central finding of the Commission’s Interim Report on the Cambridge - Milton Keynes - Oxford corridor – based on the finding of the four thematic workstreams referenced above – was that a lack of sufficient and suitable housing presents a fundamental risk to the success of the area.

It was therefore agreed that this study should examine the implications of accommodating the upper end of this range of the scenarios, to understand the spatial and infrastructural challenges that a step-change in housing delivery of this kind would create.

The brief therefore assumes that the population would increase through to 2050 according to the “Transformational Scenario” defined in the previous studies, with the potential for a further increase due to “accommodation of development due to pressures from land-constrained markets”.

This generates the following totals:



Key Considerations:

- Infrastructure requirements (their cost and sustainability)
- Cost
- Deliverability
- Sustainability
- Effect on existing settlements
- Quality of life
- Maintenance and/or protection of the corridor’s environment and cultural assets (including the green belt)
- Quality of housing and the built environment

rate



34 year totals (2016 to 2050)



number of new homes



corridor population increase (assuming 1.87 people per household)

	rate	34 year totals (2016 to 2050)	
Baseline Scenario	15,000	510,000	950,000
Incremental Scenario	20,000	680,000	1,272,000
Transformational Scenario	23,000	782,000	1,462,000
Development accommodated due to pressures from land-constrained markets	7,000	238,000	445,000
Study Brief Transformational ± Development accommodated due to pressures from land-constrained markets	23,000 - 30,000	782,000 to 1,020,000	c.1.45m to 1.90m

UNDERSTANDING THE CORRIDOR: STRATEGIC CONTEXT

The property market, transport, finance and investment and economics reports commissioned by the NIC in 2016 confirm the sense that the corridor is not currently either a functional transport corridor, nor a singular economic geography. It is defined principally through being an alignment of a number of high growth town/cities, including two of Britain's globally significant Higher Education institutions.

As a spatial, movement and economic entity, the corridor is a latent possibility rather than an existing phenomenon. For instance, the Transport Worskstream conducted by Arup notes that: "the four relatively self-contained labour market areas within the study area (Swindon, Oxford, the central area of Milton Keynes-Northampton-Bedford-Wellingborough, and Cambridge), and the degree of interaction with the London labour market, suggests that more could be done to enable the area to function as a corridor." and highlights, by way of comparison, how: "The degree of interaction in the central Milton Keynes-Northampton-Bedford-Wellingborough constellation, reflects the better transport links between those towns."

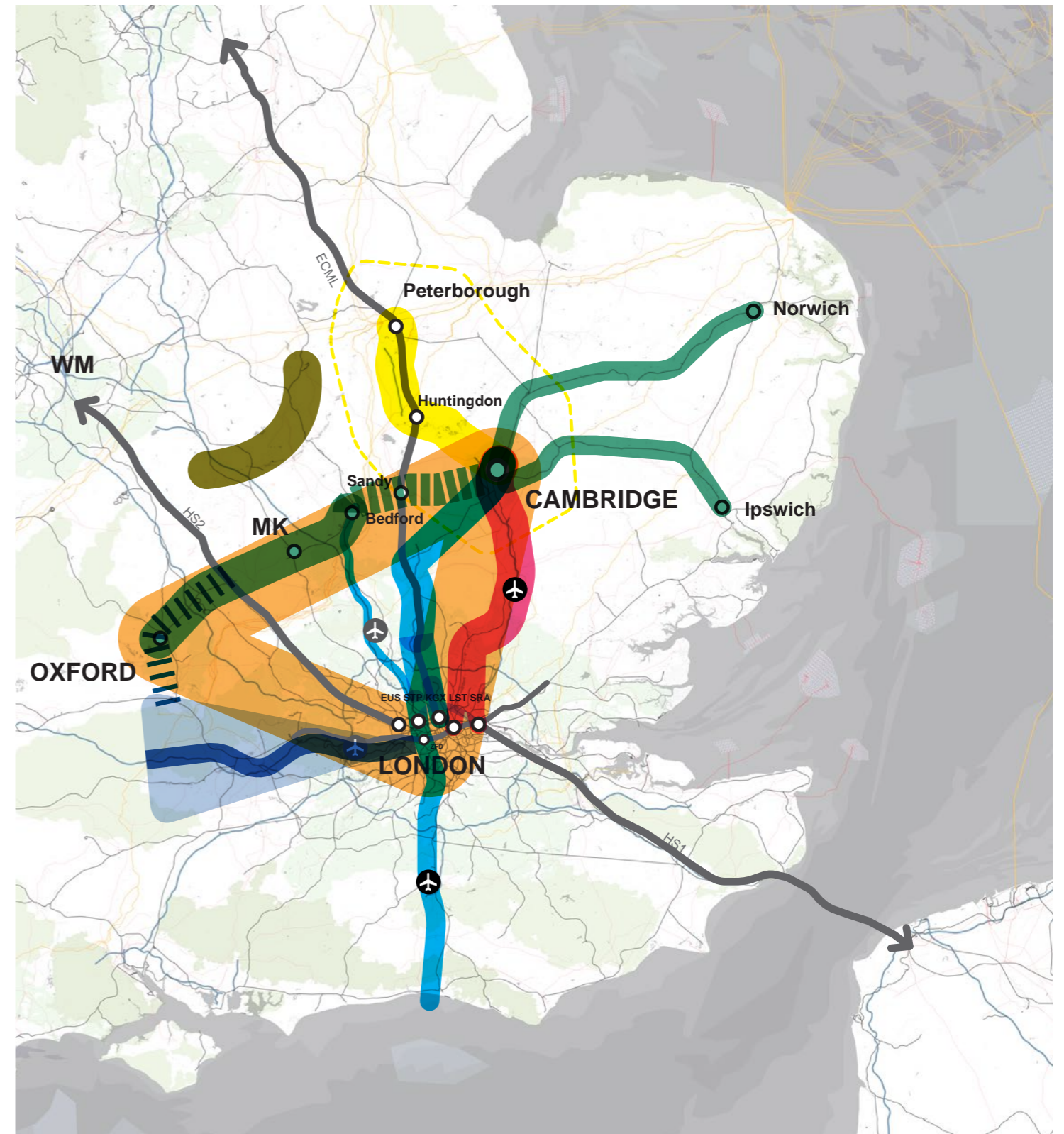
The patchwork of governance and planning bodies across the corridor also means there is very little mapping or spatial analysis that covers, in a coherent or consolidated fashion, the full breadth of the corridor.

One of the first tasks of 5th Studio's commission was therefore to create a series of mapping and analytical drawings and diagrams.

These drawings are summarised over the following pages. The full drawing sets are contained within **Appendix B**.

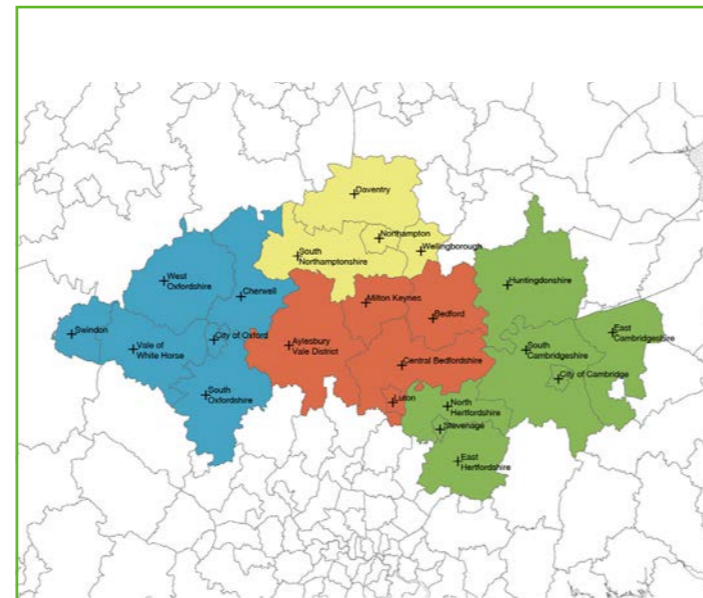
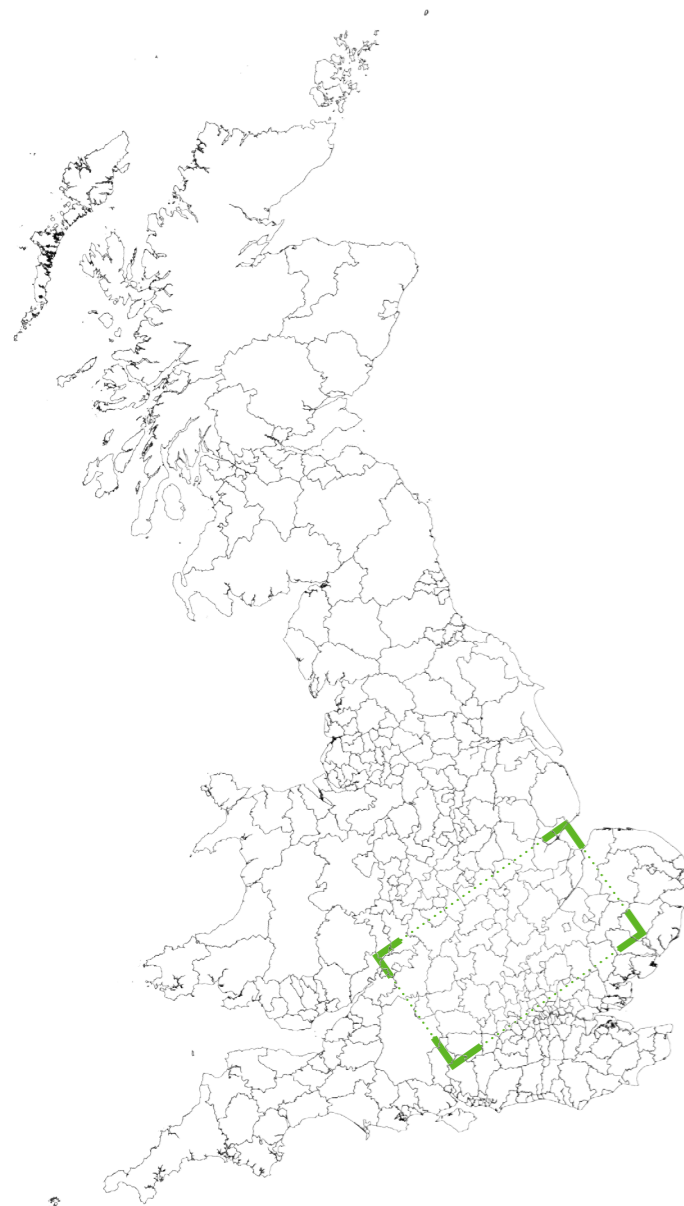
The Oxford - Milton Keynes - Cambridge corridor in the context of various other intersecting regional/cross-boundary growth corridors/initiatives/strategies >

-  East-West Rail: West section
-  East-West Rail: Central section
-  East-West Rail: East section
-  Thameslink - Great Northern
-  London-Luton-Bedford (London Plan)
-  London - Stansted - Cambridge Consortium (LSCC) - West Anglia line
-  Cambridge - Peterborough corridor
-  Cambridge-Peterborough combined authority
-  Oxfordshire "Knowledge Spine"
-  "The Golden Triangle"
-  "Western Wedge" (London Plan) / M4 Corridor
-  "Northamptonshire Arc"
-  Electricity and Gas transmission lines



UNDERSTANDING THE CORRIDOR: EXTENTS

During the study, a range of geographical definitions of the corridor were explored, as shown in the diagrams below (see [Appendix A](#) for full size diagrams).

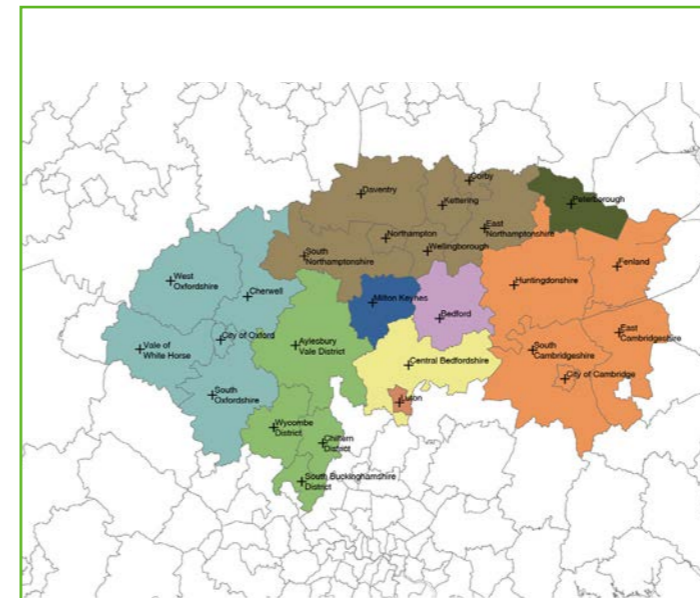


Interim Report Analysis Scope Corridor Definition

Definition used for the purpose of the NIC's previous economic/transport/Savills' property market and funding analysis, comprising four sub-areas:

- Swindon + Greater Oxford;
- Northampton;
- Aylesbury Vale/Milton Keynes/Bedfordshire;
- Cambridge and Northern Hertfordshire.

Despite the looser overall boundary adopted for this study (see right), this is the area used for the calculations in the Illustrative Scenario due to the data availability and structure, and to keep it consistent with the property market analysis. The Illustrative Scenario is discussed in the subsequent chapters of this report.

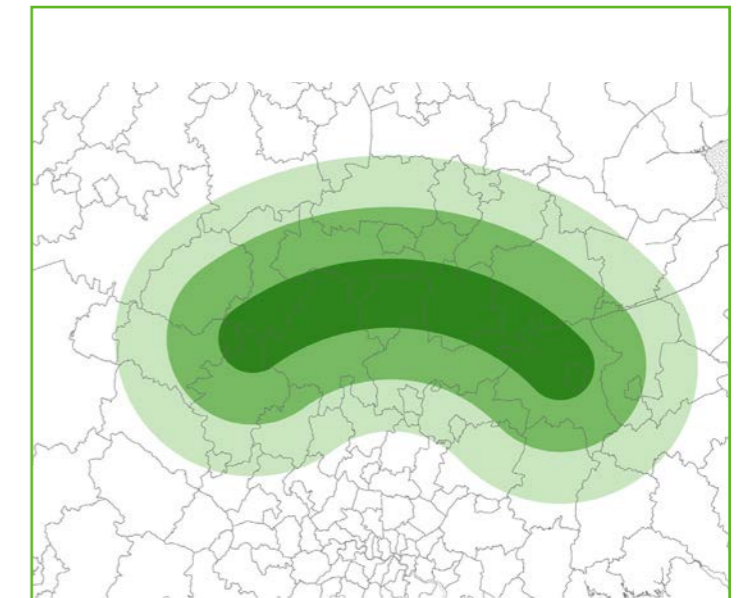


Governance Corridor Definition

Mapping of the existing Local Government bodies across the corridor.

The colours indicate county council and unitary authority areas. Districts within each county are outlined in black.

- Oxfordshire
- Buckinghamshire
- Luton
- Milton Keynes
- Northamptonshire
- Bedford
- Central Bedfordshire
- Peterborough
- Cambridgeshire



5th Studio Future Planning Study Corridor Definition

The analysis within this report is based on a definition of the corridor centred on a broad arc encompassing the anticipated alignments of East West Rail and the Oxford to Cambridge Expressway (dark green). The boundary of the corridor is less strictly defined than in the previous workstreams to allow consideration of the surrounding zone of influence in spatial terms, irrespective of abstract administrative boundaries, with, in broad terms, the degree of attention/focus diminishing in proportion to the distance away from the central arc.

The exception to this approach is the case of the *Illustrative Scenario* where the Interim Report Analysis definition is adopted to allow direct comparison with those figures.

UNDERSTANDING THE CORRIDOR: BASELINE MAPPING

Detailed GIS-derived base mapping has been produced for the corridor as per the thumbnail images shown below. These base mapping drawings underpin the analysis and investigations within the remainder of the report. Full size versions of these drawings are reproduced in **Appendix B**.

1. Topography



2. Flooding and Environmental Constraints



3. Leisure and Landscape



4. Historic Features



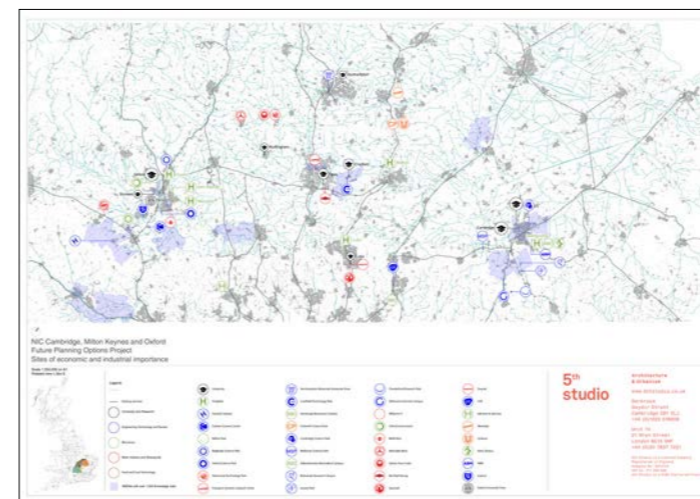
5. Rail Infrastructure



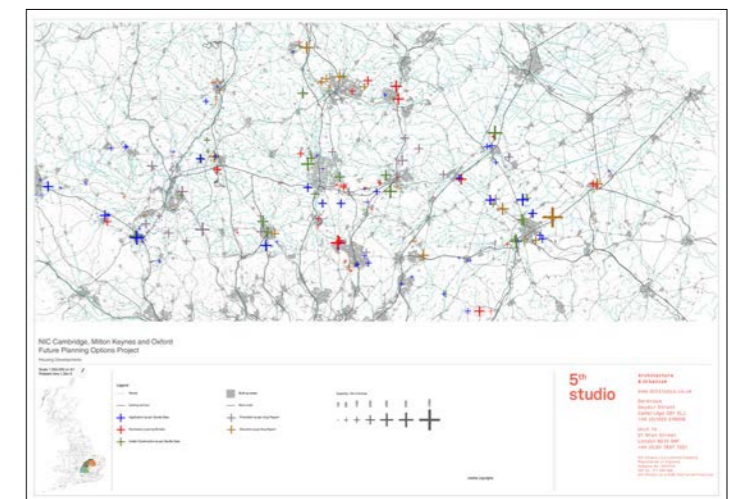
6. Road Infrastructure



7. Existing Knowledge-Based employment locations



8. Current / Proposed Housing Developments



Contains OS data © Crown copyright and database right (2016)

The drawings also selectively include data transposed from the following sources:
 Historic England | Environment Agency | Natural England | DCLG | Highways England | Department for Transport | National Infrastructure Commission
 and data provided by SQW

UNDERSTANDING THE CORRIDOR: EAST-WEST RAIL

East West Rail is a major project to establish a railway connecting East Anglia with central, southern and western England. The project is being promoted by the East West Rail Consortium – a group of local authorities and businesses formed in 1995 with an interest in improving access to and from East Anglia and the Milton Keynes South Midlands growth area.

The proposed route is broken down into three sections, as shown in the diagram below.

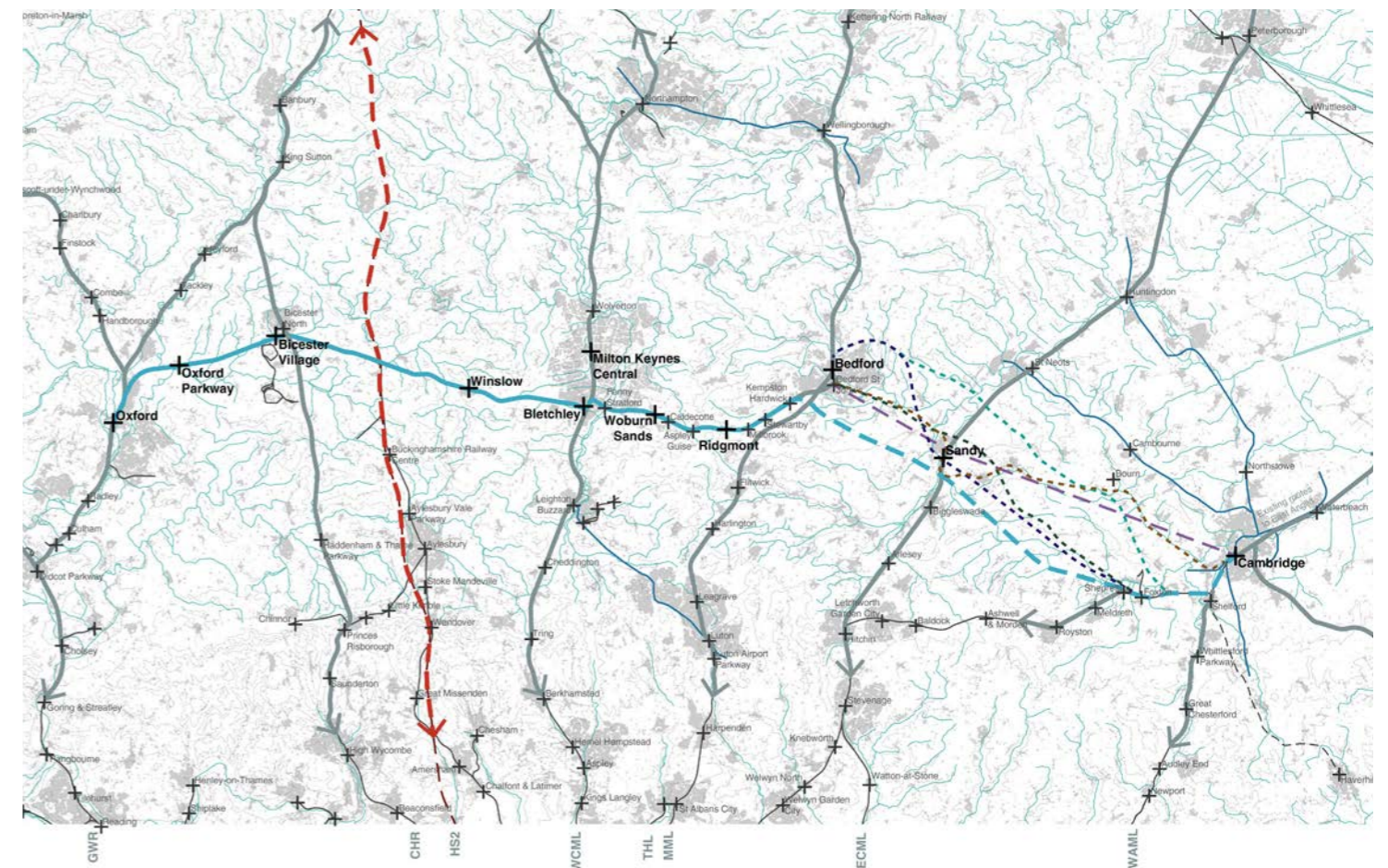
- The western section of East West Rail, which involves reopening the line between Bicester and Bletchley / Milton Keynes is due to be complete in the mid-2020s.
- The central section would involve a new railway line connecting the Marston Vale line from Bedford to Cambridge, intersecting with the East Coast mainline in the vicinity of Sandy. This section could potentially be open in the early 2030s, and is the subject of on-going engineering and feasibility work by the Department for Transport (DfT) / Network Rail.
- The eastern section consists of existing lines from Cambridge to Ipswich and Norwich. The DfT are currently examining the potential for improvements to these lines as a continuation of the route from Oxford to Cambridge.

Once complete, East West Rail would link the major population, service and employment centres, enabling them to act as a connected corridor rather than as a series of disparate towns. It would also open up connections between places that are already on the rail network but, due to the lack of connections between the parallel routes running out of London, impractical to travel between at present – and so provide benefits beyond the immediate rail corridor itself.

The drawing on the right is an extract from the base mapping **Rail Infrastructure** plan - a full size version of which is included in **Appendix B**. It shows existing and potential/proposed rail lines across the corridor, including various route options between Marston Vale and Cambridge, as transposed from the previous engineering feasibility study completed by Jacobs in 2016.

In delivering a new regional railway of this sort, it would be necessary to strike a balance between journey times (shorter journey times will be necessary for trips between major centres to be attractive), service frequency (more frequent trains are attractive to the commuting market), and the ability for the railway to enable new development. For instance, in order for longer distance journeys to be optimal in terms of travel time, it may be necessary to close or reduce service to some existing stations (e.g. on the Marston Vale line), and to limit the number of new stations across the network.

Rail Infrastructure base map of the corridor with existing and proposed railway lines



Key:

- East West Rail Western Section (existing/projected)
 - East West Rail Central Section as per Arup's Report
 - Former Bedford to Cambridge railway line - dismantled
 - High Speed 2 (HS2)
- Other existing railway lines:

East West Rail Central Section Options (Jacobs 2016):

- East West Rail Central Section Option C2-2 (BCR* 2.04)
- East West Rail Central Section Option C1-1 (BCR* 1.90)
- East West Rail Central Section Option C1-8 (BCR* 1.68)
- East West Rail Central Section Option C1-9 (BCR* 1.48)

* Benefit-Cost Ratio including Wider Economic Benefits

- GWR Great Western Railway
- CHR Chiltern Railways
- HS2 High Speed 2
- WCML West Coast Main Line
- THL Thameslink
- MML Midland Main Line
- ECML East Coast Main Line
- WAML West Anglia Main Line

The East West Rail Consortium's route map



UNDERSTANDING THE CORRIDOR: OXFORD TO CAMBRIDGE EXPRESSWAY

The concept of a strategic east-west expressway standard road across the Cambridge-Milton Keynes-Oxford corridor has been explored as part of the DfT's Strategic Studies programme.

The drawing below summarises analysis of the existing route contained within Highways England's Stage 3 Report, that identifies already planned / in-progress improvements (in the east), alongside current issues (congestion) in the west, along the route between Oxford and Cambridge. As well as these issues - which are predominantly driven by local commuter traffic - the route is also perceived as a "missing link" in the national highway network.

The Stage 3 Report identifies that the completion of a consistent expressway route could provide the following benefits:

- Improve connectivity between nationally strategic routes including the M4, M40, M1, A1, A14 and M11, reduce journey times between Oxford and Cambridge, deliver benefits for road users (including freight operators), and reduce environmental costs.
- Provide relief to congested routes elsewhere in the national network, including the M4 - M25 - M11 to the south, and the A14 - M6 - M42 - M5 route to the north of the expressway.

- Substantially reduce journey times between the cities and towns across the corridor.
- Reduce journey times, tackle congestion and improve reliability relative to the existing road connections, reducing vehicle operating costs, and improving productivity.
- Help accommodate the increasing demand for road travel by tackling capacity constraints that Local Authorities and developers have identified as a limit on local growth.

No definitive route/s have yet been identified, but the Stage 3 Report does indicate a series of potential broad route options – as summarised in the diagram below (extracted from the Stage 3 Report). This shows three broad route options between Milton Keynes and Oxford, essentially along the existing route (A421), alongside East West Rail, or via a new cross-country route, further south. A series of sub-options provide for completing the route around Oxford towards Didcot and the M4.

An appreciation of these alternative possibilities provides the background to the work within this study.

IMPROVEMENTS ALREADY BEING ADVANCED IN THE EAST

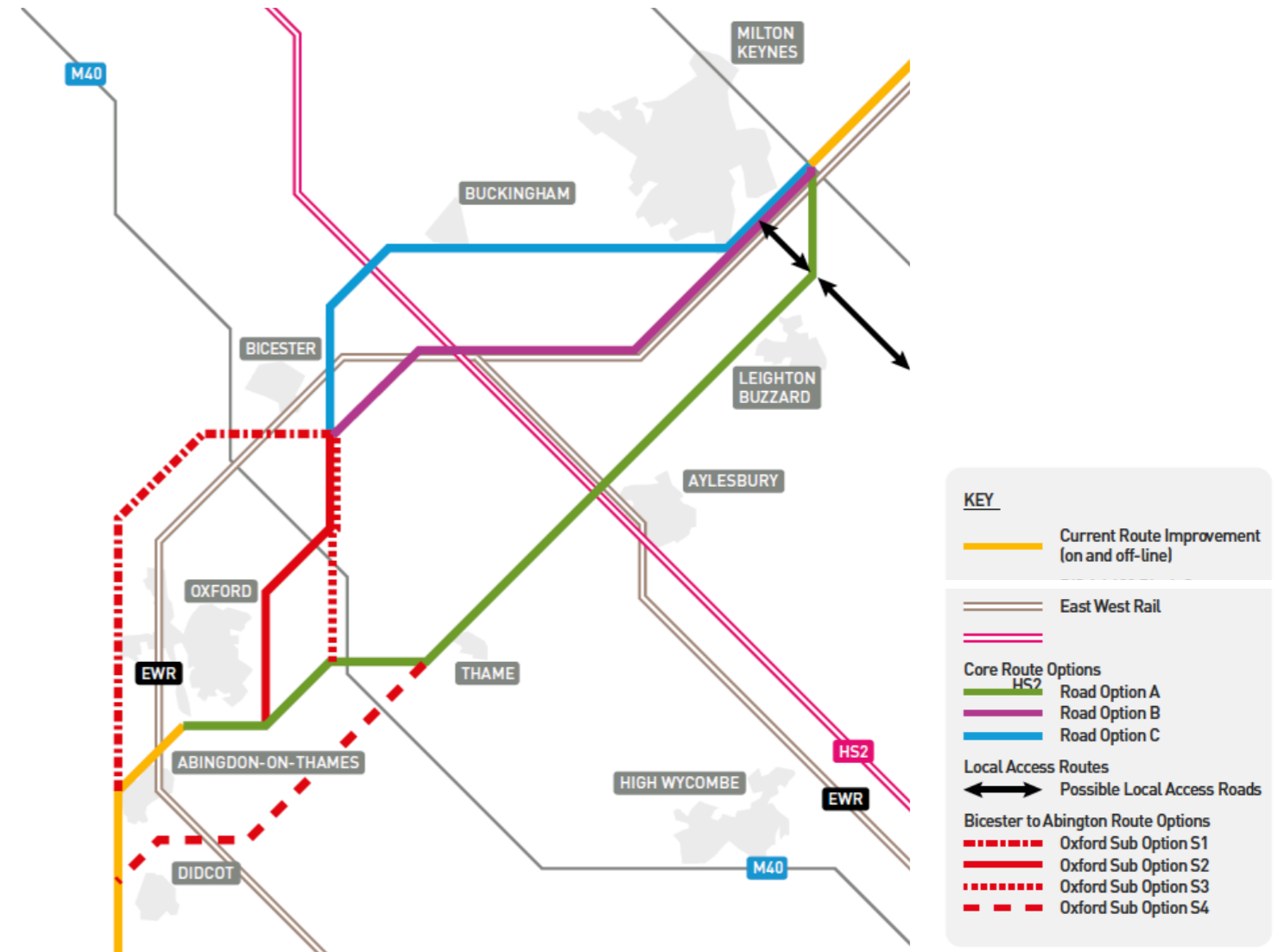
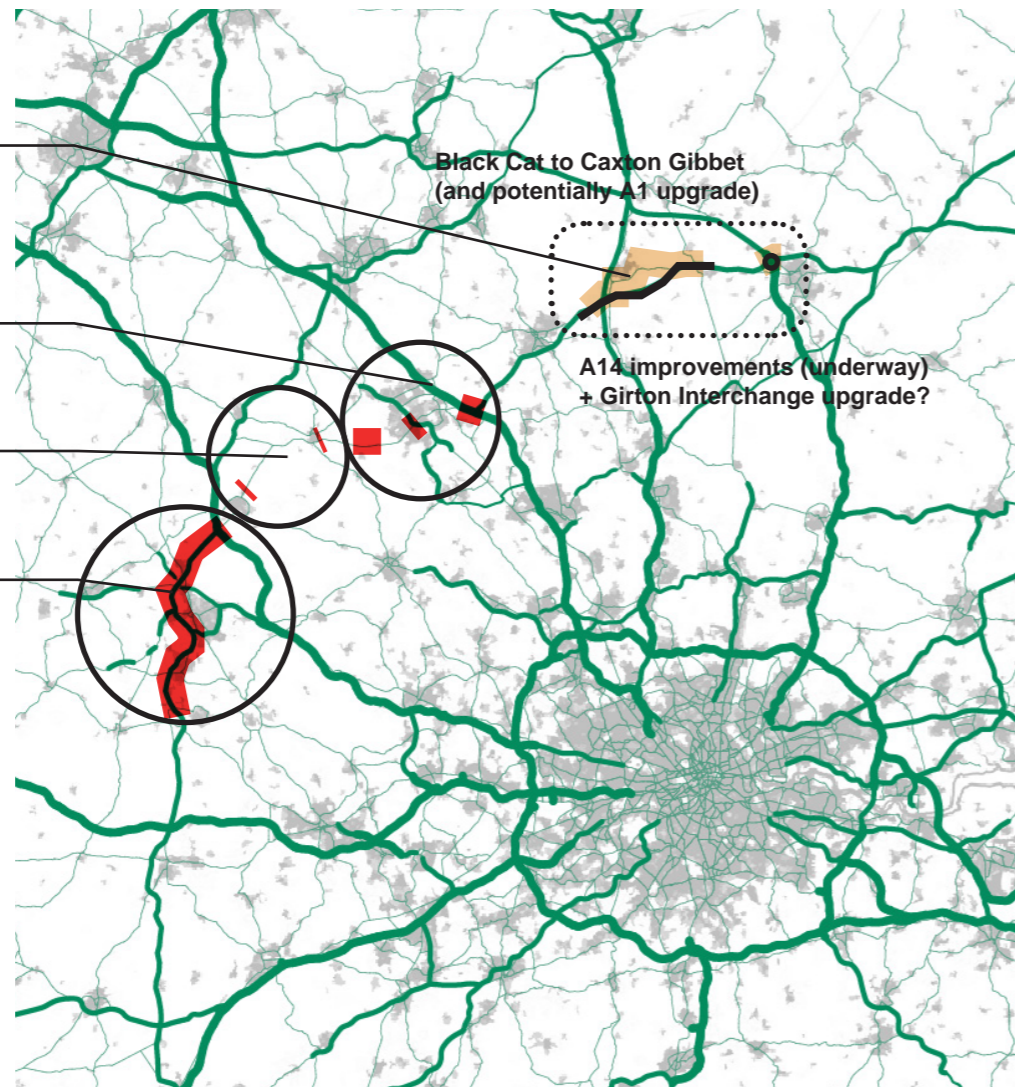
KEY EXISTING ISSUES TO BE ADDRESSED IN THE WEST*

Milton Keynes approaches:
Congestion in AM peak inbound
Congestion in PM peak outbound

Localised congestion at junctions in Bicester and Buckingham

Capacity and congestion in AM and PM peak associated with access to Oxford and in particular mixing of strategic and local traffic (similar to problems currently being addressed on A14 Cambridge to Ellington)

* red highlight shows the AM and PM congestion combined - as tranposed from Oxford to Cambridge Expressway Strategic Study: Stage 3 Report



UNDERSTANDING THE CORRIDOR: TOPOGRAPHIC CONTINUITY?

In contrast to the dominant cross-grain of infrastructure connections radiating out from London, analysis of the underlying geology and topography reveals a degree of continuity *along* the corridor, as a relatively low-lying predominantly clay landscape, bounded by more “precious” or “charismatic” landscapes on the surrounding higher ground.

The gently undulating landscape feeds the main rivers, which in the east of the area drain out to the fens in the north-east, and then in the west, since the Thames broke

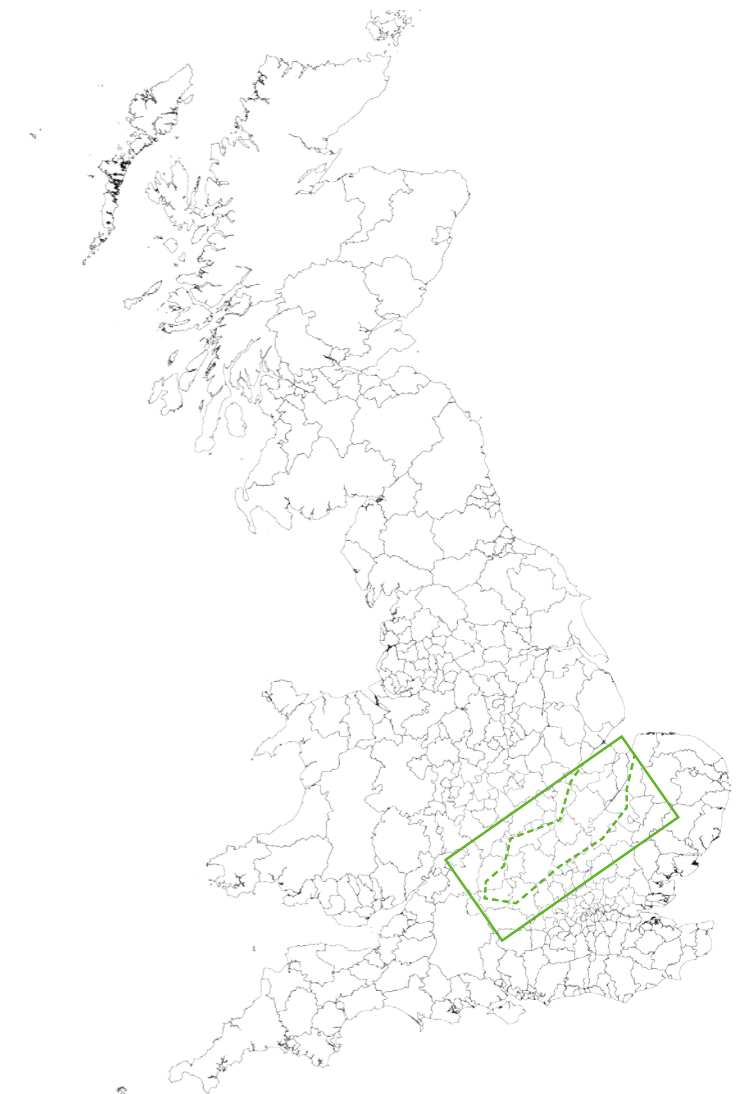
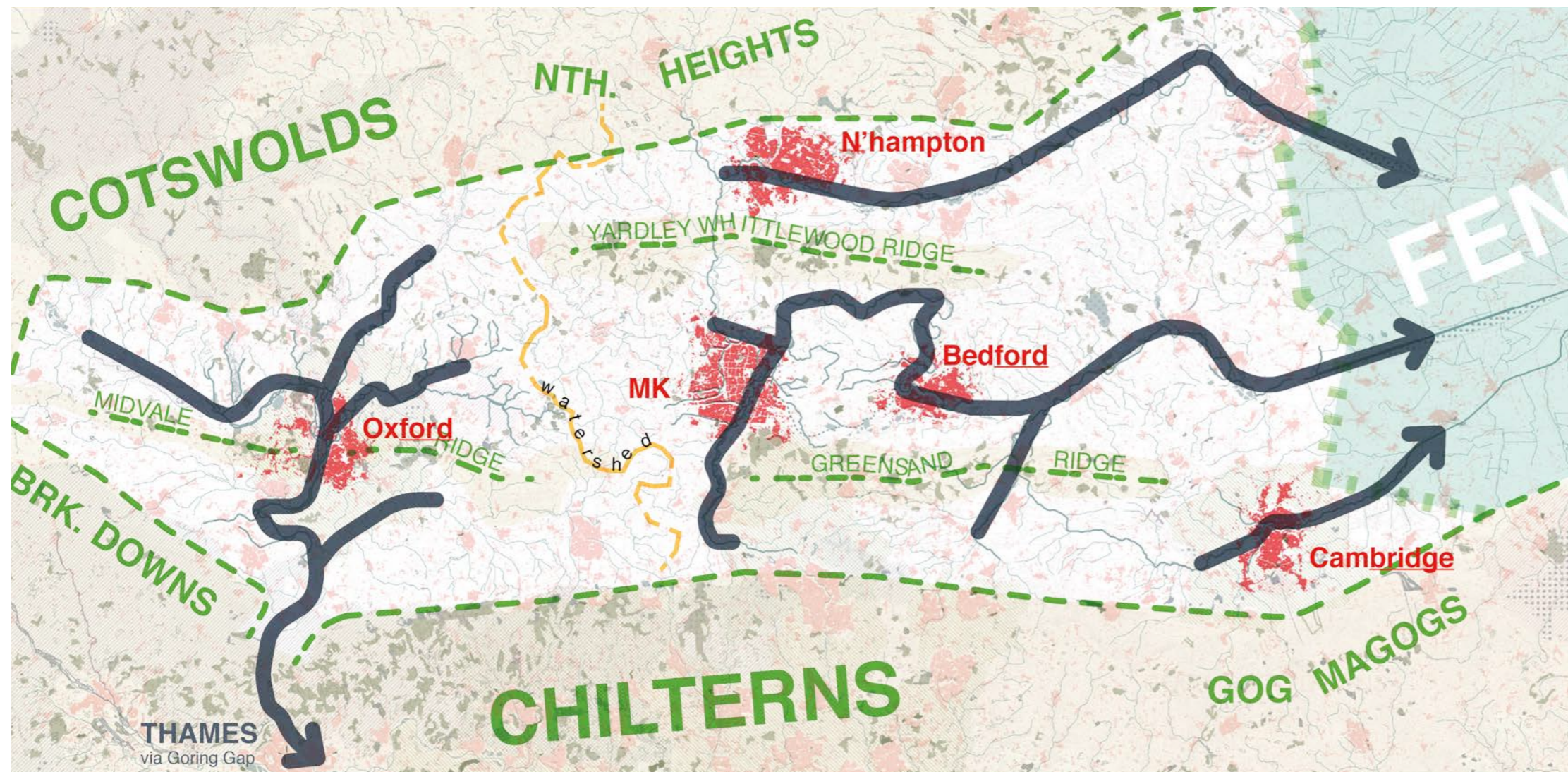
through the Chilterns at the Goring Gap during the last ice age, via the Thames Valley.

The principal settlements in the area are located on these main rivers, and the course of these rivers and their associated flood plains are often the defining characteristic of the urban morphology of these centres (with, perhaps, the exception of Milton Keynes).

A series of ridges punctuate the broad clay vale. Generally, the rivers run parallel with this grain of ridges, which

themselves follow the general geological banding running south-west to north-east. However, particular moments of topographic drama occur where these features intersect, such as at Oxford (the valley of the Thames between Boars Hill and Shotover Hill), Brickhill above the river Ouzel, and Sandy Heath against the river Ivel.

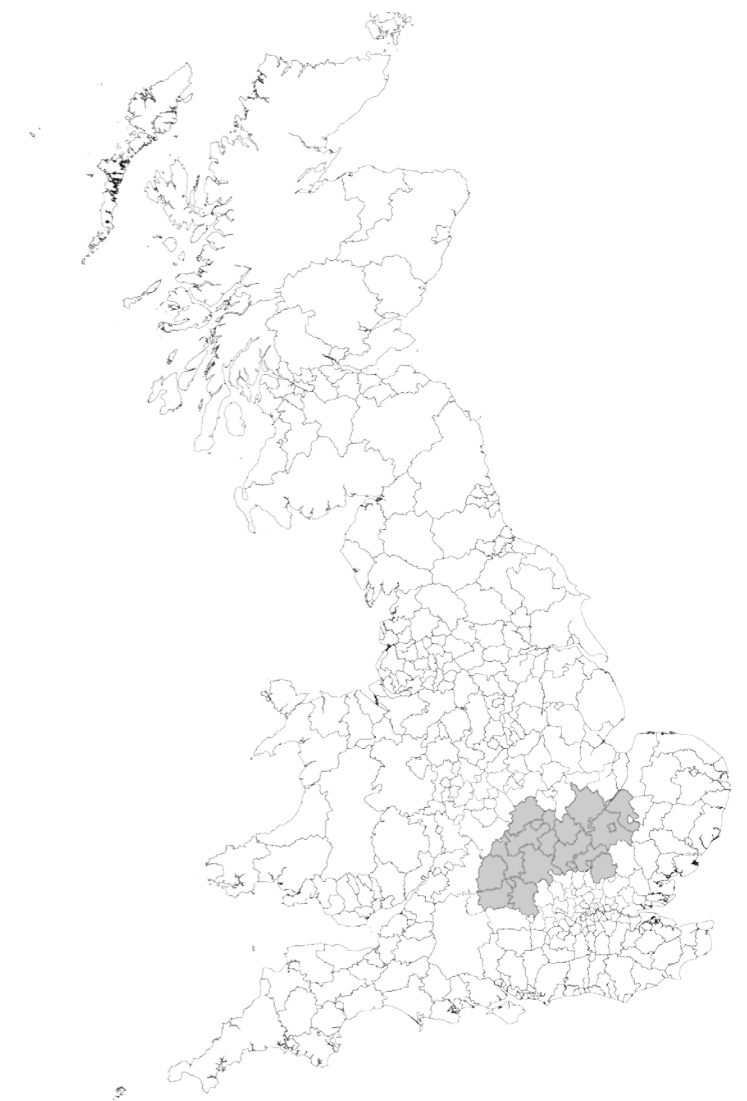
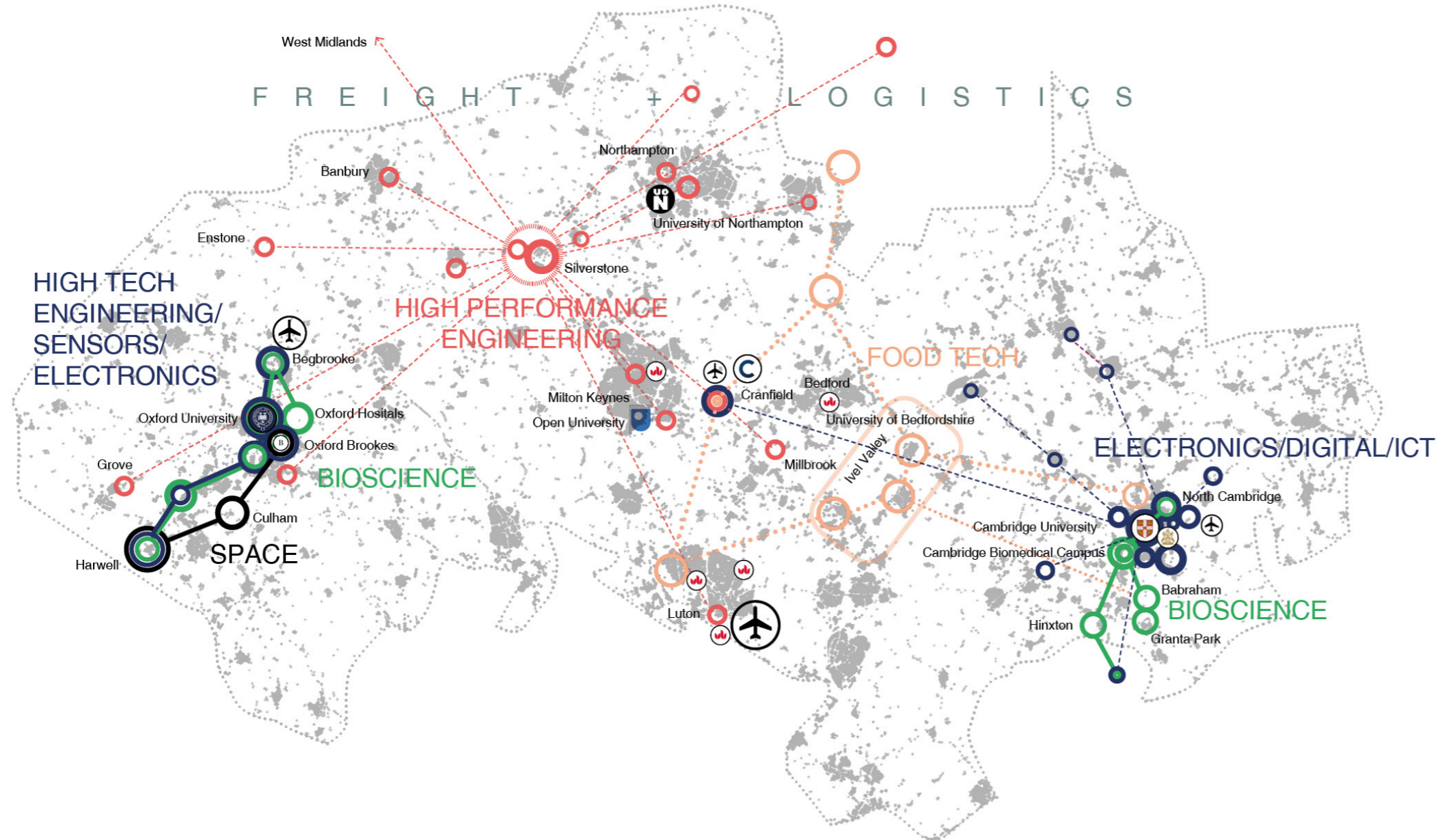
Despite the current difficulty in experiencing the corridor as a singularity, physical continuity does exist and has an effect on the character of the settlements through their relationship with water and their traditional materiality.



UNDERSTANDING THE CORRIDOR: KEY DRIVERS OF ECONOMIC GROWTH

The existing pattern of clustering of key knowledge intensive and growth sectors is schematically summarised in the drawing below. While different parts of the study area have their own distinctive qualities and strengths, this drawing demonstrates the relative lack of interaction across the corridor, with linkages from each sub-area to London being more significant than connection between sub-areas. This is unsurprising given the lack of a functional corridor in terms of movement and spatial relationships.

A key question this poses is: What would be the clustering effect within a more functional corridor geography? The distinctive qualities and strengths of each part of the corridor are outlined on the following page, extracted from the SQW/Cambridge Econometrics study.



UNDERSTANDING THE CORRIDOR: KEY DRIVERS OF ECONOMIC GROWTH

GREATER OXFORD-SWINDON AREA

The Head Offices and Management Consultancy sector is most notable in terms of job creation between 1990 and 2014, with over 10,000 jobs created in that time, representing an almost four-fold increase in just under 25 years. This was split roughly 40% Head Offices and 60% Management Consultancies. In the Oxford area, only 40% of Other Professional Services comprised scientific R&D, in contrast to the 80% figure found in Cambridge. Other prominent sub-sectors in South Oxfordshire being Advertising and PR agencies.

The number of people employed in the knowledge intensive business services (KIBS) sectors rose steadily from 62,000 people to more than 108,000. In contrast, the number employed within the High Tech Manufacturing (HTM) sectors declined marginally by around 15% during the period, from 24,000 people to around 20,000. By far the largest HTM sector across the sub-area was the Motor Vehicles sector, having almost as many employees alone as most of the other sectors together, reflecting the two large plants in Swindon (Honda) and Oxford (BMW Mini). The second and third largest sectors were Electronics, mainly based in the districts to the south of Oxford, and Machinery, centred around Swindon.

As with Cambridge, the real impact of the HTM sectors is seen in the productivity figures, where productivity growth in HTM manufacturing tripled over the time-period to hit a figure of approximately £120,000 per worker, similar to the rate seen in Cambridge, whereas the KIBS productivity rates grew slowly and steadily to reach £60,000 per worker by 2014.

The Pharmaceuticals sector has also grown significantly in Swindon, with employment growth rates of over 5% pa. Along with Motor Vehicles, this was the standout sector in terms of productivity, with rates of over £180,000 per worker in 2014.

THE GREATER NORTHAMPTON AREA

Growth in employment over the whole period averaged 1.5% pa, generally in line with population growth. Business Support Services was the largest growth sector, with over half of its total 27,000 jobs having been generated in the past 24 years, indicating Northampton's growing function as a provider of back-end support services for other sectors within the region. As with Oxford and Milton Keynes, the Head Offices and Management Consultancies sector has also seen strong growth in Northampton.

The number of KIBS jobs has risen from 25,000 to just over 40,000, whilst the number of HTM jobs has fallen from 15,000 to 9,000. In an area that has experienced overall employment growth of 100,000 additional jobs between 1990 and 2014, less than 10% of those additional jobs have been created in knowledge intensive sectors.

Whilst employment in KIBS has increased, its productivity has remained largely flat, growing 10% overall since 1990 to just over £40,000 per worker as of 2014. In line with wider national trends, HTM productivity has grown more significantly, albeit from a low base of under £30,000 per worker, to a figure of £90,000 in 2014.

IT Services have seen productivity grow the fastest, averaging 4.9% pa over 1981-2014. This strong growth is likely to have been driven by increased Computer Consultancy activities in Northampton, and South Northamptonshire and Software Development in Northampton, where most of the employment is located.

The regional success story in terms of productivity has been the Motor Vehicles industry, which has seen growth in both employment and productivity, and currently stands at around £160,000 per worker. There are two main drivers of this success. Historically, Northamptonshire had a strong engineering tradition, which has been revived by the recent success of both the UK motor vehicle industry and motorsport. In relation to motor vehicles, JLR, which is close by in Coventry, has expanded greatly in recent years and consequently increased demand for specialist supplies and services. In relation to motorsport, Silverstone is the focal point of the UK motorsport industry, and Northamptonshire is home to several of the top F1 teams (e.g. Mercedes, Force India) and many specialist suppliers (e.g. Mahle Powertrain, Cosworth and GE Precision Engineering, all based in the same part of Northampton).

MILTON KEYNES / LUTON / BEDFORDSHIRE /AYLESBURY VALE

Business Support Services, Education and Health have seen the most net additional jobs, but three knowledge intensive sectors: Head Offices and Management Consultancies, IT Services and Other Professional Services, have all seen significant job growth over this period.

Against a total employment growth figure of almost 200,000 additional net jobs by 2014, the growth in KIBS of approximately 40,000 additional jobs, some 20% of the total employment in the region, is unremarkable. Furthermore, over this same time-period, employment in HTM has fallen by almost 20,000 jobs, meaning that only 1 in 10 additional jobs generated over this time-frame was in a knowledge intensive industry.

The growth in KIBS in Milton Keynes has been largely in the IT sector, particularly Computer Consulting and Software Development; Finance and Insurance, particularly Banking; and in Head Offices and Management Consultancies sectors, with almost two thirds of this in Head Offices.

HTM employment across the entire sub-area is based largely around Electronics and Machinery, although Luton also has high levels of employment in Air and Spacecraft and Motor Vehicles, and a smaller Other Transport Equipment employment base in Central Bedfordshire, partly due to the Lockheed Martin site at Ampthill, and in Aylesbury Vale, where Moog Westcott are based.

The Motorsport Cluster also spreads into North Buckinghamshire and West Beds (notably around Cranfield and Millbrook).

GREATER CAMBRIDGE – NORTHERN HERTFORDSHIRE

Between 1990 and 2014, employment increased by 100,000 jobs (approximately 25%) in the sub-area in total, one third of which were in knowledge intensive industries.

In 2014 there were still approximately the same number of workers employed in HTM as there had been 24 years previously. In employment terms, it is a much smaller sector than KIBS, but it performs more strongly on measures of productivity.

The largest sub-sectors in terms of employment were Other Professional Services and Information Technology, both of which have grown strongly over the past two decades as 17,000 jobs have been created in these two sub-sectors alone. Both are particularly strong in the Cambridge and South Cambridgeshire area. In 2014, 50% of employment in IT was in Computer Consulting, with a further 25% in Software Development, whilst 80% of the employment in the Other Professional Services sector was in Scientific Research and Development.

The largest HTM sectors by employment are Pharmaceuticals, Electronics, Machinery and Other Transport Equipment.

The most productive sub-sector is Pharmaceuticals, with a GVA level of £250,000 per worker.

UNDERSTANDING THE CORRIDOR: HISTORIC GROWTH PATTERNS

The graph and notes to the right outline the historic population change across the constituent parts of the Greater South East of England (London, South East England and East Anglia).

The drawing sequence below shows the total urbanised area at 30-40 year intervals across the 20th century in the area between London and Birmingham.

From the graph it is apparent that the population of the Greater South East has increased at a fairly consistent rate across this period, yet the amount of land taken up with settlements increases disproportionately in the second half of the century.

This large jump - most apparent between the 1939 and 1982 plans - includes significant suburban development on the edge of most towns and villages, as well as a large number of entirely new settlements.

The increase in the amount of urbanised land is a mark of the reduction in development densities and occupancy ratios that occurred during this period (as well reflecting, to a lesser degree and by accident of the available data, that this is the longest interval).

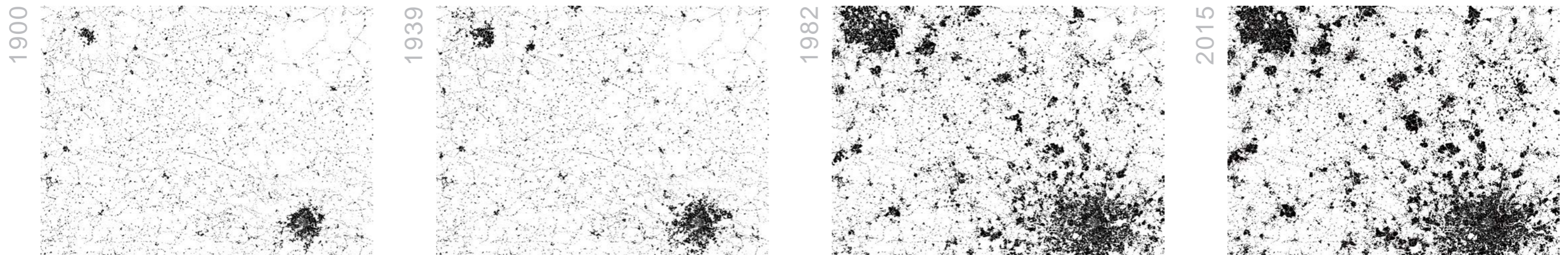
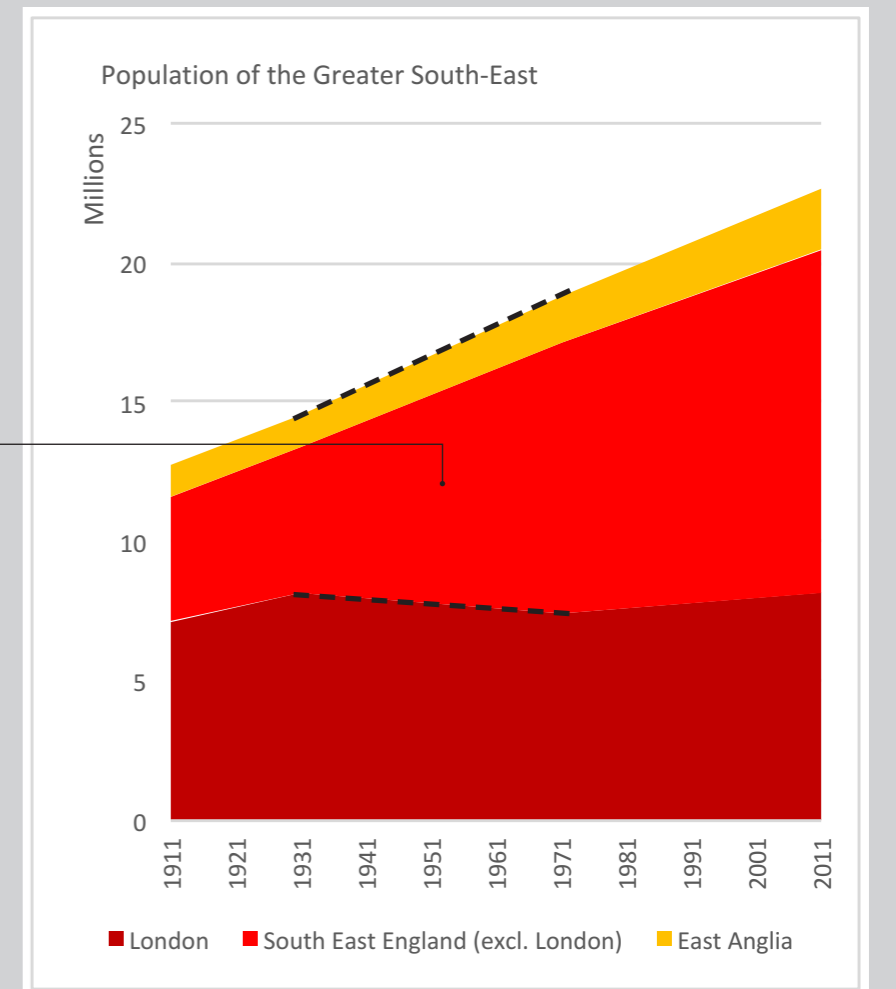
Together this background highlights that the proportional change the population increase envisaged in the brief for this study is plausible, in that it represents a continuation of what has already occurred. It also shows how this nonetheless presents a massive challenge in terms of:

- delivering ever increasing numbers of homes in absolute terms
- arresting or tempering the loss of countryside that has resulted from relatively low density development that has been the prevailing model for growth for much of the twentieth century.

The challenge of how to develop at scale while also creating sustainable, successful, high-quality places is further developed over the following pages.

Notes on Population Change 1911 to 2011

- The average year-on-year population growth was **0.95%** across the South East England and East Anglia between 1911 and 2011.
- By 2011 the population of the South East England and East Anglia (excluding London) was two and a half times what it had been in 1911, rising from 5.6 million people to 14.5 million.
- The peak period of population growth was in the post-war period, between 1931 and 1971, where growth in the South East, outside of London, averaged **1.42%** year-on-year. During this 40 year period alone, an extra 4.9 million people were accommodated, with the total rising from about 6.5 million to 11.4 million, a 75% increase.
- By comparison, to achieve the population increases outlined earlier in this chapter across the Oxford to Cambridge corridor, a year-on-year rate of population growth between **0.95%** and **1.17%** would be necessary to accommodate, respectively, an extra 1.45 to 1.90 million people by 2050.
- This range of year-on-year percentage increase matches, or is only marginally more than, the long-range average, and is also below the fastest rate of growth achieved over the last century.
- However, with the increasing total the absolute increase each year is now far greater than before.



KEY ISSUES AND CHALLENGES: ACCESSIBILITY

The ability of residents to access jobs and services is fundamentally important to the success of new development. There is considerable academic and policy work that emphasises both the importance of integrated transport and land-use planning, and the promotion of sustainable transport modes in preference to the private car (in support of a wide range of desired outcomes including improved health, environmental protection, equality, reduced congestion, better “place” quality etc.).

This approach is supported by government policy and Paragraph 29 of the National Planning Policy Framework (NPPF) states that:

[...] The transport system needs to be balanced in favour of sustainable transport modes, giving people a real choice about how they travel

In practice this balance is not being achieved by current developments in the corridor. A legacy of suburban development forms militates against active and public modes of transport. Indeed, the majority of recent development observed is of a form that is demonstrably more car-dependant than older suburban developments (Barton et al, as cited in *Good Cities, Better Lives*, Peter Hall, (2014)), including many of the current crop of “Sustainable Urban Extensions” at Northampton and Bicester for instance.

Simultaneously, many traditional town centre uses have been spun out to the urban periphery in locations that are relatively difficult to reach on foot, by cycle, or by public transport. Evidence from the corridor underlines that residents of many recent housing developments have very little choice other than to use their cars.

The quality and activity of many urban centres are impacted by the dominance of car movement and parking, with serious issues of congestion, noise and air pollution, the wasteful use of space, and the dilution of any sense of urban “buzz”. Two apparent examples are Bedford and Aylesbury.

The challenge – to be developed further through the case studies – is to favour development typologies that either :

- possess certain qualities of themselves, such as a high degree of use-mixing, sufficient scale/density to support higher order services, and coherence, quality and permeability at street level, to support active and sustainable modes ahead of the private car, for most journeys;
- or
- are located and connected to opportunities elsewhere through the provision from the outset (given the importance of habit forming in transport choices) of high quality public transport services;
- or
- a combination of both.



Extensive areas of surface level car parking in central Bedford

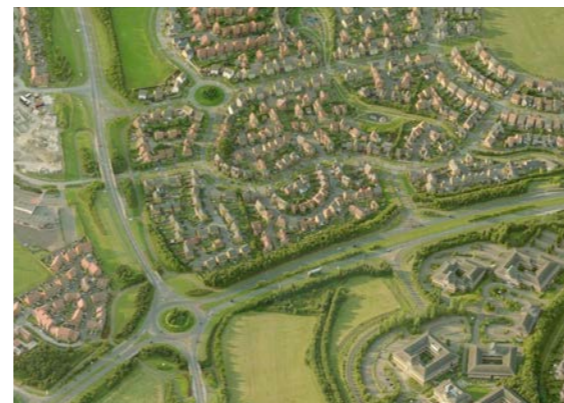
Oxford



Bicester



Milton Keynes



Bedford



Cambridge



Generic and unsustainable peripheral estate development appears right across the corridor with little or no relation to its specific context.

KEY ISSUES AND CHALLENGES: QUALITY + DISTINCTIVENESS

Within the Oxford-Milton Keynes-Cambridge corridor there are many historic examples of good, sustainable urban form, and high-quality design and building from a range of different eras – from the medieval grain of streets, lanes and quadrangles of the historic cores of Oxford and Cambridge, to the remarkable “techno-paganism” and singular vision of Milton Keynes as a “forest city”. There is a rich variety of architectural and material traditions, often reflecting the particularity of the landscape in which they are situated.

However, much recent development does not achieve similarly high standards:

- Very often existing good places have been undermined by insensitive development, or the intrusion and over-dominance of cars [1];
- Efforts to encourage social inclusion and active travel are undermined by poor quality street environments [2];
- Similarly, efforts to encourage use of public transport are hampered by the delivery of poor quality environments in and around transport interchanges [3];
- Many business and innovation locations that aspire to provide world-class facilities and operate on the global stage are compromised by their environment - and as such will increasingly struggle to attract the best talent [4];
- The majority of volume house builder development is generic (see the images on the previous page and [2] opposite) and low quality. Some of the fringe developments around Cambridge are unusually good for a British context, but these are very much the exception.

1 A historic aerial overview of the Market Place in Thame (left), showing a strong urban setting even in the context of a relatively small settlement, compared to same location today – undermined by its domination by car parking (right)



2 A poor quality, highways driven, generic street setting characteristic of much new peripheral development (left), compared to an example, from Northampton of the sorts of characterful, mixed use urban settings to be found in many town centres across the corridor (right)



3 The promise of arriving in Didcot from the station (right), compared to the reality (left).



4 The underwhelming entrance to the internationally significant Diamond Light Source synchrotron at Harwell (left), compared to the celebratory entrance gateway at the former Ironworks in Bedford (right).



Good quality design and sustainability are intended to be fundamental pre-requisites for development, as enshrined in the National Planning Policy Framework but, as shown, this is often not being achieved in current development.

It is, of course, obvious that we should aspire to make good places that people enjoy and feel good in, that use resources efficiently, that are robust, and that stand the test of time. Should further encouragement be necessary, a Commission for Architecture and the Built Environment (CABE) Publication called “The Value of Good Design” includes a reference to an exploratory study carried out by Savills in 2002. That study indicated that volume house builders who had invested in higher quality design in residential schemes could expect to yield a residual value per hectare of up to 15% more than conventionally designed schemes.

What constitutes good design is complex, and depends on the combination of a great many factors, especially in the context of larger-scale developments. The over-arching urban form, the location of the development, and the provision of social and transport infrastructure are the key aspects that this study focusses on.

Across the rich and varied landscapes of the corridor, a range of different responses will be required to positively respond to the particular needs of each locale in terms of both the urban/typological form but also of the architectural and material responses that particular designers might wish to explore.

The typologies explored through the case studies do not look to dictate a particular “look” or “feel” in architectural terms – and a number of architectural and material responses may be appropriate within the urban frameworks that the typologies propose. Nonetheless, certain architectural approaches may be incompatible with the urban forms engendered by particular typologies.

The typologies explored later in this document are developed from an empirical understanding of what works well elsewhere through the examination of a number of best practice examples, and a review of academic sources. They also seek to acknowledge their specific context, hence the importance of selecting real sites as case study locations.

KEY ISSUES AND CHALLENGES: SCALE

For the purpose of this study, overarching targets to 2050, based on the previous Savills/Arup/Econometrics analysis and their "Transformational Scenario", were agreed as follows:

TRANSFORMATIONAL + DEVELOPMENT ACCOMMODATED DUE TO PRESSURES FROM LAND CONSTRAINED MARKETS



The drawing alongside illustrates this quantum of development, broken down into each of the four sub-areas used within the previous reports.

The areas are shown scaled at an overall development density of 3,500 people/km², including development in the pipeline.

While such a rate of growth is not unusual in the context of the last 100 years, it is a significant challenge in absolute terms, not least given the scale of urbanisation that has already occurred in this region of the country.

Development at a density typical of much twentieth century growth (3,500 p/km² serves as a proxy for this), and as indicated by the scaled areas shown here, would mean a significant reduction in areas of open countryside.

More efficient use of land through increasing development above this relatively low level, and the careful and co-ordinated location of new development, are therefore key challenges if this scale of growth is to be acceptable, while preserving the overall character and quality of the area.

TRANSFORMATIONAL SCENARIO TO 2050

New areas of settlement at a scale of **3,500 people / km²** with approximate totals.

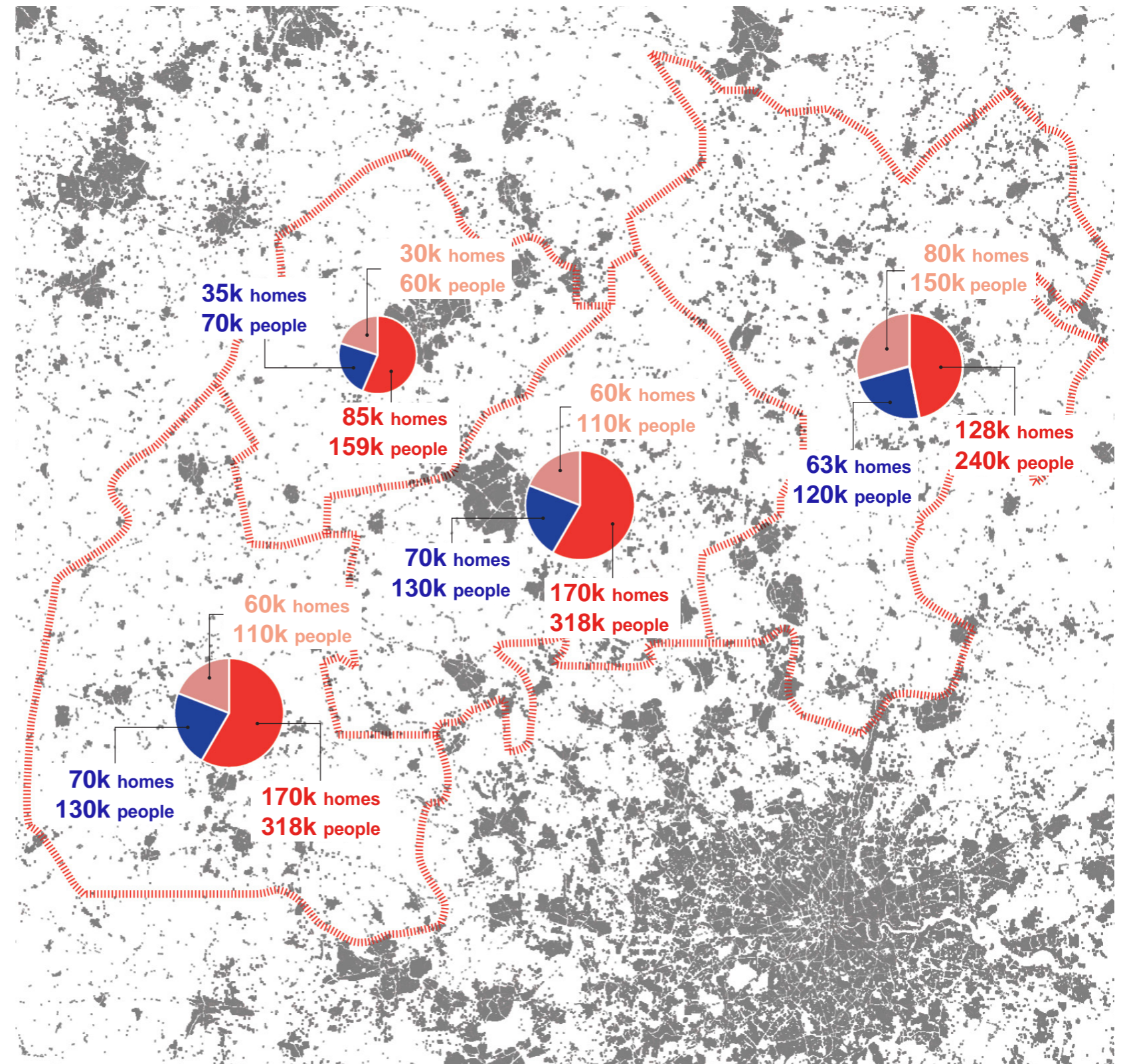
This drawing shows the additional urban area required for the transformational scenario at a settlement-wide density of 3,500 people/km², distributed according to Savills/Arup/Cambridge Econometrics analysis.

The density is typical of much twentieth century growth and was selected based on a rounded average of the built-up density found across the corridor.

- Current known planned development *
- Additional development required to meet the Transformational Scenario's Housing and Population Targets by 2050
- Development accommodated due to pressures from land constrained markets**

* Under construction, approved, in for planning, or allocated.

**The distribution is indicative and follows a proportional trend according to the distribution of the "Additional development required to meet Transformational Scenario's Housing and Population Targets by 2050".



KEY ISSUES AND CHALLENGES: LAND-USE CONSTRAINTS

CONSTRAINTS

The question of where, and in what form, development should occur is further framed by the various landscape, environmental and ecological constraints that are present and have shaped settlements in the corridor.

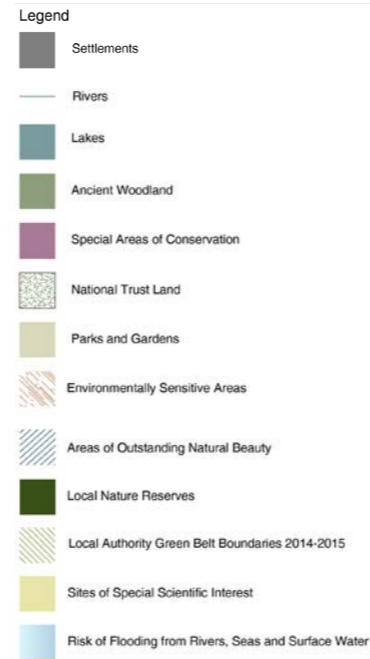
While any potential development location needs careful appraisal and justification at the local level, a broad sense of the key areas of constraint and opportunity at the corridor-wide scale has been generated using the GIS derived mapping layers, collated as part of this study.

The drawings alongside summarise this analysis. The top drawing shows the various designations that have been mapped (with further detail available via the detailed mapping drawings in [Appendix C](#)), while the bottom drawing masks out (in black) all locations where significant development is impossible or difficult to achieve based on these designations.

The effect of this - in particular exclusion of the extensive areas of Areas of Outstanding Natural Beauty (AONB), green belt and areas at Risk of Flooding - is to significantly reduce the areas where development would, aside from any other Local Plan/ planning policy designations, or specific environmental/ecological constraints, be theoretically possible.

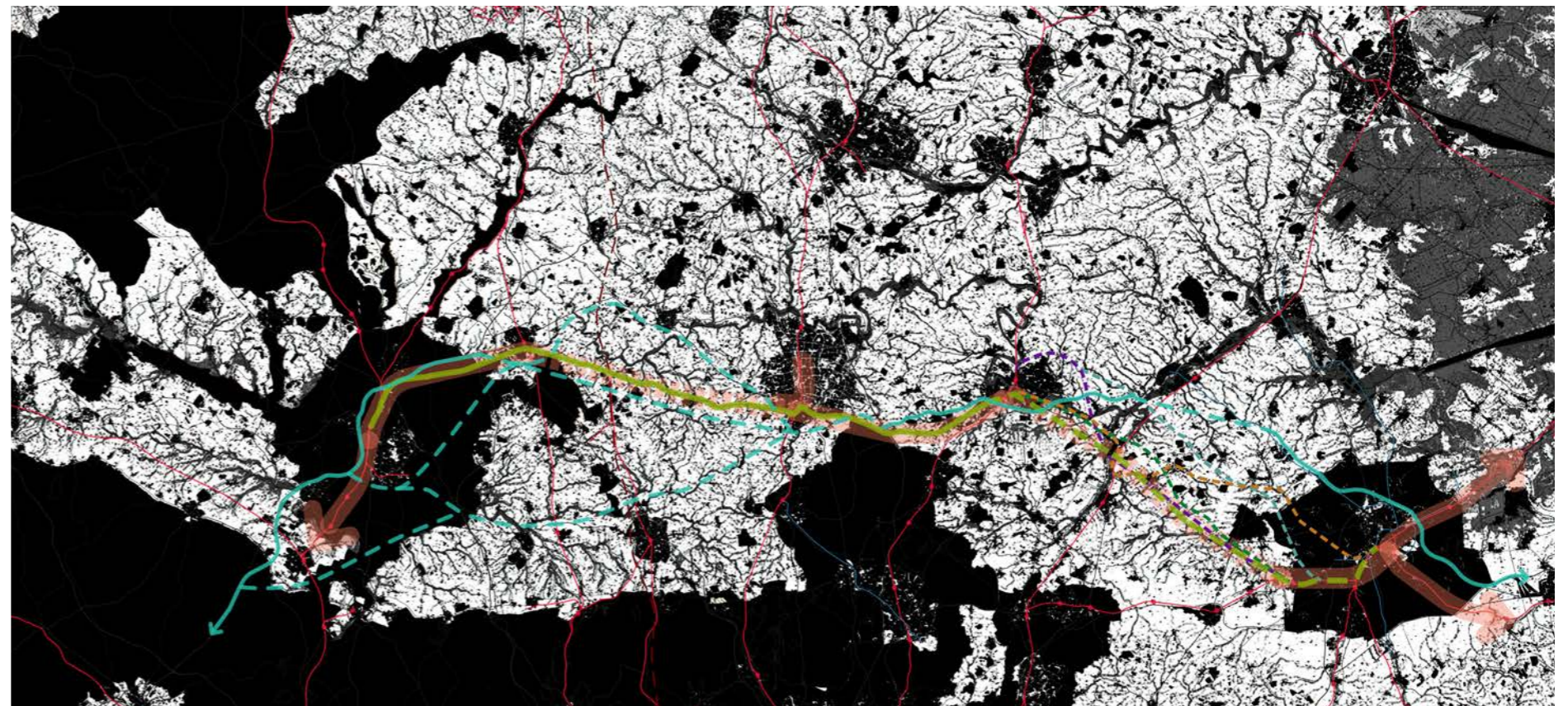
This illustrates the finite nature of development land in the corridor, and reinforces the argument for optimising the productive use of this scarce resource.

Composite land-use / statutory designation / infrastructure mapping - detailed version of these plans are available in [Appendix C](#).



High-level constraints mapping with areas of constraint (AONB, areas of high flood risk, green belt etc.) masked out in black.

The potential route options of East West Rail and the Oxford to Cambridge Expressway are also shown.



“WHAT-IF” SCENARIOS

INTRODUCTION

A series of seven high-level spatial scenarios have been examined and are summarised on the following pages. Each achieves a total population increase of 1.9 million.

Each scenario is modelled assuming a theoretical concentric urban form at a settlement-wide density of 3,500 people / km². The reasons for adopting this benchmark figure, and the effect of adopting different density figures, is explained in the box below.

Legend

- Locally generated growth (equivalent to c. 23k homes per year)
- Development accommodated due to pressures from land constrained markets growth (equivalent to c. 7k homes per year)

SCENARIO 1

1 X BIG CITY OF 1.9 MILLION PEOPLE

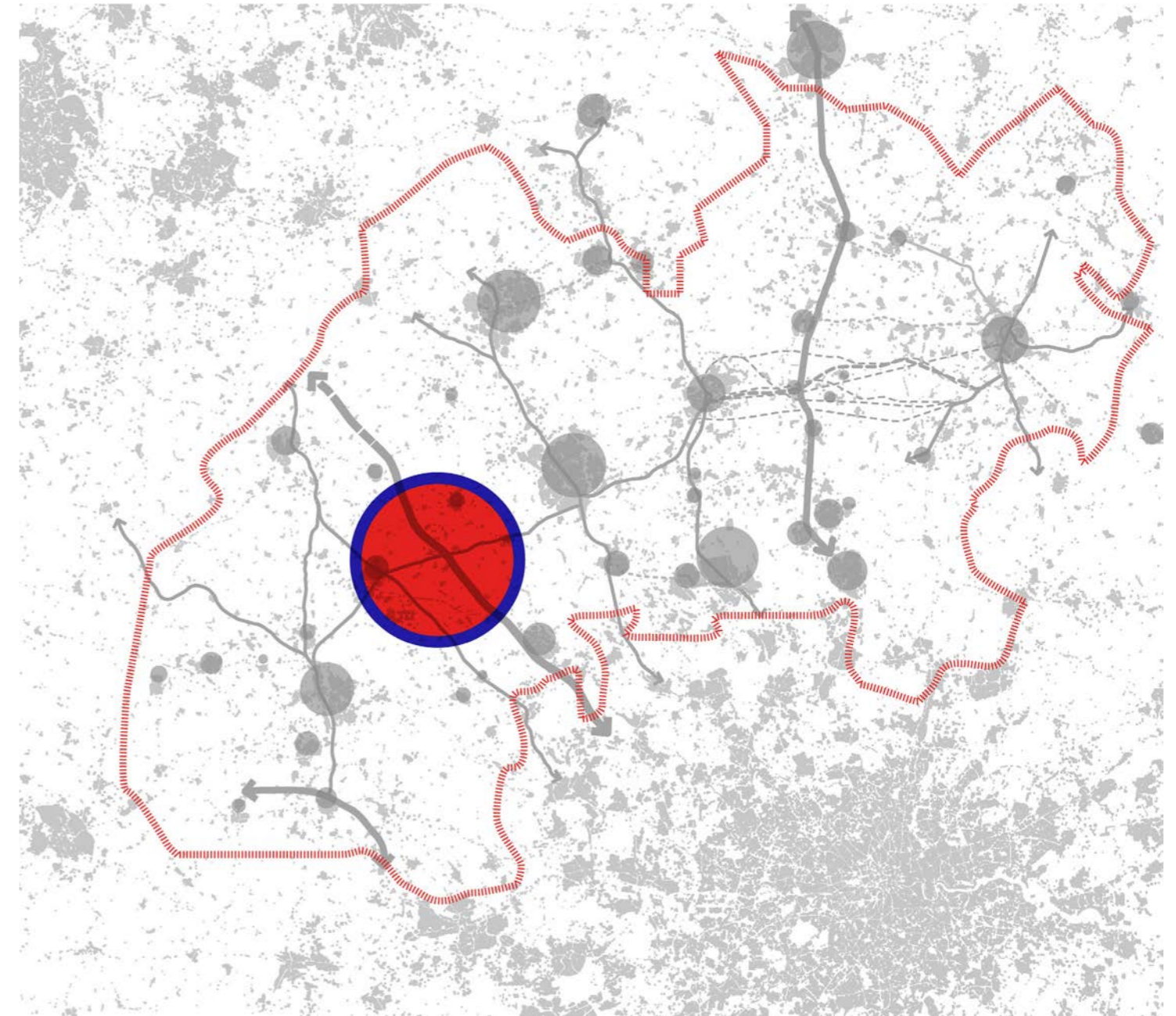
(which is larger than the population of the built-up area of the Leeds-Bradford conurbation)

Settlement radius of c. 13.1 km at 3,500 people/km²

DENSITY

The development area is shown overlaid on the map in each scenario at a assumed development density of 3,500 people/sq km, a figure that is typical of many of the mixed-age, mixed-use cities and towns across the corridor. The dots below show the affect of doubling and quadrupling the assumed settlement density - an approach which could be applied to any of the following scenarios.

	<p>3,500 people / km² [Norwich]</p> <p>A circle of radius 13.1 km would accommodate a population of 1.9 million people</p>	
	<p>7,000 people / km² [Waltham Forest]</p> <p>A circle of radius 9.3 km would accommodate a population of 1.9 million people</p>	
	<p>14,000 people / km² [Hackney]</p> <p>A circle of radius 6.6 km would accommodate a population of 1.9 million people</p>	



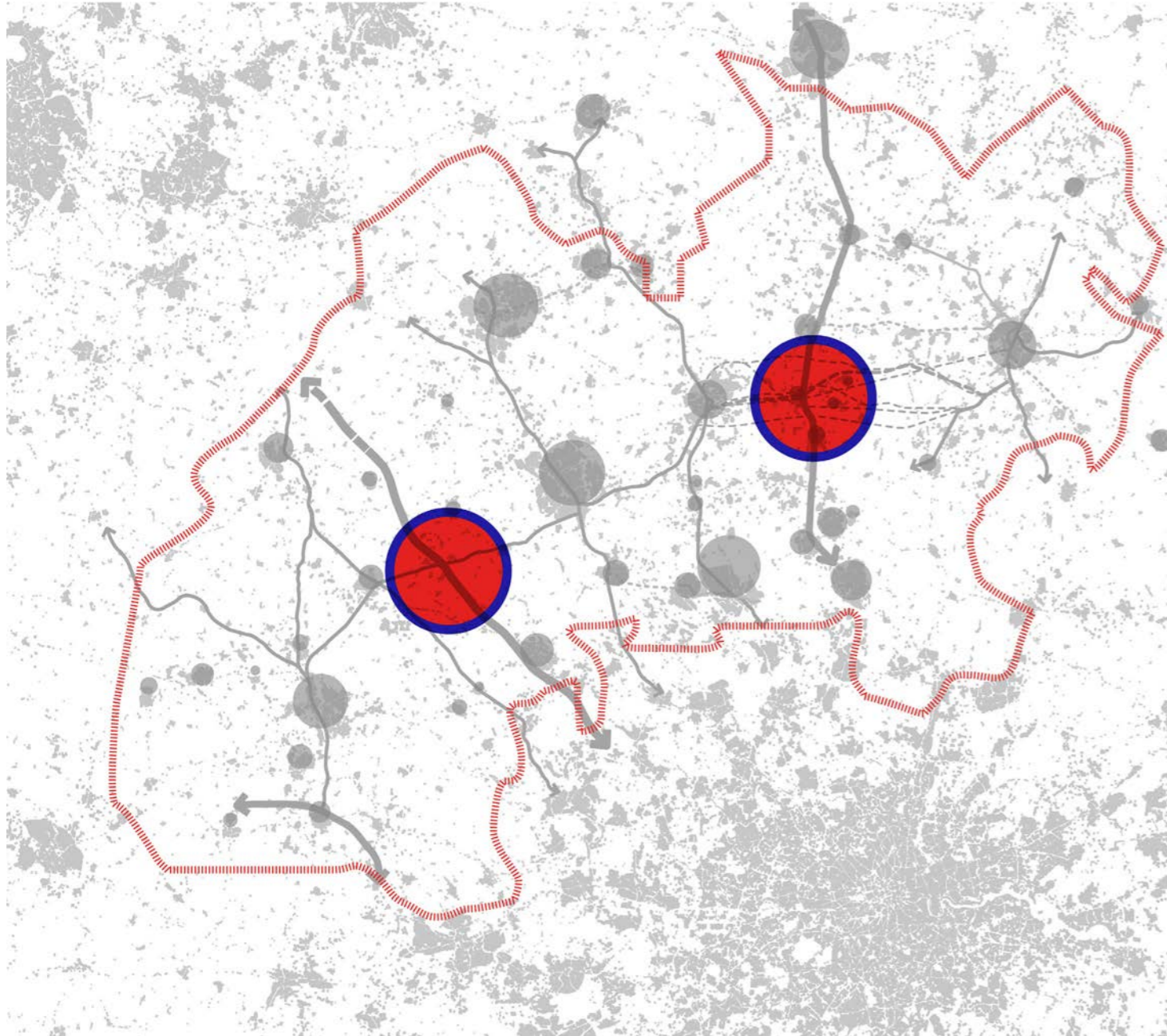
“WHAT-IF” SCENARIOS

SCENARIO 2

2 X MEDIUM CITIES OF c. 950,000 PEOPLE

(each of which is larger than the population of the built-up area of Liverpool)

Settlement radius of c. 9.3 km each at 3,500 people / km²

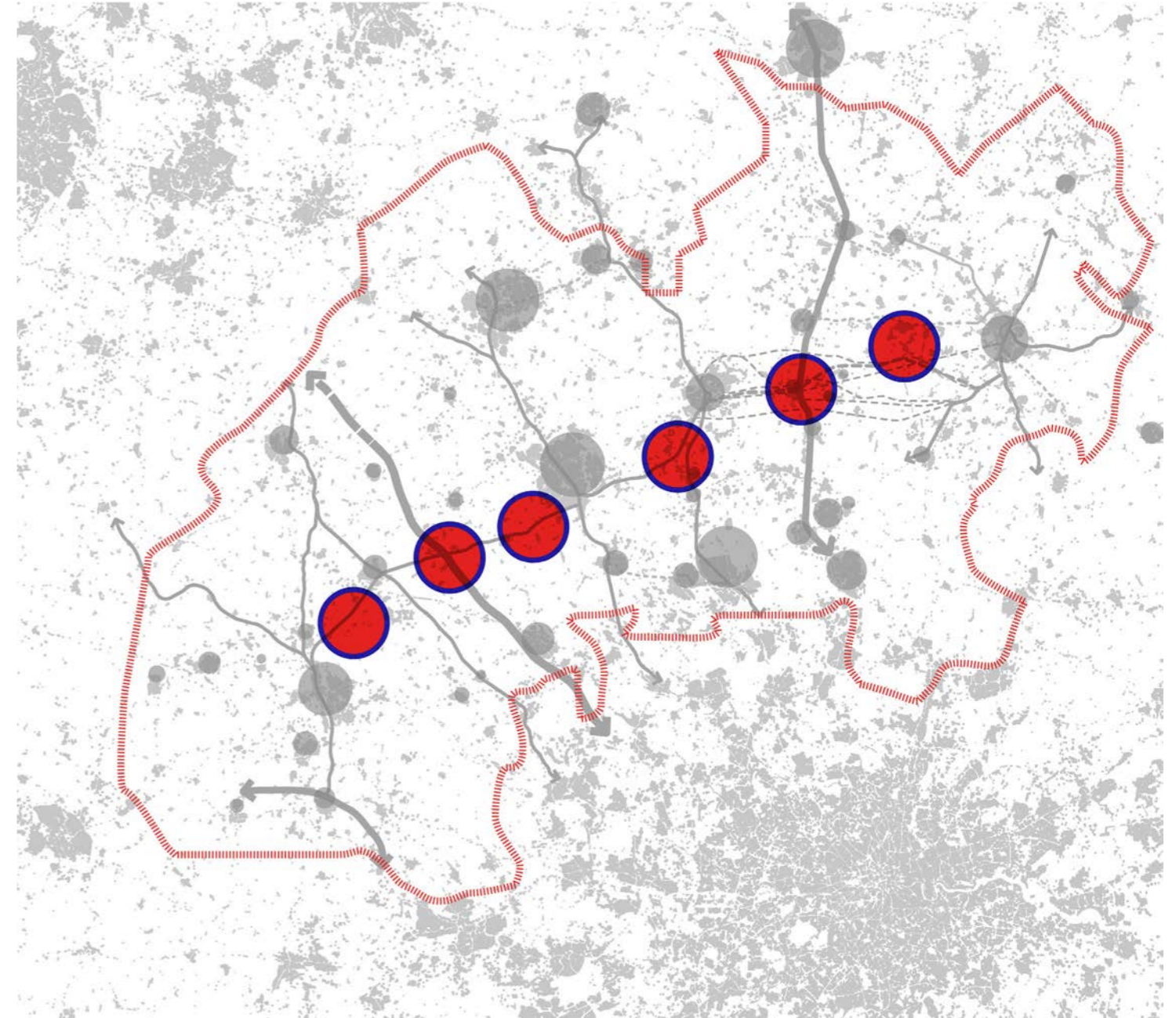


SCENARIO 3

6 X SMALL CITIES OF c. 320,000 PEOPLE

(each of which is about the population of the built up area of Reading)

Settlement radius of c. 5.4 km each at 3,500 people / km²



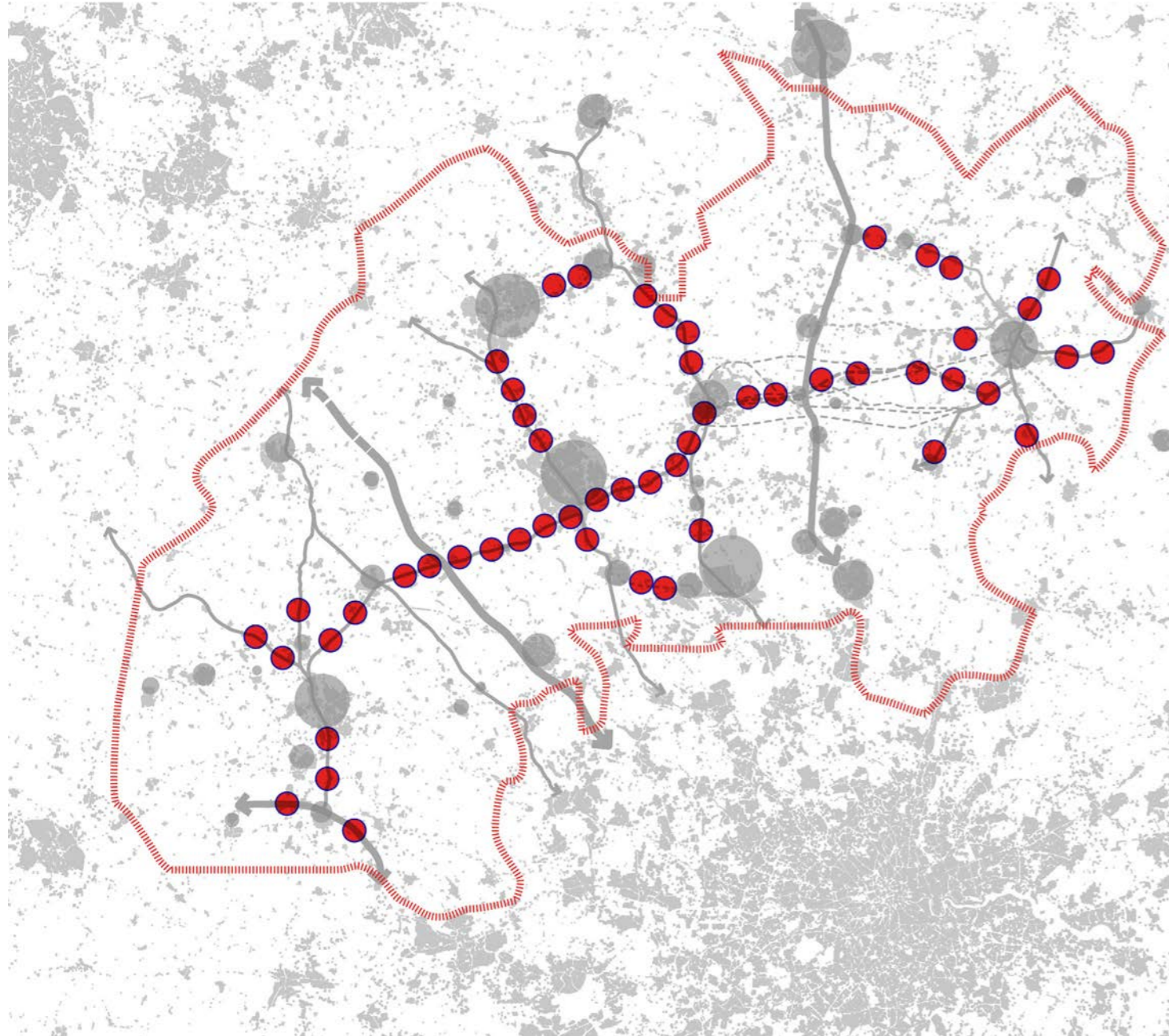
“WHAT-IF” SCENARIOS

SCENARIO 4

50 X TOWNS OF c. 38,000 PEOPLE

(each with a population similar to Newbury or Bishops Stortford)

Settlement radius of c. 1.9 km at 3,500 people / km²

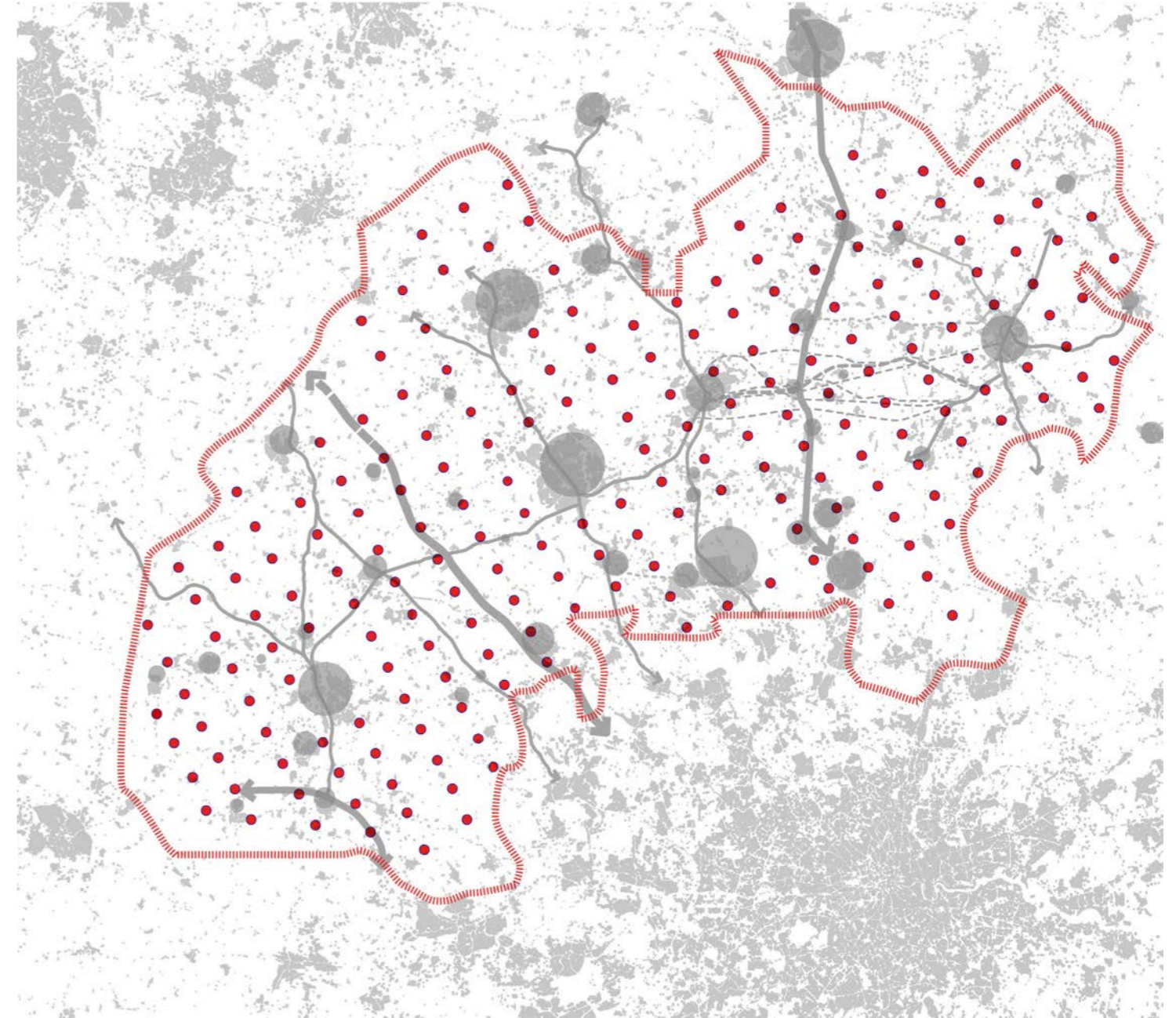


SCENARIO 5

200 X VILLAGES OF c. 9,500 PEOPLE

(each with an average population equivalent to Histon in Cambridgeshire)

Settlement radius of c. 900 m at 3,500 people / km²

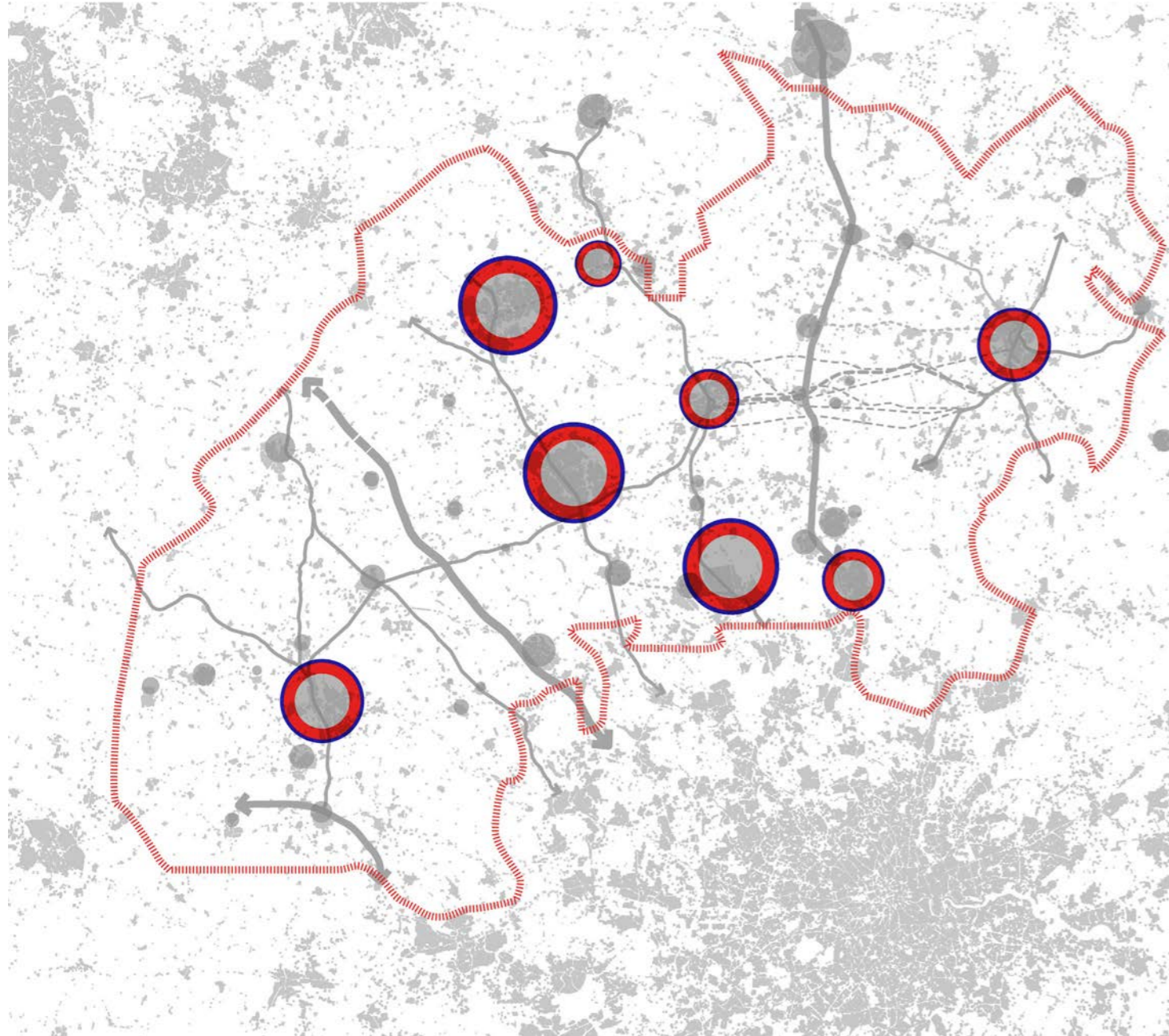


“WHAT-IF” SCENARIOS

SCENARIO 6

CONTINUOUS CONCENTRIC EXPANSION

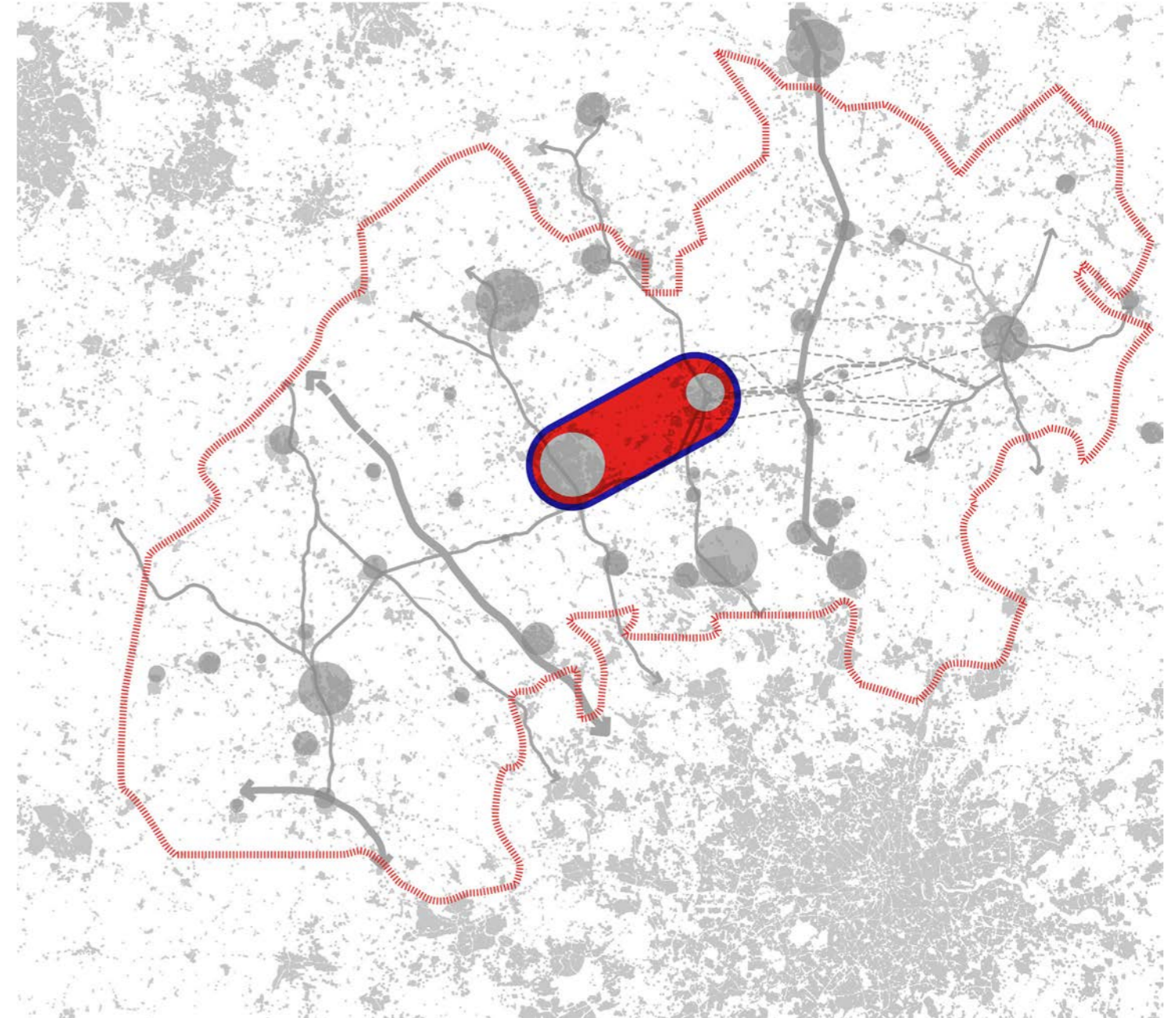
More than doubling the population of eight of the largest settlements within the corridor.



SCENARIO 7

“CONURBIA”

Concentrating development around and on an axis between two or more existing settlements to create a larger combined settlement approaching the population (including the existing places) of the Birmingham/West Midlands conurbation.



“WHAT-IF” SCENARIOS

ANALYSIS & CONCLUSIONS

The first conclusion drawn from the “what-if” scenarios is that the application of generic typologies in this (deliberately of course in this case) crude fashion does not account for the particular conditions of different parts of the corridor. For instance, it is not credible (certainly within the terms of the brief for this study) to consider the concentric expansion of Oxford or Cambridge, or indeed Luton, given their landscape and green belt constraints. Equally, the application of a single large city in the position shown, while logical in terms of potential rail connectivity, does not, as shown, account for the specific nature of the Vale of Aylesbury. Even at the scale of a village, development needs to be integrated carefully in its landscape, and with respect to neighbouring settlements in design, as well as economic/social terms.

The “what-if” scenarios do however, allow a series of thought experiments to consider the pros and cons of different development patterns across the corridor, and to explore the trade-off between the concentration or dispersal of the impact of new settlement, against the cost (financial and in terms of travel time) of the infrastructure needed to support a given population.

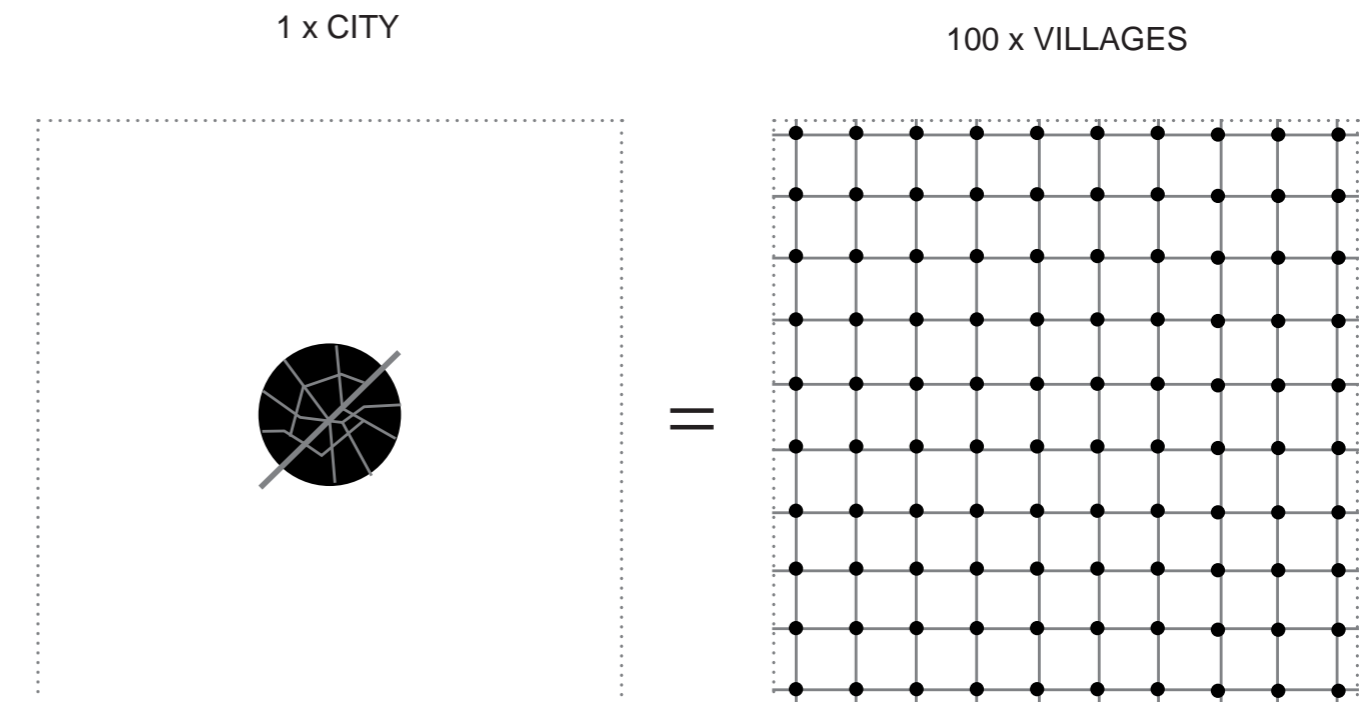
A single new city, for example, would minimise the scope of impact on existing communities and their infrastructure (although a relatively small number of existing communities would be very significantly affected); allow for maximal land value capture to fund new infrastructure if a new town model is adopted; preserve journey times on EWR, for example (requiring only one station stop); and preserve green belt, but do little to reduce housing pressure in Cambridgeshire or South Oxfordshire, and may require large-scale upfront (albeit efficient and concentrated) investment in national road and rail networks and other city-scale infrastructure.

At the other extreme, making many small villages might minimise the case-by-case impact of development on existing communities, but would spread this impact across a much wider area. The wide distribution of villages needed to achieve the levels of population required in total would also make the provision of high quality public transport to access jobs and the full range of services needed to support their aggregate population, relatively more difficult (costly, energy intensive and time-consuming) as the diagram alongside demonstrates.

With the greatest pressure for housing being at the two ends of the corridor, scenarios that concentrate growth in the centre – Scenario 7 for example – will be less effective in addressing shortages of suitable housing, potentially a brake on economic growth in Oxford and Cambridge, and in capitalising on the opportunity of growth around those cities. On the other hand, concentrating development – particularly in the centre of the arc, where links to London and the Midlands/North are best, and equidistant from both Oxford and Cambridge – would be more likely to create the critical mass needed to create an energetic, mixed and dynamic new place and achieve positive agglomeration effects.

Taking these various factors together, it is clear that a granular approach that starts from the particular conditions of particular sub-regions, landscapes and sites will be necessary. Such an approach is likely to encourage a diversity of responses from across the range of possibilities described by the “what-if” scenarios – including, in appropriate locations, larger-scale settlements.

ALTERNATIVE MODELS FOR DISTRIBUTING URBAN DEVELOPMENT



The diagram here compares two different models for the distribution of urban development.

The black represents urban areas, and the total area of this is the same in both versions – meaning that at the same density both models would accommodate the same population.

The grey lines represent the connective infrastructure needed to provide similar levels of connectivity (bus services say). The number of connections/services required to cover the same population are significantly greater in the village model, although with co-ordinated placement of the villages it should be possible to create patterns of settlement that require less infrastructure for only marginally less accessibility. This is explored in the case studies later in this document.

The impact of the city model on its location is total, but over a comparably small area. In contrast, each village has a less significant impact on its environment, but, in aggregate, over a much larger total area.

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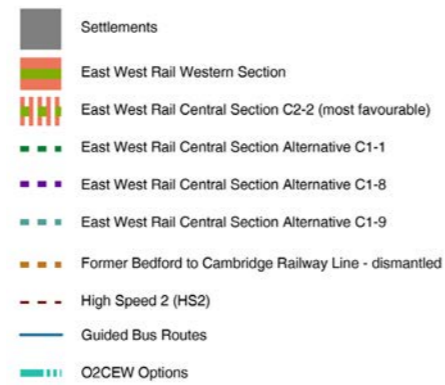
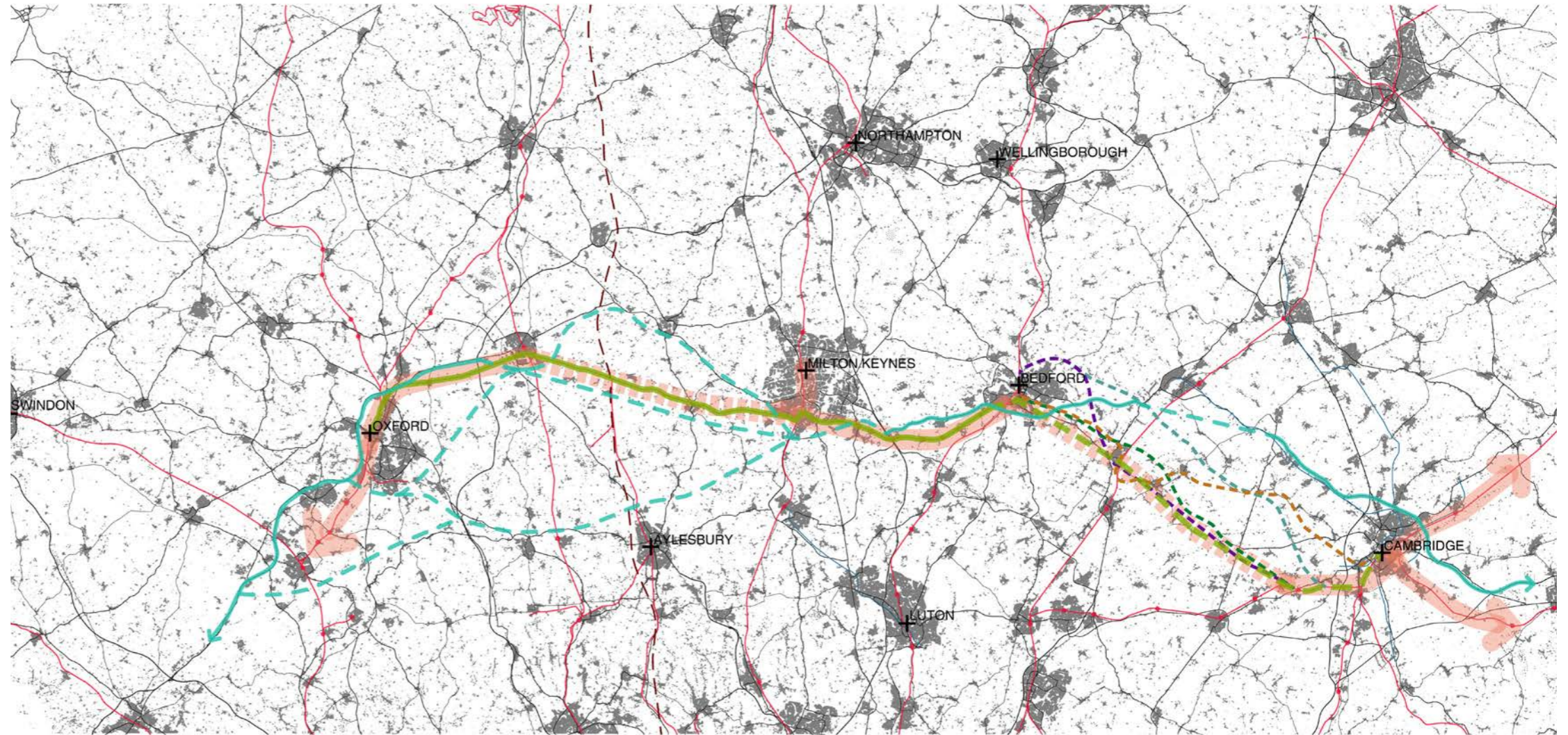
**CHAPTER 2:
SPATIAL
FRAMEWORK**

SPATIAL FRAMEWORK: INTRODUCTION

The analysis in this chapter seeks to develop a spatial strategy across current administrative boundaries that synthesises an understanding of:

- The opportunities and constraints of the landscape;
- The parameters of an efficient, sustainable transport system, in light of the existing and projected infrastructure;
- The grain of sub-regional economic, civic and institutional activity and identity, within which new or expanded settlements, economies and identities would need to successfully integrate.

A consistent mapping extent – as per the drawing here – is used for the spatial plans in this section. The plan to the right shows existing settlements in the context of the principal potential, namely East West Rail and the Expressway, and existing transport infrastructure routes.



SPATIAL FRAMEWORK: DIFFERENTIATION

The core of the corridor, through which the key new or improved east-west transport connections would pass, varies a great deal in terms of its ability to accommodate different types of development, and to what extent.

Based on the high-level constraints mapping assembled in this study, it is clear that the areas around Oxford, Cambridge, and south of Milton Keynes have limited scope for large-scale greenfield development – principally due to the green belt designations.

There may be opportunities for development within the existing urban areas of the green belt-bounded cities of Oxford and Cambridge, but this is likely to be limited relative to the overall scale of growth envisaged, and relatively complex.

In contrast other cities in the corridor may have capacity for greater levels of intensification and infill given, for instance, the open structure of Milton Keynes and Northampton (both Mark III New Towns) and significant areas of slack-space or previously developed land in existing town centres (Bedford, for example). However, intensification and infill in locations such as this will not on their own achieve the levels of growth anticipated by the Transformational Scenario. Those cities not constrained by green belts may also offer opportunities for growth at their edges, for example south of Milton Keynes and South of Bedford, in terms of locations that are along the anticipated alignment of East West Rail and the Expressway.

This leaves three broad areas where there may be greater potential to accommodate larger-scale greenfield development. These locations are:

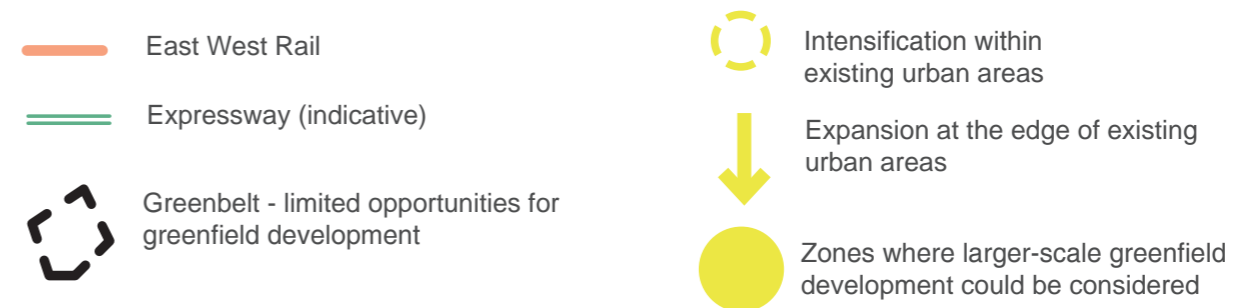
1. Aylesbury Vale - subject to the delivery and location of a new station on the re-opened East West Rail Line. Large-scale development in this location is probably also dependant on delivery of, and connection to, a new Expressway alignment between Milton Keynes and Oxford.

2. Marston Vale - between Milton Keynes and Bedford. This location is already well served by road, and rail access could be improved through the reorganisation (and supplementation) of services on the Marston Vale line.

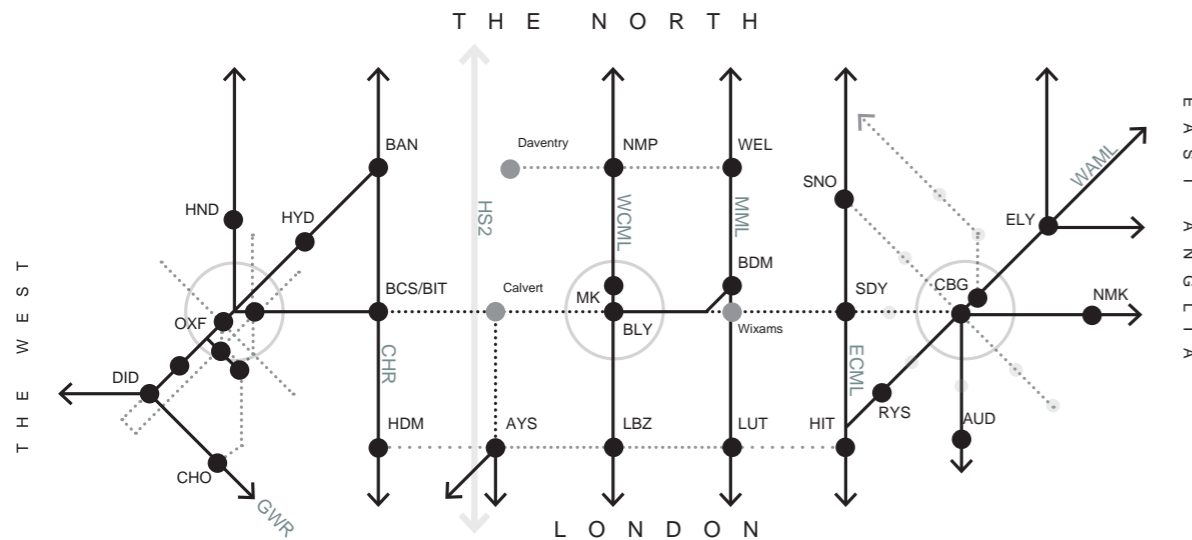
3. Around Sandy and Biggleswade - at the intersection of the East Coast Main Line and the proposed new East West Rail route. This location is on the A1 so it is also well served in terms of road access - with further improvements planned.



Diagram of different conditions along the East West Rail and Expressway corridors (only) generated from the constraints mapping summarised in the *Introduction* chapter



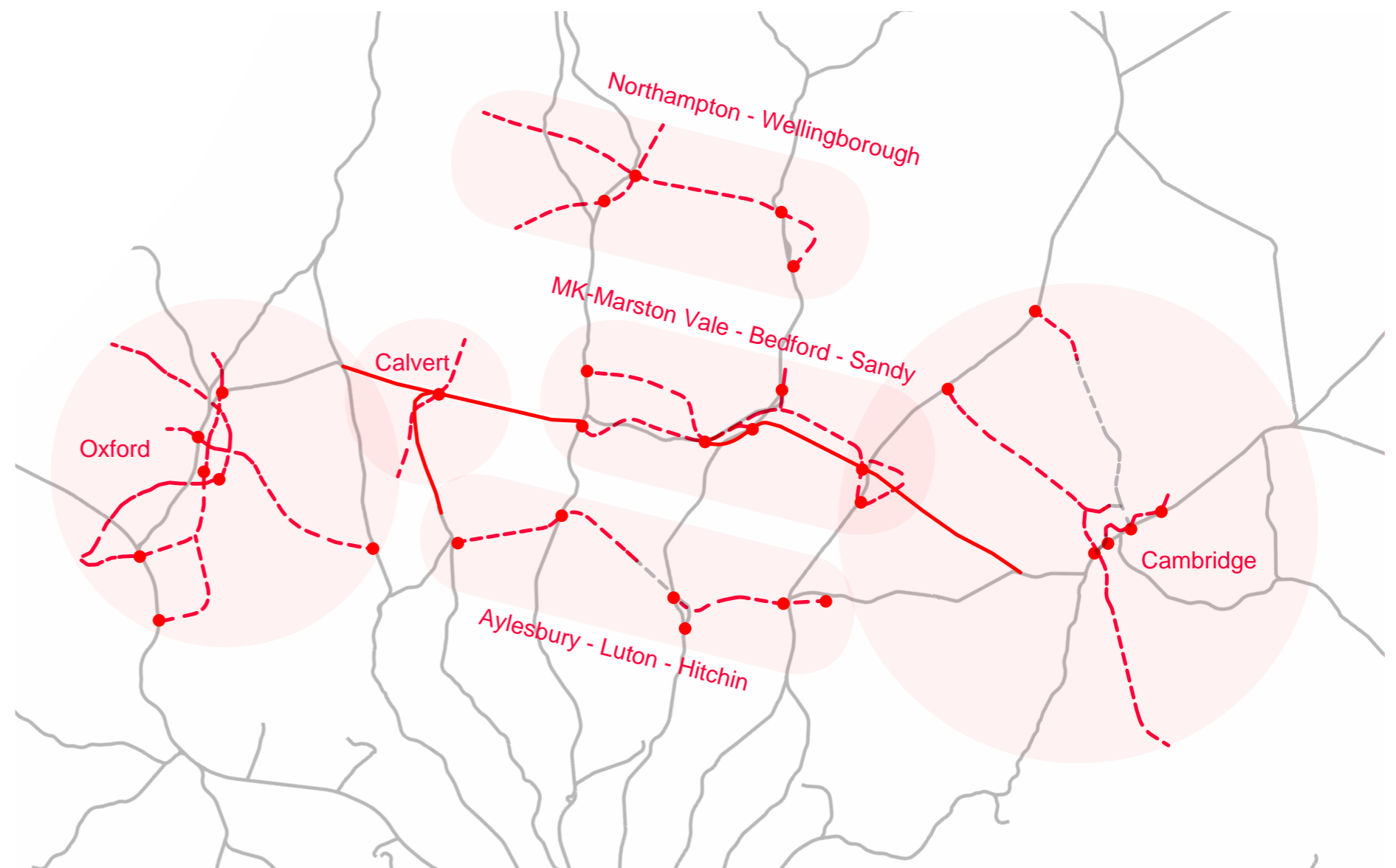
SPATIAL FRAMEWORK: INTEGRATED TRANSPORT



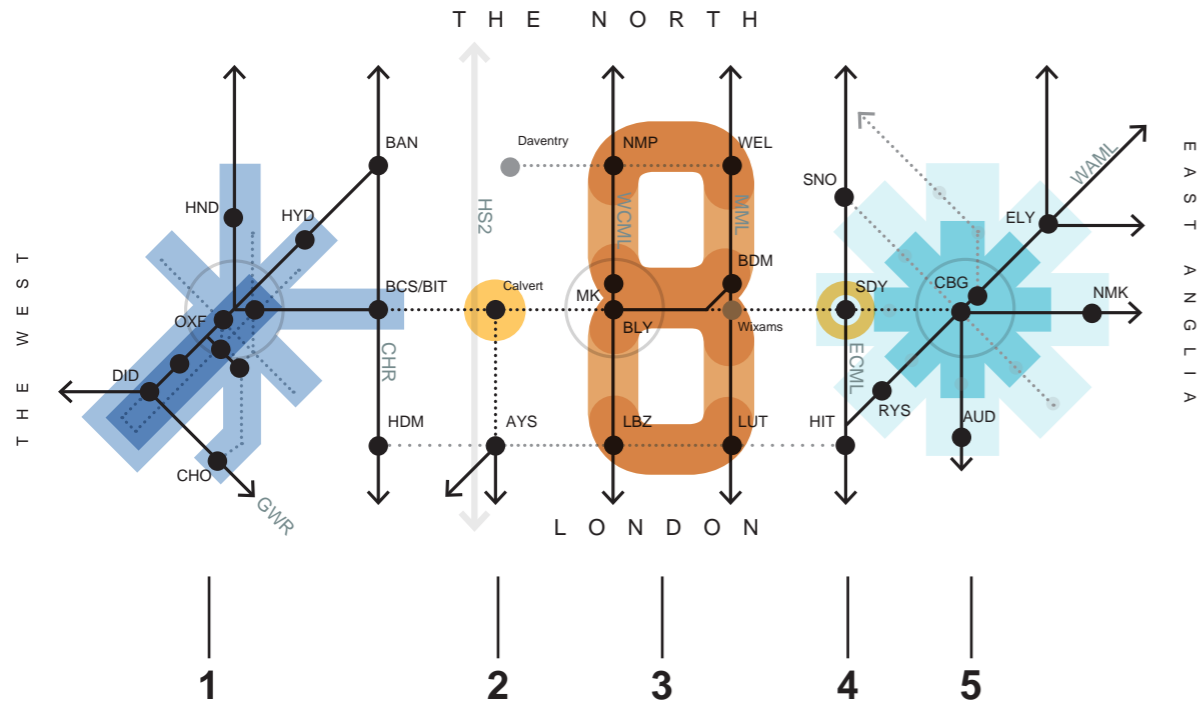
- existing railway lines
- proposed railway lines (EWR)
- existing busway/transit lines
- potential busway/transit lines (light rail/tram-train/tram/busway/BRT)
- railway/transit interchange

The spatial framework is underpinned by a proposition for the creation of a high-quality public transport network comprising:

- Existing National Rail routes - these run predominantly north-south - providing excellent connections into London;
- Completion of East West Rail - providing long-distance services across the region, links between towns and cities along the route, greater resilience on the network, and facilitating interchange between north-south and east-west services, thereby allowing a number of journeys that are currently impractical by rail (for example Bicester to Northampton);
- Extension and creation of a number of high-quality transit routes, building on existing completed projects in Cambridge and Luton/Dunstable, and established initiatives in Oxford and Northampton. These networks would interchange and work in concert with the National Rail network, as indicated in the diagram above, to provide greater coverage and connections between existing towns. By being able to sustain more frequent stops and services than the mainline/regional rail network, these would be able to serve a wider range of settlement types/scales and provide a more useful armature for development. Depending on the specific circumstances and passenger volumes, these routes might be delivered as light rail, tram-train, tram, BRT (bus rapid transit), or with smaller-scale autonomous vehicles services. Whatever the technology selected, the services offered should be high quality, segregated and reliable, with integrated ticketing and co-ordination of services, and with the potential for the route to be upgraded in the future as/if passenger numbers increase.
- At the local scale, new development would be located and designed for homes and places of work to be within a short walk or cycle (via a safe and pleasant route) of a station and/or transit stop, as well as a range of local facilities that reduce the *need* (but not necessarily the *desire*) to travel.



SPATIAL FRAMEWORK: STRATEGY

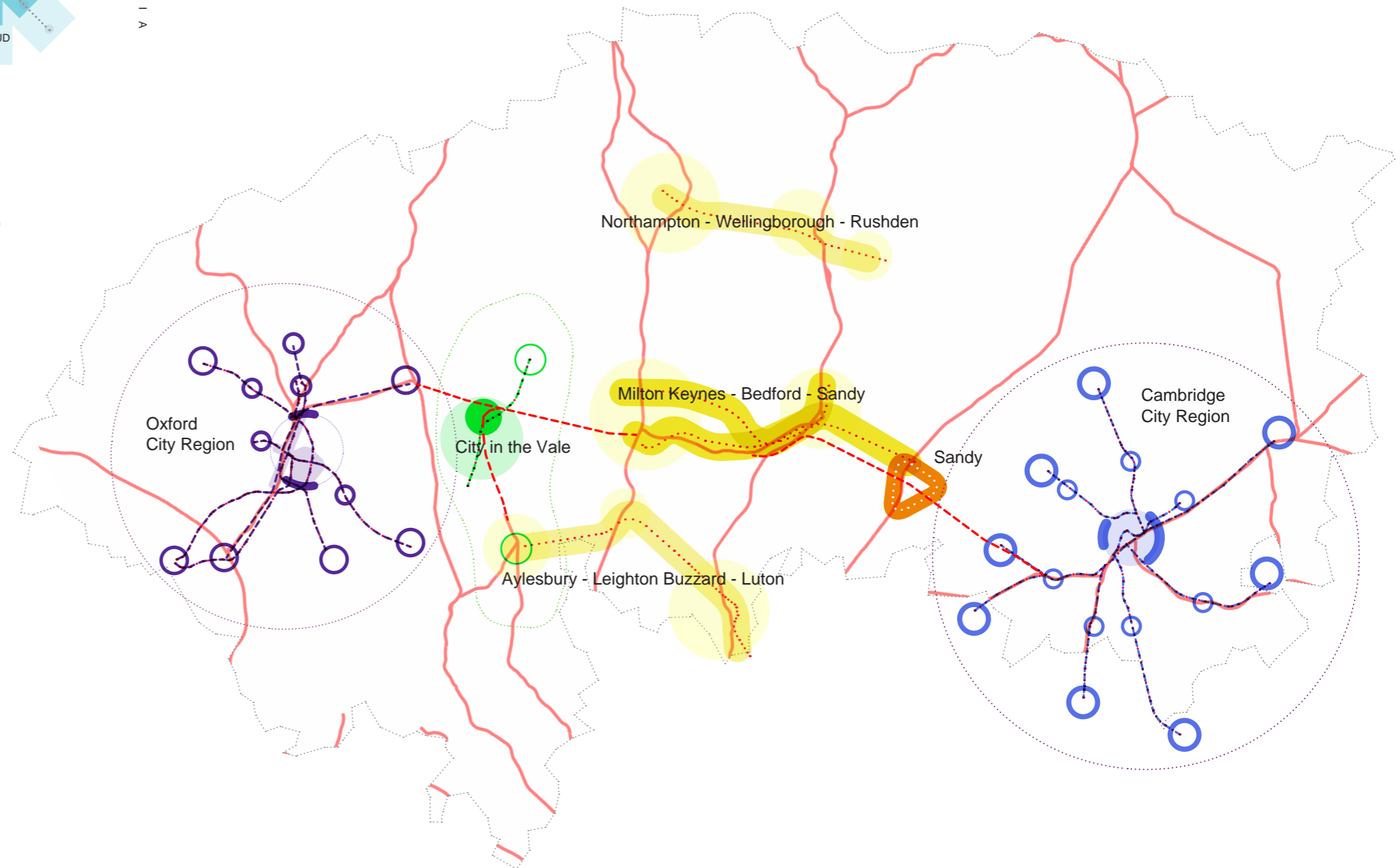


The comprehensive regional public transport network outlined on the previous page forms a structure upon which future growth could be planned.

In line with the analysis above, the strategy for the spatial distribution of growth differs according to location within the corridor, and the diagram above summarises five sub-regional zones as follows:

1. Oxford City Region
2. Calvert
3. Eight Town Figure-of-eight
4. Sandy
5. Cambridge City Region

Each of these zones relates to one of the three structural approaches outlined on the following pages. Each zone has its own spatially-specific response to accommodating growth successfully, allied to its particular circumstances, challenges and opportunities.

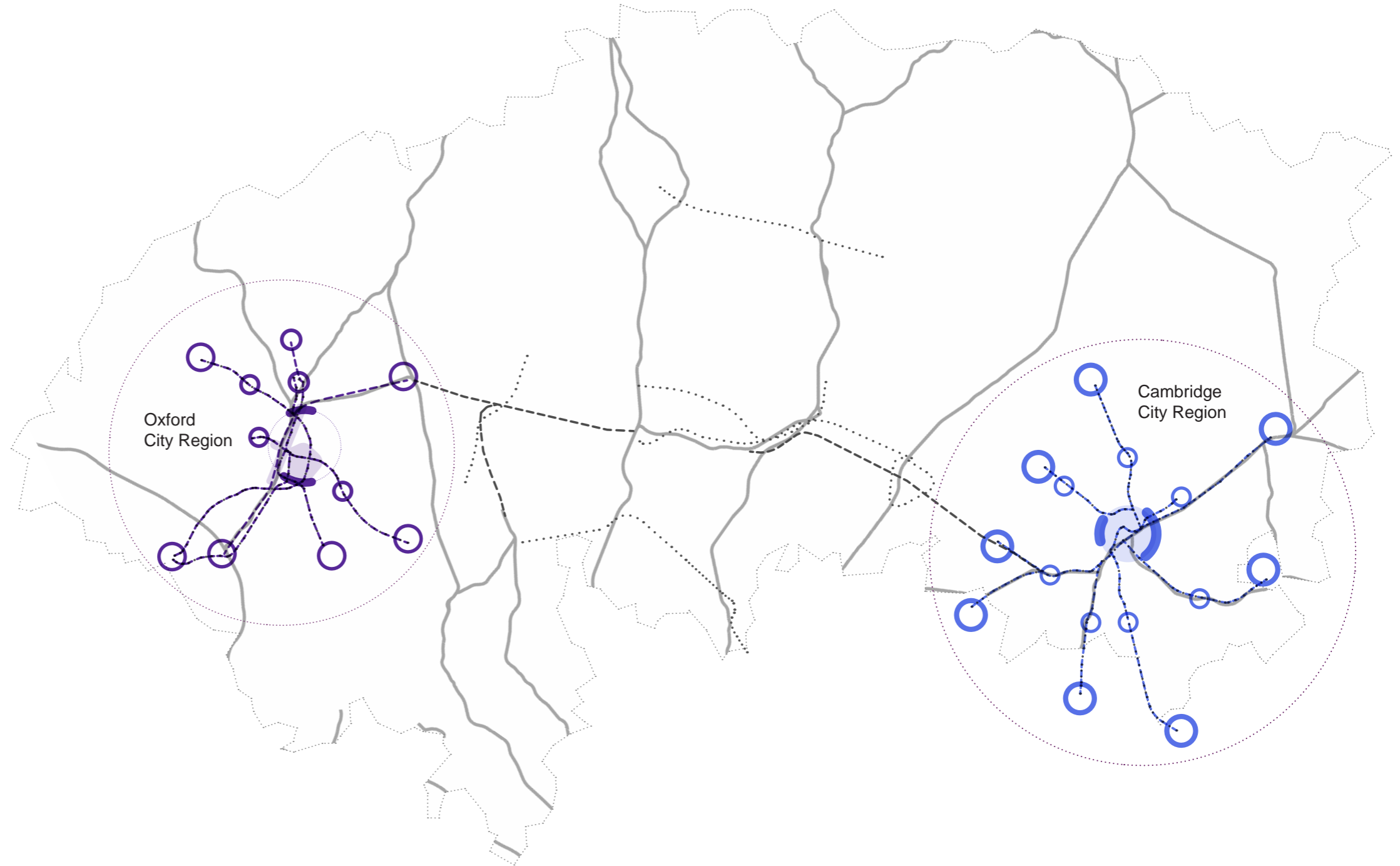


SPATIAL FRAMEWORK: STRATEGY

OXFORD AND CAMBRIDGE CITY REGIONS

The core of the strategy for Oxford and Cambridge is a focus on preserving the best aspects of each of these historic cities, including their very immediate relationship with surrounding countryside, while also:

- Promoting more intensive and mixed-uses within the existing extent of each city - especially in the low density peripheral science park, retail park, and industrial areas - and the continued prioritisation of active and public transport within the city and to surrounding towns and villages;
- Selective design-led and landscape-led adjustment of the green belt to strengthen its overall functions, while allowing for the careful repair and extension at the edge in locations that link and integrate well with the wider city;
- Facilitating the creation and expansion of compact settlements in satellite locations around the city. Internally these would be designed around walking and cycling and, with a mixture of uses, would cater for a proportion of day-to-day activity on site, rather than being purely dormitory “exurbs”. They would nonetheless be linked to key activity locations within the city, as well as to the national rail network, by a comprehensive, reliable and rapid, city-region transit system;
- Creating a high-quality, legible and integrated public transport network spanning the city-region, to provide a viable alternative to car travel for most journeys and a cohesive whole linking the different approaches to growth outlined above.



SPATIAL FRAMEWORK: STRATEGY

TWO NEW COMPACT CITIES

Two locations across the corridor have the potential to accommodate larger-scale standalone settlement as they are:

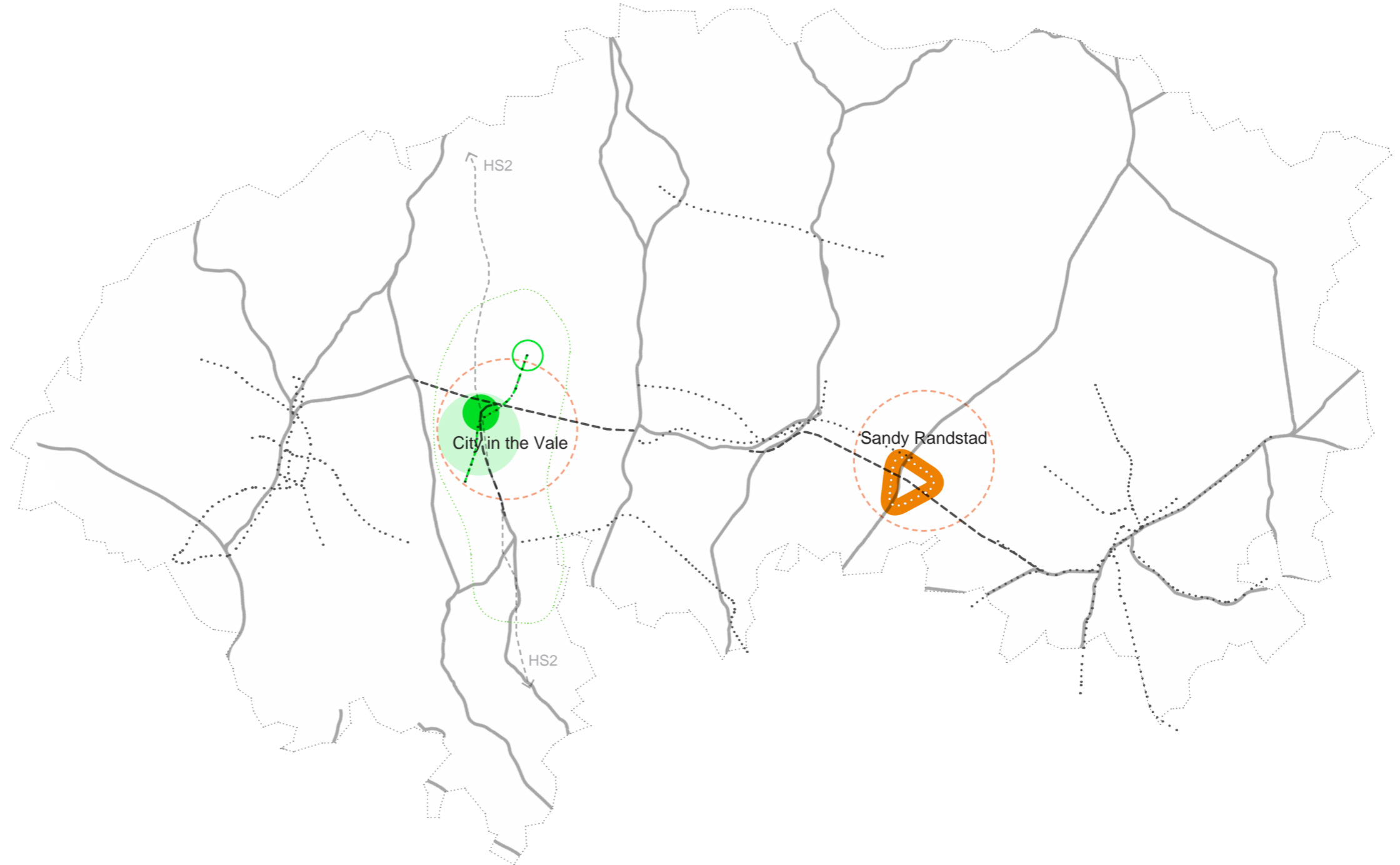
- Within areas of relatively unconstrained countryside (notwithstanding any site specific environmental constraints not identified within the high-level mapping exercise) in the zone between the Oxford green belt and Milton Keynes in the west, and between Bedford and the Cambridge green belt in the east;
- At key intersections of the new East West Rail route and existing/extended north-south routes, but without there already being a substantial town/city making use of that connectivity (as at Oxford, Bicester, Milton Keynes, Bedford and Cambridge);
- In the case of the City in the Vale, have the potential to be, highly accessible from the strategic highway network.

Nonetheless, imagining a new town or city where currently there is countryside is controversial and great care would need to be taken in doing so. The terms in which this might happen, and the potential differences between these two locations given their different landscape settings, is discussed further in **Chapter 3: Typologies** of this document.

The UK was once ground-breaking in the creation of new towns and cities, and the tools for this are well tested and have been successfully deployed in the past. However, this scale of development has not been undertaken in the UK since the creation of Milton Keynes and would require a concerted effort to establish structures of funding, governance and delivery to enable it to happen.

The timetable for the incremental delivery of a settlement of this scale would need to be carefully co-ordinated with the delivery of access infrastructure (such as the Expressway in the case of City in the Vale), so as not to unduly impact on existing infrastructure networks and communities.

The incremental delivery of the infrastructure of the city itself, including the provision of higher order services as the city grows, would also need to be carefully considered given the prolonged period over which a settlement of this scale would be created. The city should never feel “unfinished”.



SPATIAL FRAMEWORK: STRATEGY

THREE EAST-WEST STITCHES

The creation of linear concentrations of development along new/extended high-quality transit routes that connect existing towns, and their respective stations on north-south rail connections.

Three such “stitches” are envisaged:

- Daventry/Silverstone-Northampton-Wellingborough-Rushden - in line with Northamptonshire’s aspirations for a Northamptonshire Arc Mass Transit (NAT). A necklace of existing places and new walkable human-scale settlements would be located along this link.
- Milton Keynes/Bletchley-Marston Vale/Cranfield-Bedford-Sandy - with the potential for a busway or tram-train route continuing to serve existing stations in Marston Vale that would otherwise be bypassed by the proposed new alignment of East West Rail, as well as serving new development locations within Milton Keynes and Bedford, and in the recovered landscape of the former brickworks of Marston Vale.
- Aylesbury-Leighton Buzzard-Dunstable-Luton - by completing an extension of the successful Dunstable to Luton busway to Leighton Buzzard, and potentially on from there via Cheddington to Aylesbury. This would provide an armature for development connected by high-quality public transport to the economic centres of Milton Keynes, Aylesbury and Luton. Consideration could also be given to extending the definition of this stitch eastwards to connect to the East Coast Mainline at Hitchin.



SPATIAL FRAMEWORK: CONCLUSION

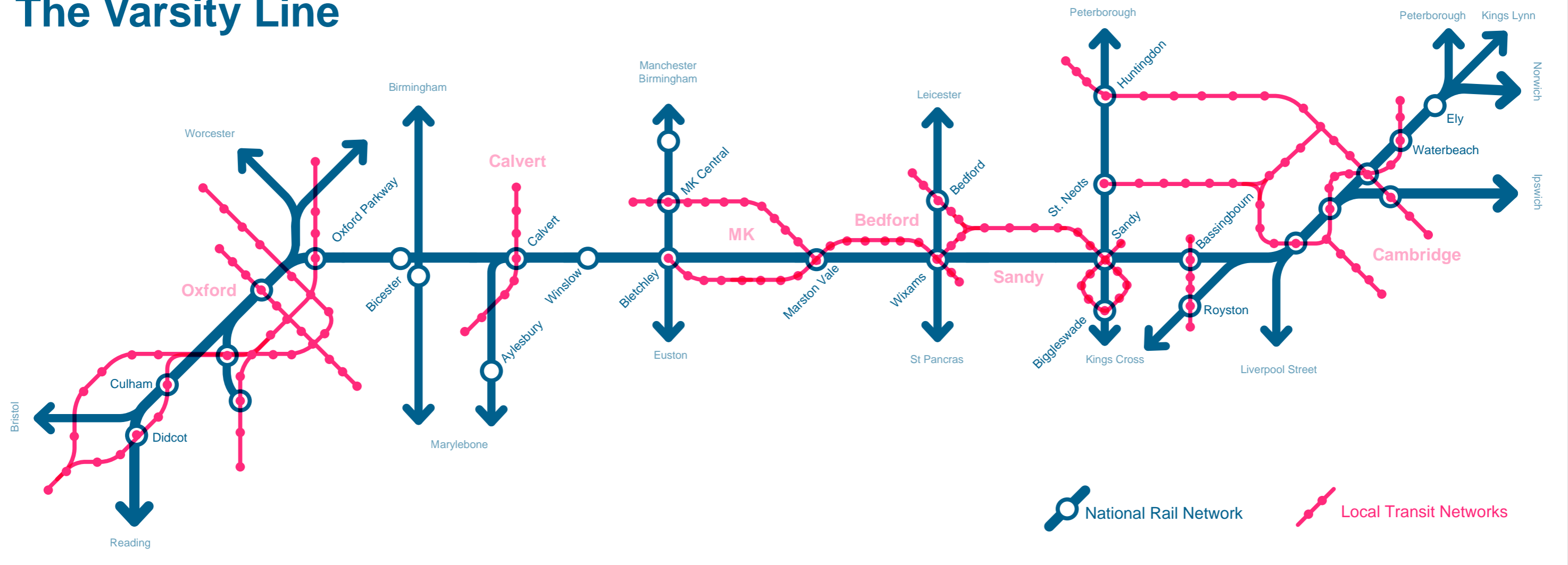
The image below presents a potential future public transport network based on the spine of East West Rail – spanning from Harwell in the west to Ely in the east.

Through co-ordination with land-use planning, stations and stops on this network would be within walking and cycling distance of all new major development within the corridor, as well as giving access to existing centres of activity and destinations beyond the corridor.

The constituent parts of this overall network might be co-ordinated and integrated through the definition of a Sub-National Transport Body, with, similarly to Transport for London (TfL) in London, the mapping and integrated ticketing of the entire public transport network being central to the sense of the area covered being a cohesive whole.

High levels of public transport accessibility across all the important existing places and new development locations would serve to support the creation a single, knowledge intensive cluster, able to compete on the global stage.

The Varsity Line



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CHAPTER 3:
TYPOLOGIES AND
CASE STUDIES










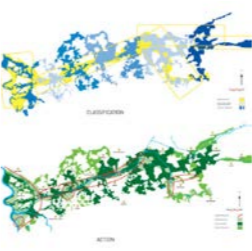










INTRODUCTION TO THE TYPOLOGIES

5th Studio have been asked to identify and assess the different types of development that could deliver significant new housing across the corridor. These investigations were to include, but not be limited to: densification and urban extensions, new garden towns, cities and villages.

The initial “what-if” scenarios in **Chapter 1: Introduction** sketched-out what the corridor might look like if a selection of singular approaches were to be applied across the corridor. These scenarios ranged from the creation of a single large new city, through to many small villages, and include alternatives for expanding around existing settlements rather than creating new ones. All of the typologies that form the basis of these scenarios have their limitations or costs, particularly when deployed at scale, and no clear favourite emerges from that high-level exercise.

The challenge of this study has therefore been to understand how particular development types (typologies) might be more or less suited to particular circumstances, including their relationship to infrastructure provision, and what the key characteristics of these typologies might be for them to be successful.

Beyond the simplified models used for the “what-if” scenarios exercise, we have sought to understand the nature and features of such a range of potential development forms through a review of a range of domestic and international best practice examples, alongside a review of relevant academic and research based guidance. The matrix on the right shows 18 of the best practice locations we examined in more detail and further information for each of these can be found in **Appendix D**.

X-LARGE	>	 <p>1 Clara Plan Australia</p>	 <p>2 Stedenbaan Netherlands</p>	 <p>3 Helsinki Finland</p>	 <p>4 Stockholm Sweden</p>		
LARGE	>	 <p>5 Nieuwegein Netherlands</p>	 <p>6 Letchworth UK</p>	 <p>7 Sheffield City Region UK</p>	 <p>8 Emscher Park Germany</p>		
MEDIUM	>	 <p>9 Hafencity Germany</p>	 <p>10 Vastro Hamnen Sweden</p>	 <p>11 Linear City Spain</p>	 <p>12 Vathorst Netherlands</p>		
SMALL	>	 <p>13 Carlsberg District Denmark</p>	 <p>14 Zuidas Netherlands</p>	 <p>15 Euralille France</p>	 <p>16 King's Cross London, UK</p>	 <p>17 Rieselfeld Germany</p>	 <p>18 Southern Fringe Cambridge, UK</p>

INTRODUCTION TO THE TYPOLOGIES

Having established a background of successful models for development that have been employed elsewhere, it was necessary to assess and tailor our understanding of these approaches to the context of the specific needs of the corridor.

Given the scale and diversity of the corridor, a robust and meaningful assessment of what type of new housing development is “best”, based on a generic or abstract understanding of the features of a particular development type (typology), would be problematic. Equally, a comprehensive assessment of how particular typologies perform in particular places throws up an impossibly large number of potential permutations.

Consequently we have adopted an approach that allows a focussed investigation of the characteristics, qualities and limitations of particular development typologies by looking in detail as a series of sample locations. A series of nine case study locations provide a representative spread of typologies and geographic coverage.

Each of nine development types is examined with respect to an appropriate example location, agreed with the National Infrastructure Commission in advance, in light of the analysis within **Chapter 2: Spatial Framework**.

These draw reference from the best practice examples and are intended to demonstrate the reasons why a particular development type might be appropriate to a particular sort of location, as well as what makes for a good version of any particular typology. They are purely illustrative and are not, given the limitations of this commission, detailed propositions*, but are instead intended to provide a guide to more general lessons.

*For instance they do not take full account of current local planning policy, and indeed in some cases are deliberately contra-policy, and they are not based on a complete understanding of the specific site conditions in each case.



A collection of photos taken at various locations during site visits in the corridor

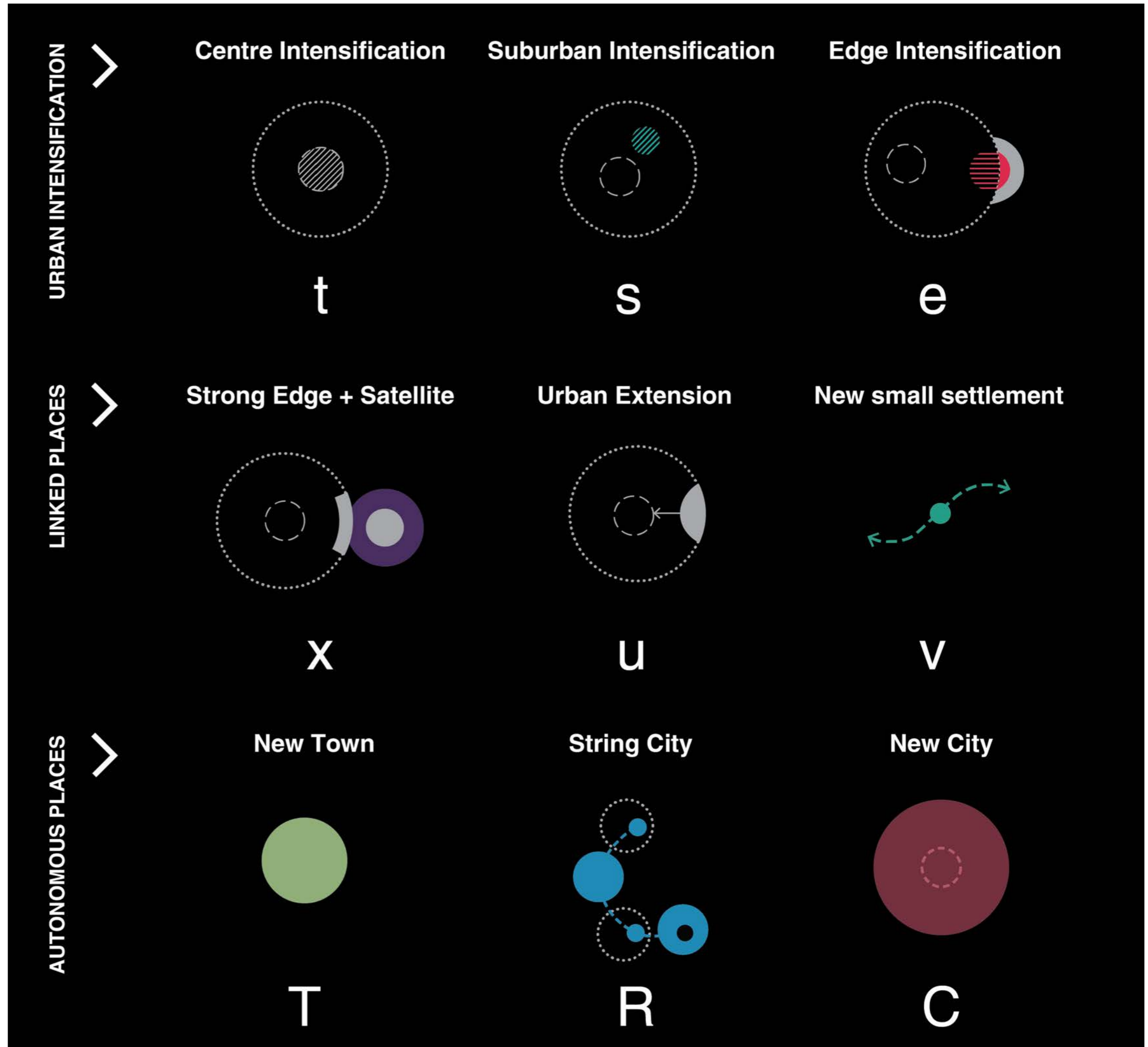
3x3 TYPOLOGIES

In total, nine different typologies have been identified and examined in greater detail through a located case study. While these only represent points within a wide field of possibilities, they are selected with the aim of providing a clear sense of the different approaches and issues across that range.

The nine typologies are broken down into three broad types, as indicated below, and in the overview to the right:

- **Urban Intensification** – The first set of three all relate to intensification with existing more or less urban areas.
- **Linked Places** – The next set of three are all, in one way or another, linked to a nearby town/city and would need to work in concert with the infrastructure of that existing place to provide the full range of jobs/services/facilities need to support the given residential population. So for instance, a new small connected settlement would most likely need to work in tandem with the town centre intensification typology.
- **Autonomous Places** – The final set of three are all new settlements of sufficient scale to be more self-contained than the last three. As such, they take a more active functional economic role, with a greater proportion of employment uses and higher order services (in proportion to the scale of the settlement) within the settlement itself – and consequently less reliance on surrounding settlements in terms of day-to-day activity. These settlements also require a higher level of connectivity, particularly in terms of access to national road and rail networks.

The nine typologies have been developed based on an appreciation of the best practice examples referenced on the previous page. Each one is presented in turn through the remainder of this chapter.



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**3.1: TOWN CENTRE
INTENSIFICATION**



3.1. TOWN CENTRE INTENSIFICATION

INTRODUCTION

This typology involves the intensification of existing town or city centres. Such an approach has the potential to make the most efficient use of existing infrastructure by concentrating development in the most accessible and sustainable locations. As well as providing space for new homes, these areas have the potential to provide new or expanded higher-order facilities and amenities in anticipation of the general increase in population within the areas that these centres serve (through the deployment of other typologies say, in particular the “linked places” typologies).

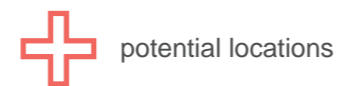
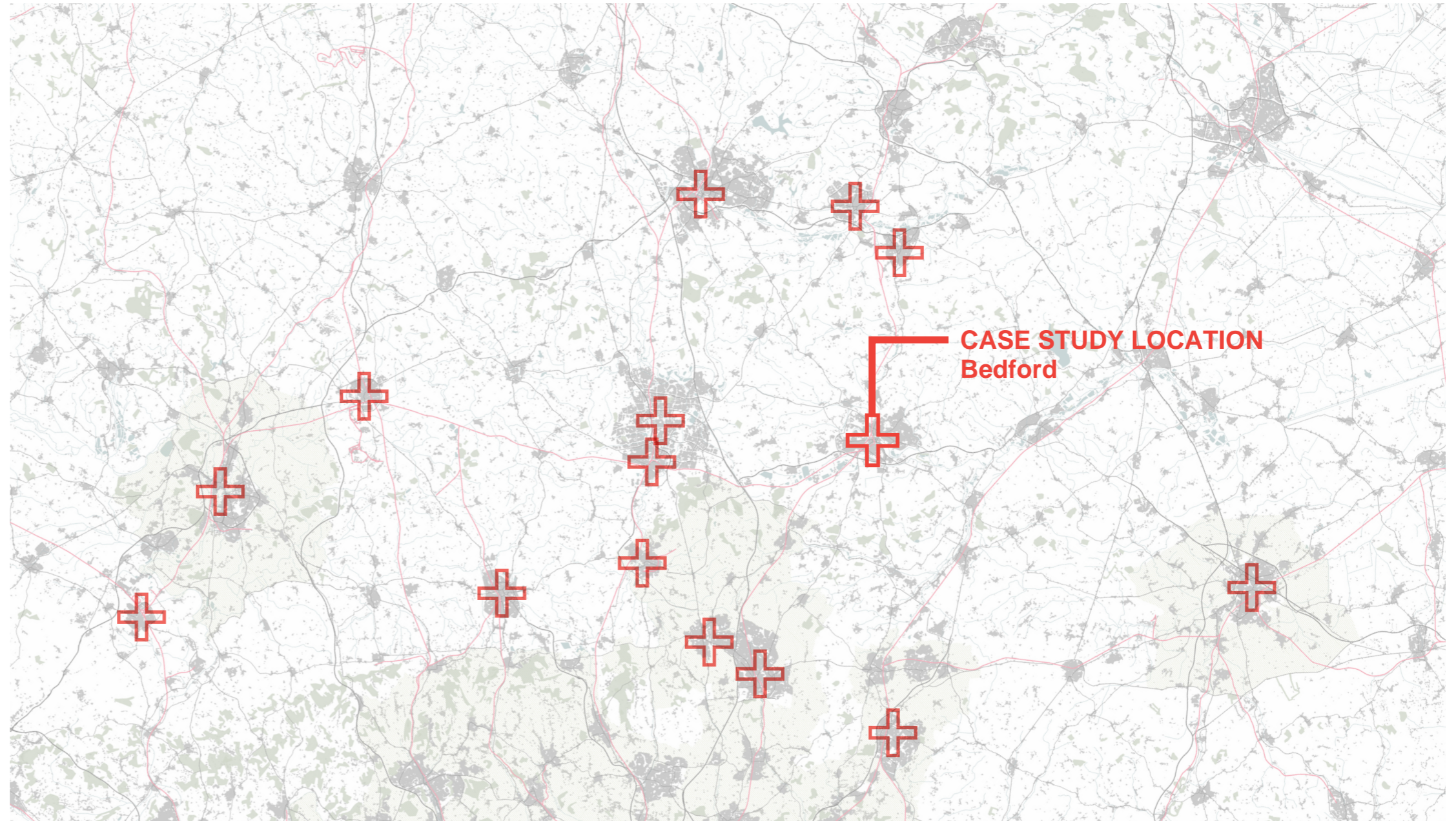
The reappraisal and redevelopment of land within existing town centres has the potential to achieve twin benefits of creating additional space for residential, commercial and social/civic uses, while also regenerating and improving the townscape and public realm for existing residents.

The scale and nature of intensification will differ by location. Oxford or Cambridge for instance, with their compact, cohesive historic cores and selective intensification already complete or underway, will have fewer or less extensive opportunities for change. In contrast, places like Milton Keynes with its extensive surface car parking within the centre, Bedford, or Northampton with large areas of slack or post-industrial space adjacent to the middle of town, offer far greater opportunities.

This is a proven typology which has worked successfully in the past in a range of situations. The best practice examples of Euralille and King’s Cross provide an indication of how key transport interchanges can act as a catalyst for regeneration and intensification. Hafen City in Hamburg, the Carlsberg District in Copenhagen, and Vastro Hamnen in the Netherlands also provide examples of how higher density mix of uses mixed development can extend and integrate with existing city contexts, strengthening the whole. All best practice examples are covered in more detail in [Appendix D](#).

Over the following pages we illustrate the key features and potential of an approach of this type with reference to a particular location. In this case the area under investigation is Bedford’s Town Centre.

The drawing alongside also identifies, illustratively, a number of potential locations where this typology might be applied. These locations are speculative, based only on an initial appraisal of their fit with the essential characteristics of this typology. A comprehensive assessment of these sites has not been undertaken and would be required to validate them. Equally, this initial search is not exhaustive.



3.1. TOWN CENTRE INTENSIFICATION

ILLUSTRATIVE CASE STUDY

Bedford has not prospered in recent years, despite its good rail and road links to London and a long tradition of excellent independent schools (Bedford, Bedford Girls, Bedford Modern and Dame Alice to name a few).

Some traditional industries, such as engineering, have declined. Similarly, the central area has suffered from the town's proximity to two strong regional retail and service centres in Milton Keynes and Cambridge. However, parts of the town centre remain very attractive, and regeneration of the area between the station and the retail core could lead to the re-vitalisation of the market town role, serving a prosperous and growing urban region.

The western margin of the town centre is predominantly a zone of surface car parks, overweening junctions, unused marginal land around rail infrastructure, space-hungry and unnecessarily central train stabling, and a swathe of disused post-industrial land. As the best practice example scale-comparisons below show, this is a very large area in aggregate, capable of accommodating a substantial mixed-use development. It is in a highly sustainable location on the margin of the town centre, with excellent levels of accessibility by existing public transport, and able to capitalise on the presence of the river and the parkland landscapes along it.

In order to ensure the best overall outcome would be achieved, a plan for the development of this quarter would need to happen in dialogue with the wider plan for the public transport network, the provision of alternative forms of access (to ease the removal of car parking), and the decanting of certain activities such as train stabling.

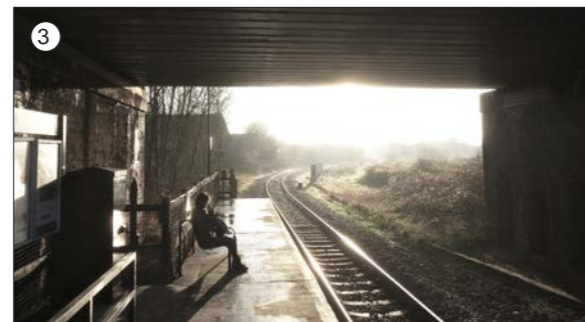
If East West Rail were to be routed to the south of Bedford rather than through the middle, there would be the potential for the eastern section of the Marston Vale line to operate as a tram-train service. France and Germany, for example, routinely use the tram-train service in similar situations, and it is currently being trialled in Rotherham. This would maximise the potential for development along its route as a street-based public transport spine. It would have more regular stops, similar to the concept of Arturo Soria's Ciudad Lineal covered in the best practice examples, instead of a fenced-off rail corridor that would sterilise large tracts of land in the centre. Such an approach could also link development opportunities in Marston Vale to the town centre, as per the **Typology 3.6 New Small Settlement** which should be read in conjunction with this typology.



Space-hungry train storage yard centrally located

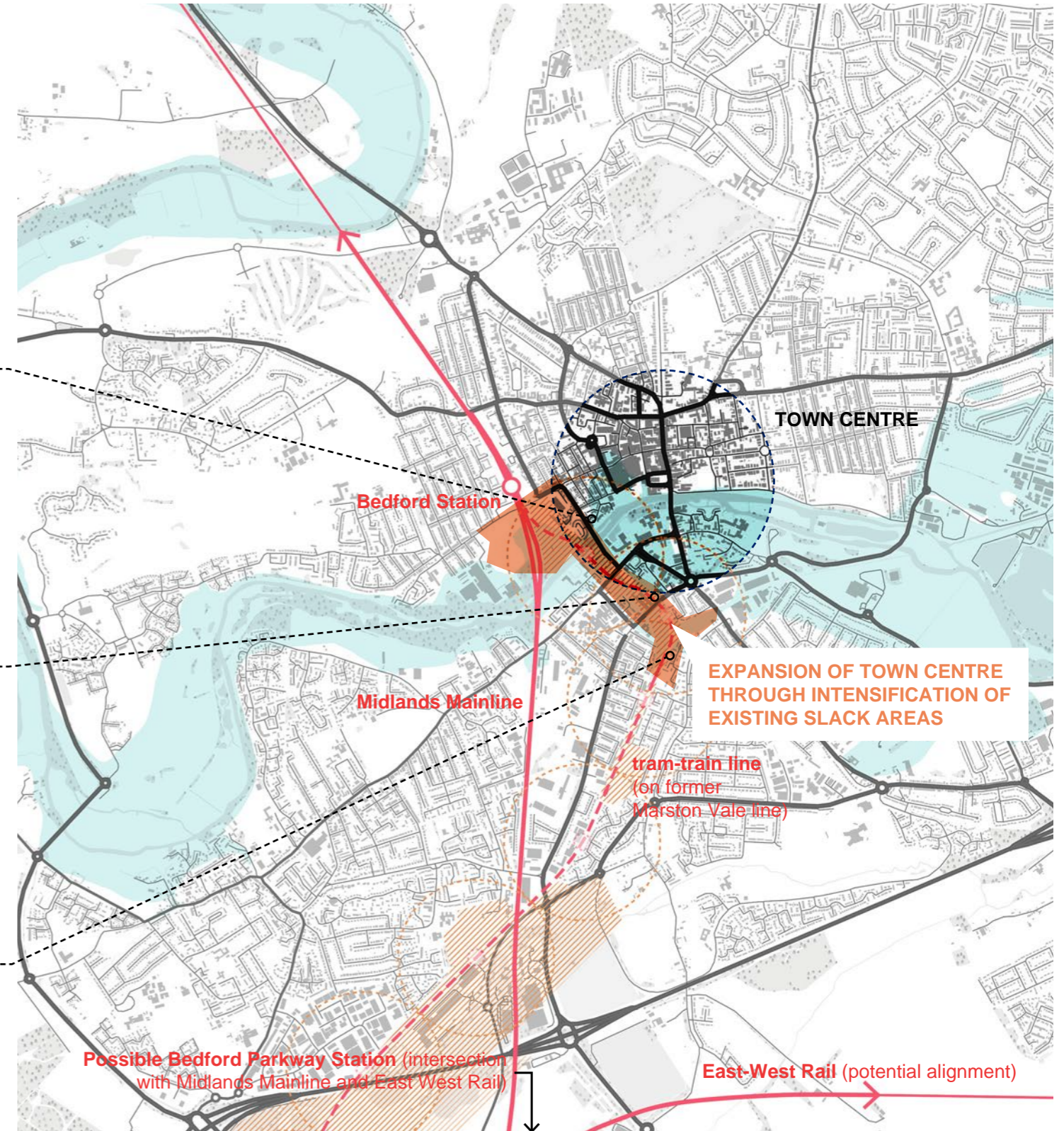
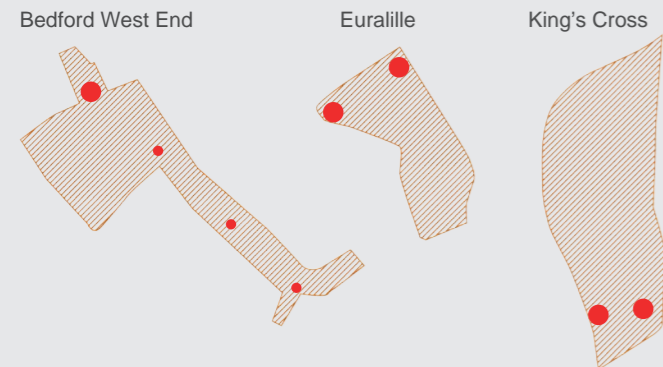


Extensive surface car parks

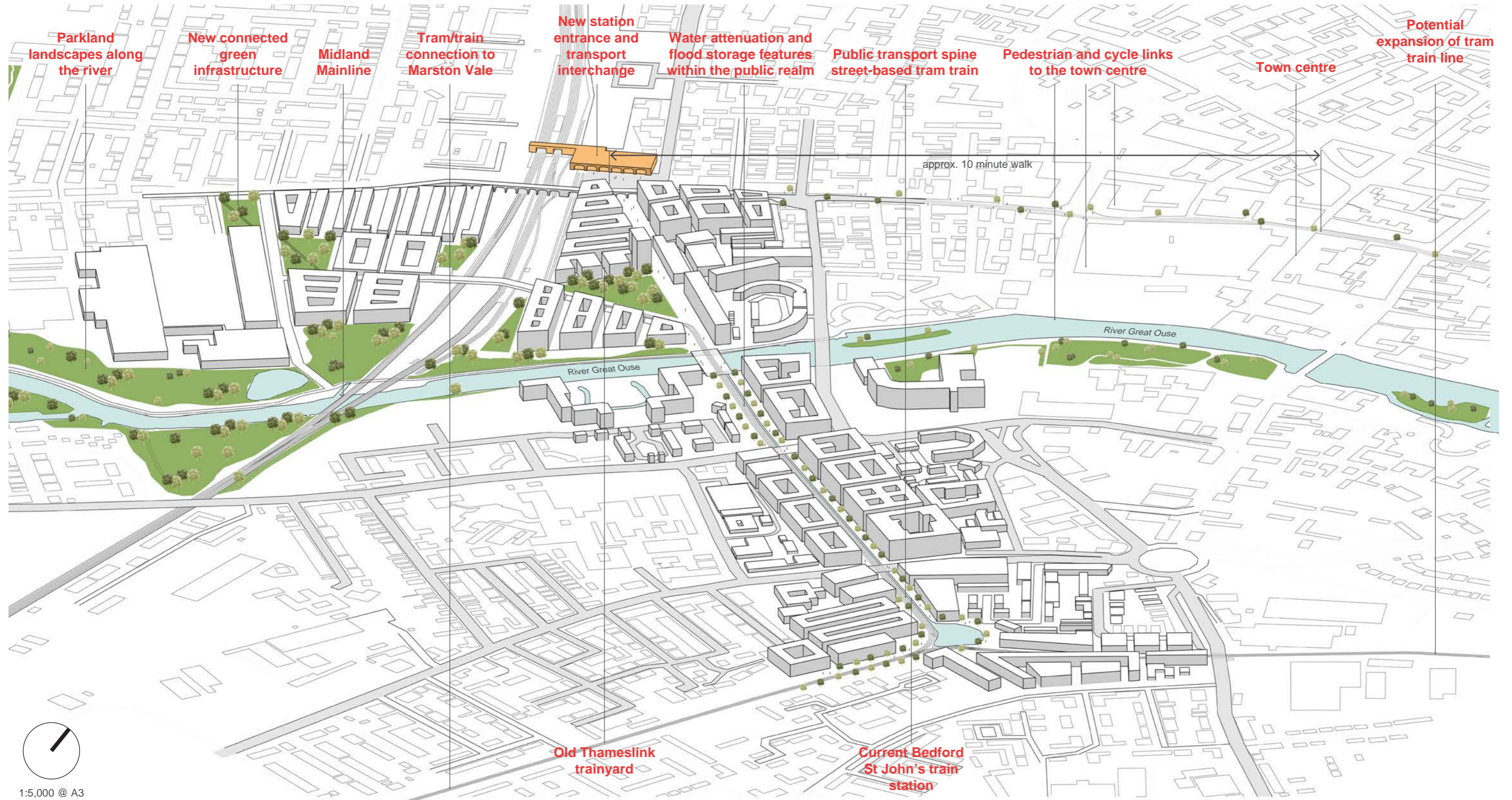


Basic and unwelcoming public transport infrastructure

Scale comparisons with Best Practice Examples (all at the same scale)



3.1. TOWN CENTRE INTENSIFICATION ILLUSTRATIVE CASE STUDY



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3.2: SUBURBAN
INTENSIFICATION



3.2. SUBURBAN INTENSIFICATION

INTRODUCTION

The majority of the area of the towns and cities within the corridor consists of 20th century suburban development.

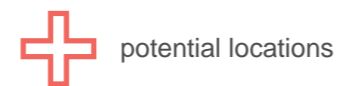
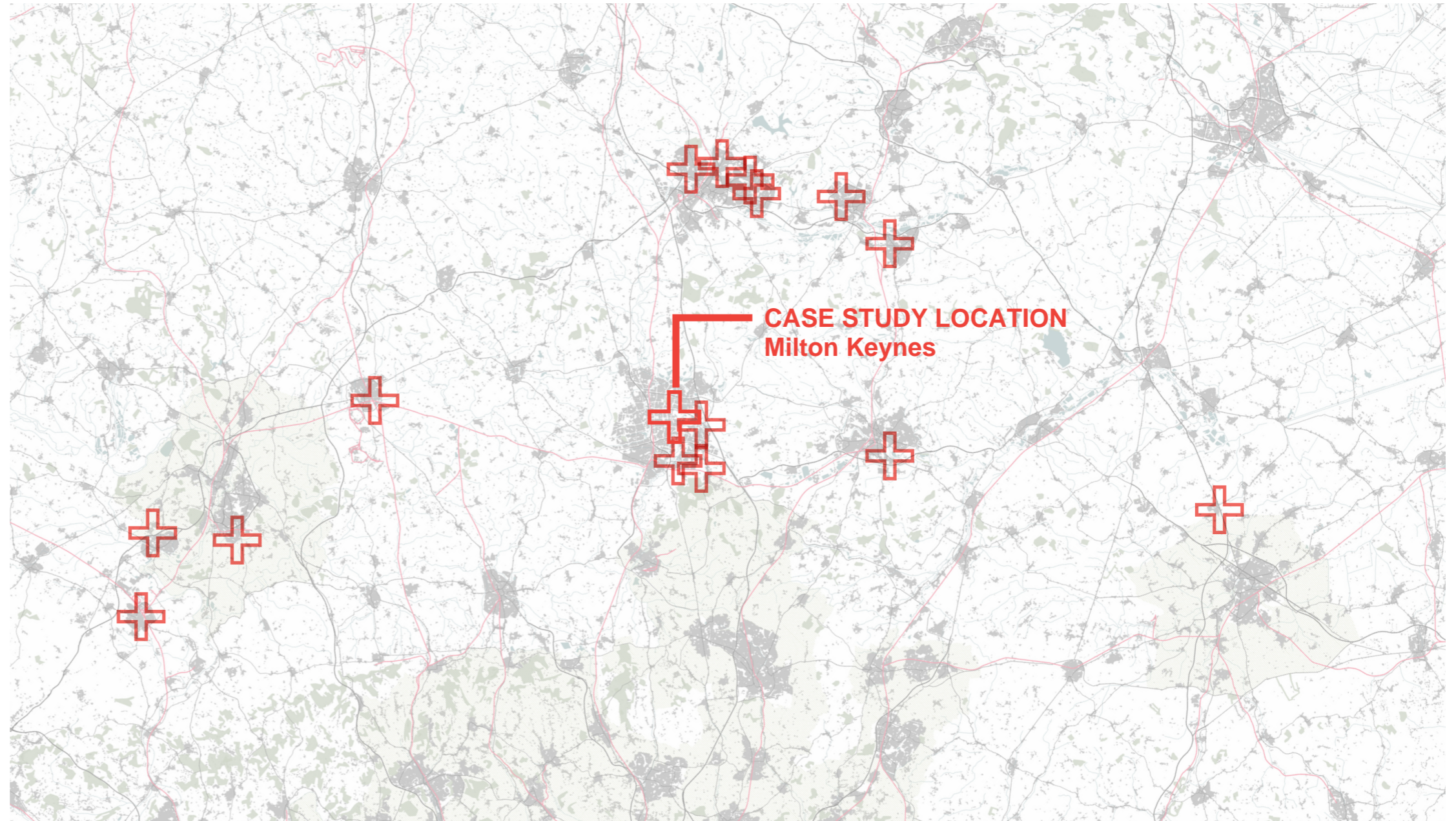
If the population increase of 1.9 million as projected in the “Transformational Scenario” were all to be accommodated within existing residential areas, this would equate to a c.60% increase in occupancy in those areas. If no new homes were to be built, average occupancy would rise from 2.4 people per home to 3.75. This would hypothetically require an extra floor on an average two storey house to provide the same amount of interior space per person, and for occupancy patterns to deviate significantly from current trends.

Co-ordinated intensification in existing suburban areas is typically very difficult, due to the prevailing urban forms and the atomised ownership patterns of this kind of development. The constraints of planning, attitudes to the preservation of amenity, and the fact that many of opportunities for incremental plot-by-plot intensification (through extensions, loft conversions or backland development, for example) have already been taken, together means that such change can only account for a small proportion of the projected overall growth within the corridor.

However, certain forms of 20th century suburban development such as open plan council housing estates, and the large areas of often underused and marginal green space around road infrastructure in the later New Towns (e.g. Northampton, Peterborough and Milton Keynes), may offer more potential. Much of this “Space Left Over After Planning” would benefit from sensitive intervention to better frame highways and open space, and remains in single, most often public, ownership, making larger-scale, coordinated development possible.

Over the following pages we illustrate the key features and potential of an approach of this type with reference to a particular location and in light of best practice examples such as Zuidas, Holland and the Carlsberg District, Copenhagen (see [Appendix D](#)). In this case the area under investigation is a transect of Milton Keynes extending east from the centre.

The drawing alongside also identifies, illustratively, a number of potential locations where this typology might be applied. These locations are speculative, based only on an initial appraisal of their fit with the essential characteristics of this typology. A comprehensive assessment of these sites has not been undertaken and would be required to validate them. Equally, this initial search is not exhaustive.



3.2. SUBURBAN INTENSIFICATION ILLUSTRATIVE CASE STUDY

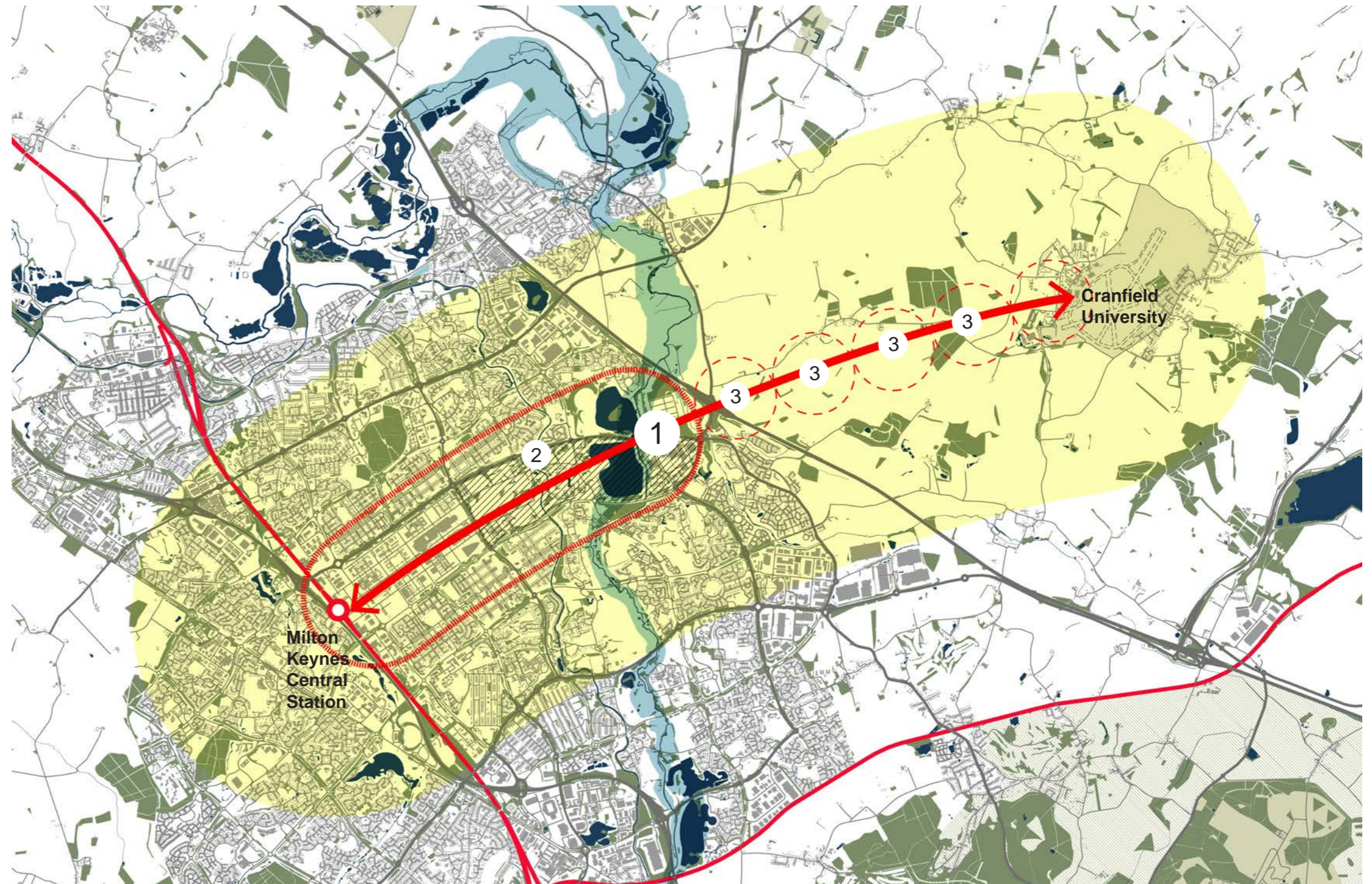
The key drivers of economic growth in Milton Keynes include its strategic location and connectivity, strong governance, housing growth and continual innovation in adding to the service offer to residents and people in the surrounding area. Over time, increasing scale has generated agglomeration benefits. Milton Keynes has experienced strong and consistent population growth over the last 20+ years: 60% in just 24 years, compared with the national average of 15%, and the rest of Oxford-Milton Keynes-Cambridge corridor of around 20%.

A stronger link to Cranfield through suburban intensification and eastwards expansion of the urban area could create the potential to generate employment growth in high technology manufacturing. Cranfield has an outstanding reputation in this area and very strong links with industry. But the growth of economic activity around the university has been hampered by its rural location and poor connectivity.

Walkable neighbourhoods and viable public transport services are difficult to be achieved at typical suburban densities. Therefore, the proposal would be to identify locations where the provision of a high quality transport spine would be co-ordinated with intensification. Ideally, these locations would have a wider strategic role, such as a connection from Central Milton Keynes to Cranfield or from Central Milton Keynes to Bletchley.

A particular opportunity in Milton Keynes may be to use autonomous vehicles on the linear route between central Milton Keynes and Cranfield - as part of one of the “stitches” identified in **Chapter 2: Spatial Framework**. The route between the station and shopping centre in Milton Keynes has already been the site for a trial of remotely controlled Autonomous Vehicles (AV) pods, operating at low speed in a pedestrian environment. Milton Keynes is also home to the Transport Systems Catapult which focuses on supporting innovation in intelligent mobility.

In addition, the recently opened Intelligent Mobility Engineering Centre at Cranfield has announced its intention to develop a Multi-User Environment for Autonomous Vehicle Innovation (MUEAVI) using the main arterial road for the University as the test site. It would be an obvious step to link the two with an AV service, once the technology has been proven in a real world environment.



KEY

1 High quality, frequent transit spine (potentially utilising Autonomous Vehicles) connecting Milton Keynes Central Station, the town centre and Cranfield University

2 Zone for suburban intensification - as investigated further in this case study

3 Other potential development locations along the Milton Keynes to Cranfield transit route - see the “New Small Settlement” typology

3.2. SUBURBAN INTENSIFICATION ILLUSTRATIVE CASE STUDY

The figure/ground drawing below shows the division between the area covered by buildings (figure, coloured grey) and open areas (ground, coloured green) for the study area (labelled 2 on the previous page).

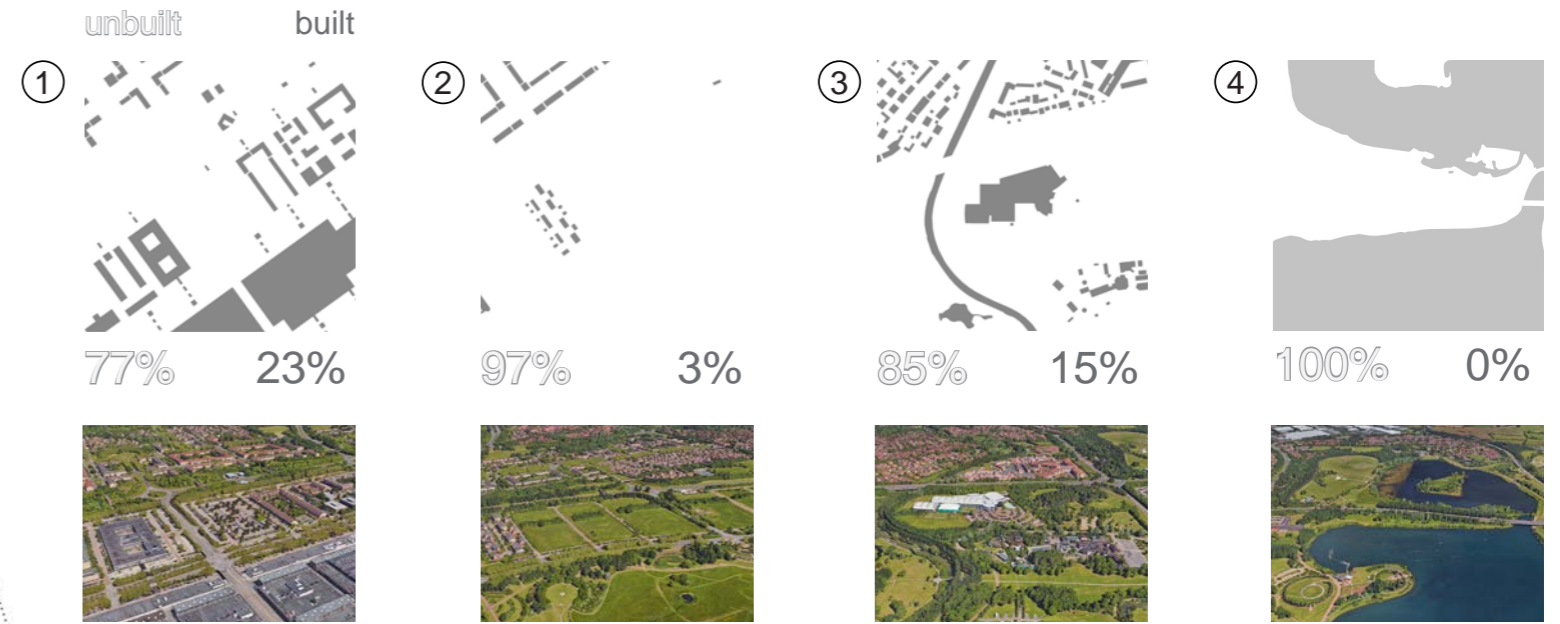
Area analysis based on this demonstrates the very low ratio of built to unbuilt land within the selected intensification corridor. Even when Campbell Park and the lakes are discounted, barely 14% of the land is occupied by building, compared to between 33% and 50% in a range of very successful urban environments elsewhere.

A range of indicative sample locations are presented alongside, and at the same scale as, a selection of comparator locations. These exemplify the kinds of higher density development that could, with appropriate master-planning and safeguarding of important functions of the existing open spaces, be inserted into the existing loose grain of buildings

Whole Area

unbuilt	built	unbuilt	built
89%	11%	86%	14%
across whole area		excluding lakes and parks	

Sample Locations



Source 01: Google Maps, 2016

Alternative Models



Utrecht University Campus, Netherlands

Source 02: Carl030nl, 2009

Novartis Campus, Basel

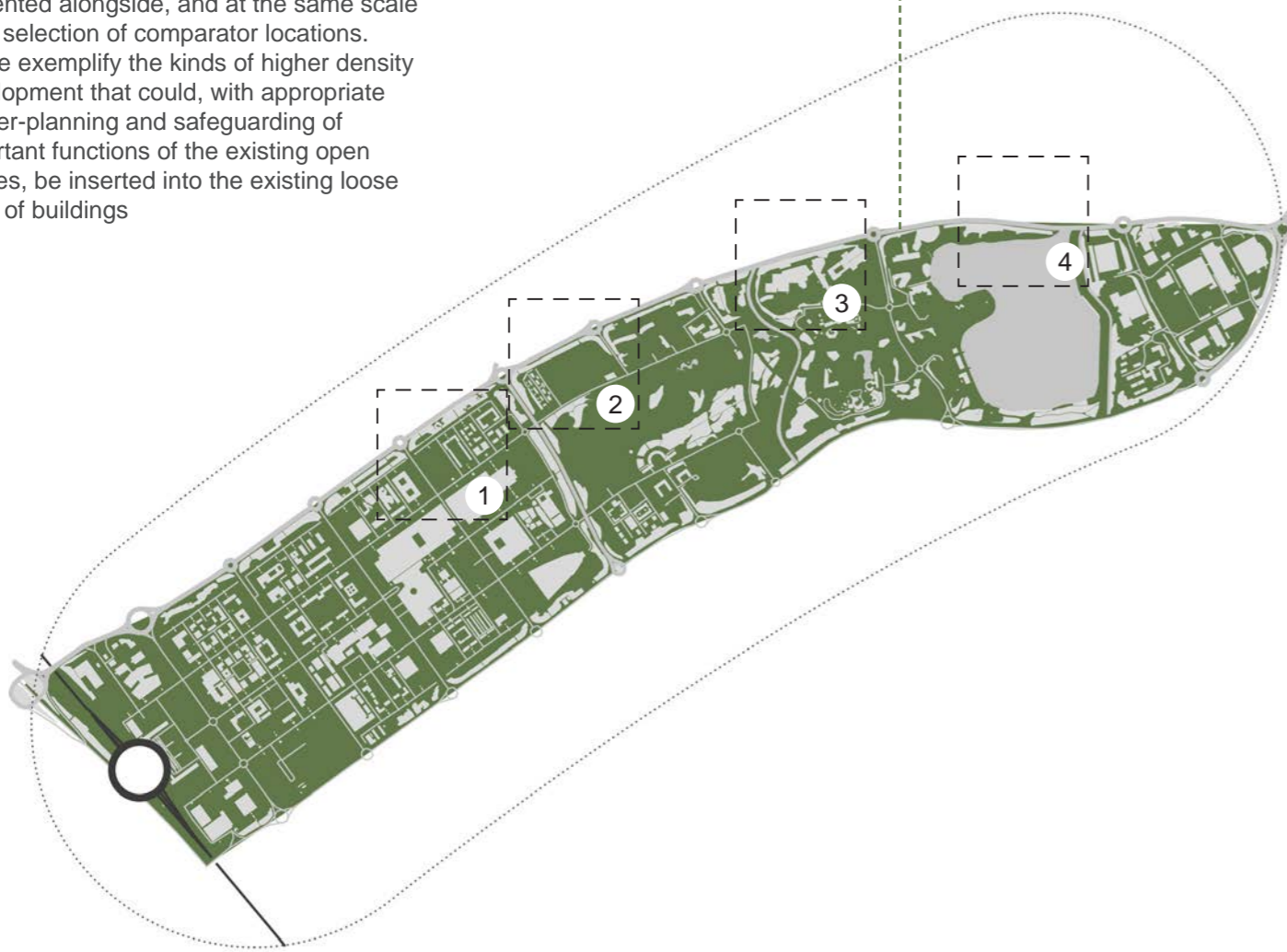
Source 03: WMM Ingenieure, No date

City Centre, Cambridge

Source 04: Deepali Shukla, 2012

Helsinki

Source 05: N/a



3.2. SUBURBAN INTENSIFICATION ILLUSTRATIVE CASE STUDY

Abundant open space is a key quality of Milton Keynes, and intensification should not mean simply the loss of greenspace. Exploration of a number of sample locations within the area described on the previous page shows that a range of potential approaches could be deployed:

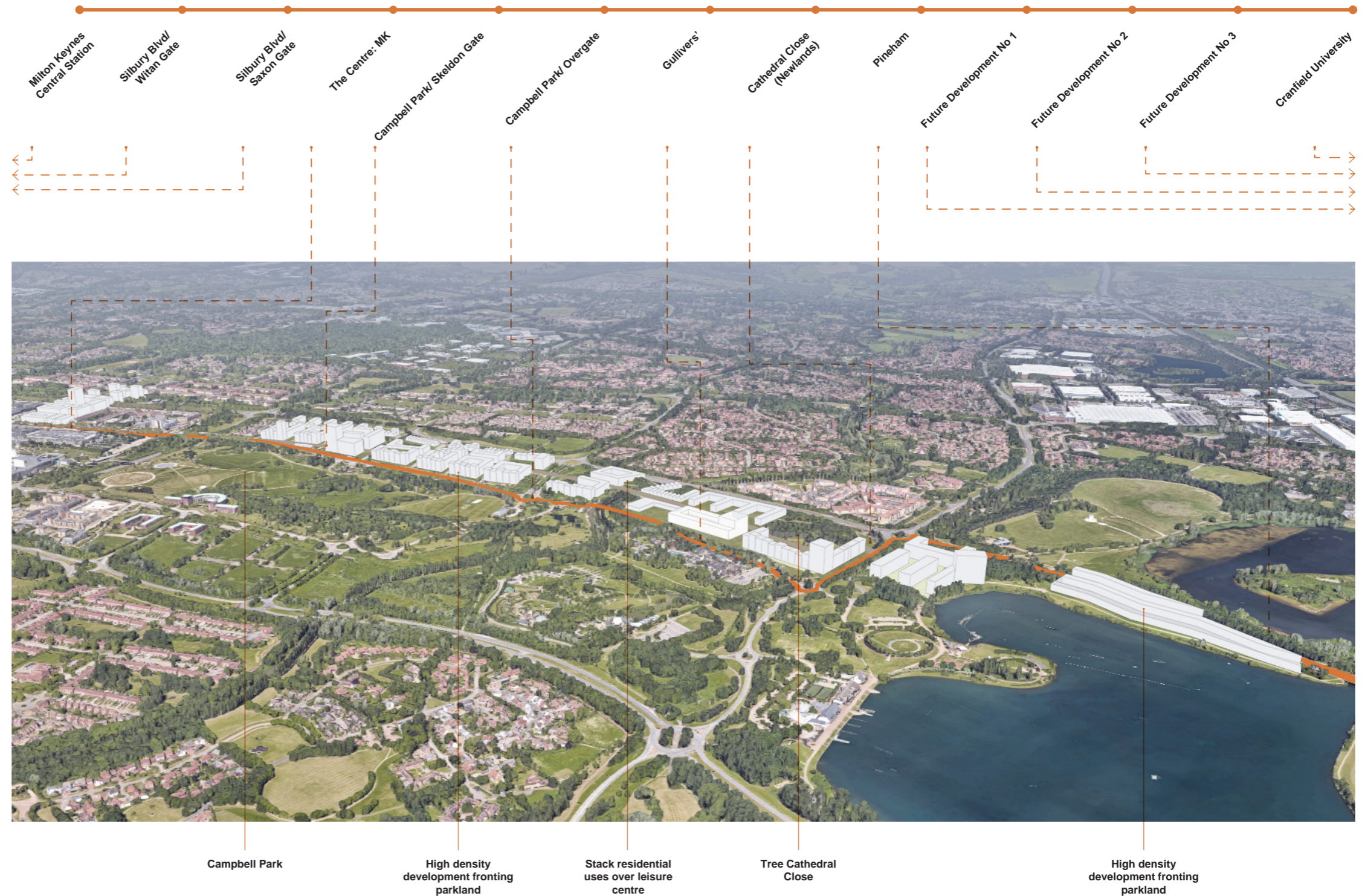
- Areas to the north of Campbell Park could be developed in an analogous way to new high density development near the main station if high quality public transport were available;
- Smarter use of existing areas of car parking could be made or by stacking residential uses over commercial or leisure uses - for example at the sports/gym complex;
- The creation of a “Cathedral Close” around the Tree Cathedral and the framing of certain open spaces, such as Campbell Park and the lakes, with bigger buildings could strengthen the relationship of green open spaces with the fabric of the city;
- While the major set-piece open spaces and grid road verges might be maintained in general, a more complex interweaving of built areas and open space could be selectively applied to help to connect existing residential areas with each other and with the centre by way of human-scaled streets, as an alternative to the pastoral redways. Homes fronting the parkland spaces would provide passive surveillance as well as benefiting from the outlook.

Rather than detracting from the quality of Milton Keynes’ green infrastructure, such moves could make its green spaces more accessible, safer, and more intensively used. They could also safeguard their financial viability, while enhancing local amenity and accessibility to public transport and mixed uses and services at the same time.

The drawing here shows that intensification may proceed in a number of different ways depending on land-ownership and current planning designations: from more intensive use of plots already allocated for development; to the infill and stacking of uses on existing commercial sites; to the re-designation of areas of existing public open space for publicly-led development.

The creation of a place-led master-plan for intensification would serve to identify these opportunities in a coordinated way and provide a strategy for delivery.

THE MILTON KEYNES “METRO” MAP

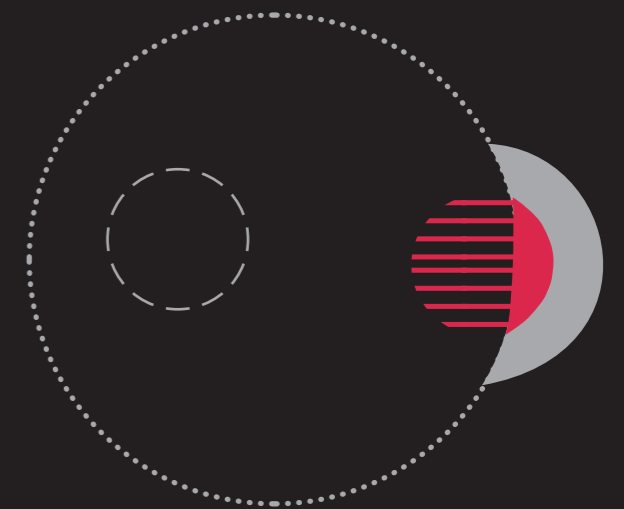


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3.3: EDGE
INTENSIFICATION



3.3. EDGE INTENSIFICATION INTRODUCTION

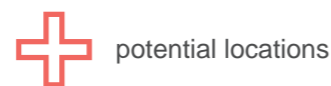
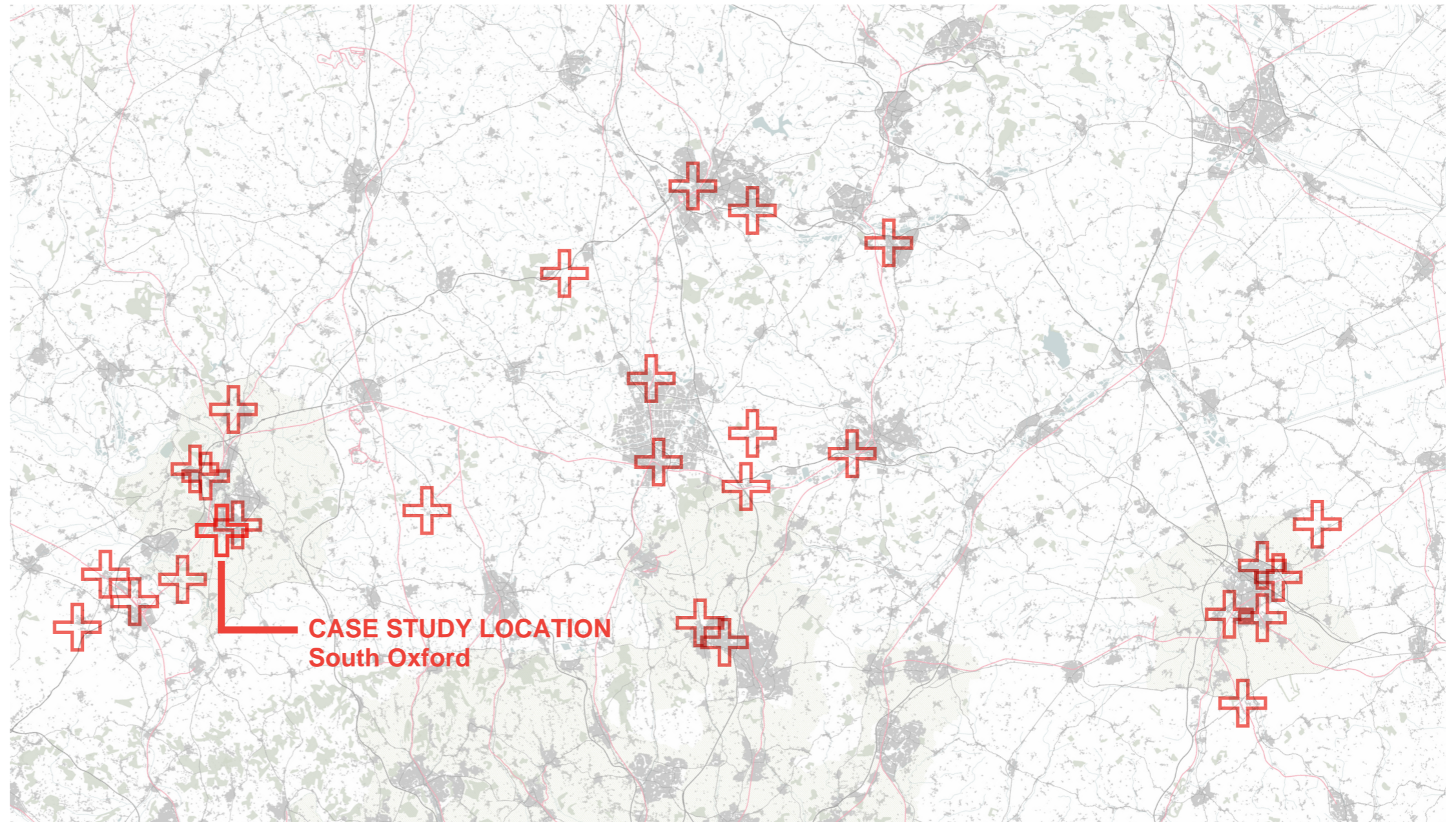
The last of the intensification series concerns the retrofitting of peripheral, low density, and currently mono-cultural employment, retail and leisure areas, to diversify their use and make more efficient use of the land.

Attitudes to the relationship between where people live and where they work are changing, towards more mixed, walkable neighbourhoods, especially for younger people, who are correspondingly less likely than ever to own a car. This can be seen internationally in the emergence of mixed use Innovation Districts in preference to isolated Science Parks. It is also visible in the resurgence in popularity and affluence of traditional mixed neighbourhoods in cities like Oxford and Cambridge, as well as in larger cities like Manchester and London, reversing the declines seen during much of the 20th century.

This typology examines the potential for certain areas at the edge of the built up area to be adapted to allow a more compact, more sustainable and more mixed urban form, in response to these trends.

Over the following pages we illustrate the key features and potential of an approach of this type, with reference to a particular location. In this case the area under investigation is South Oxford.

The drawing alongside also identifies, illustratively, a number of potential locations where this typology might be applied. These locations are speculative, based only on an initial appraisal of their fit with the essential characteristics of this typology. A comprehensive assessment of these sites has not been undertaken and would be required to validate them. Equally, this initial search is not exhaustive.

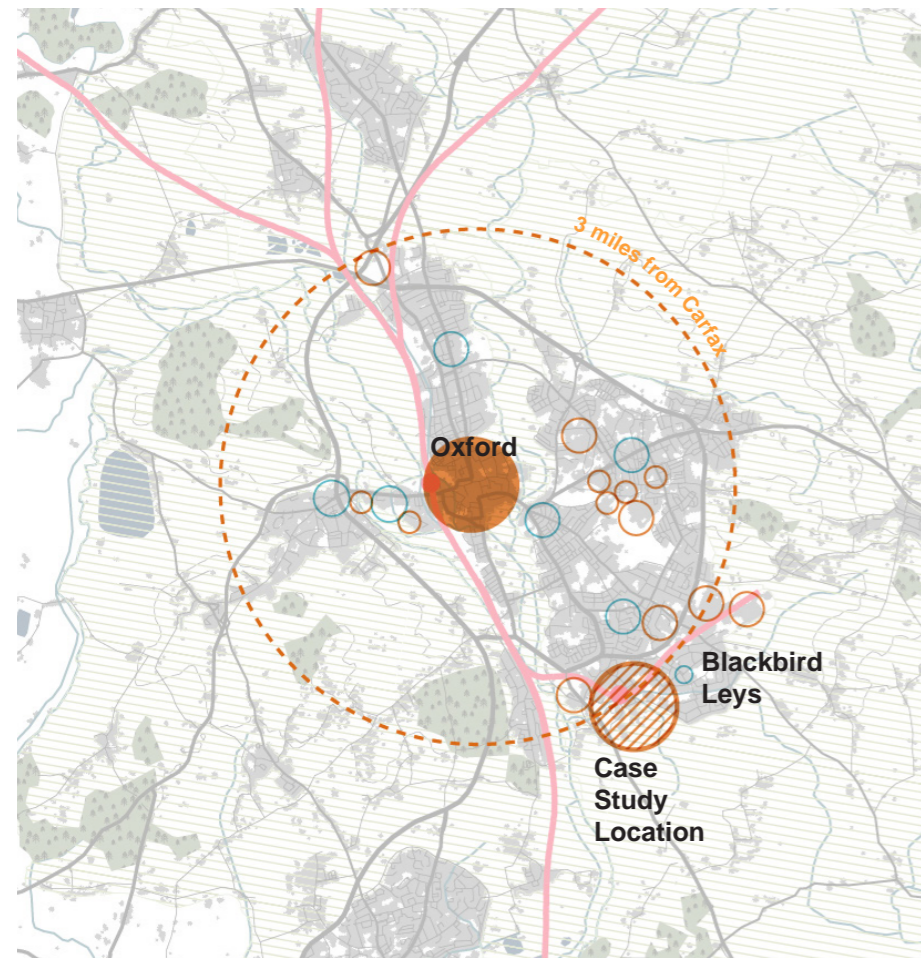


3.3. EDGE INTENSIFICATION ILLUSTRATIVE CASE STUDY

KEY ISSUES

Integration and Autonomy

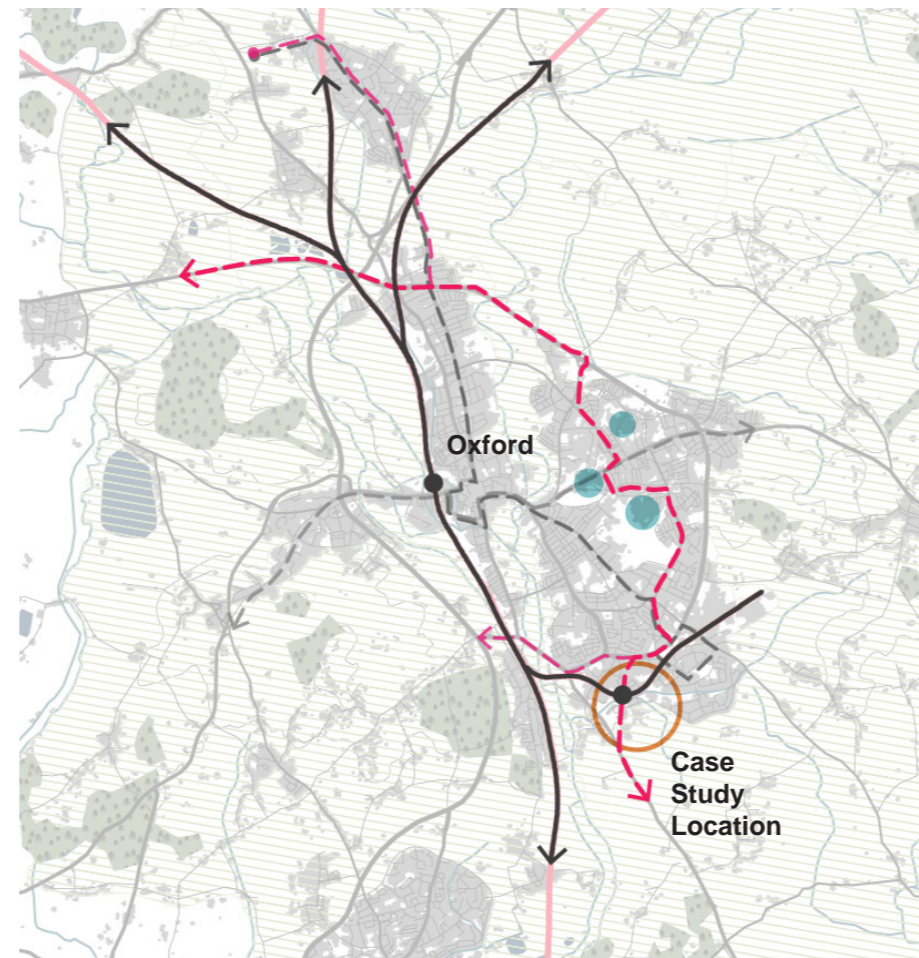
The city of Oxford consists of its historic core, and a number of suburbs built around distinct villages that were engulfed as Oxford grew. These village suburbs retain their own identity and sense-of-place to a certain extent but are well-integrated with the rest of Oxford. This balance has been harder to achieve with more recent additions that are further from the historic core, such as Blackbird Leys. The case study location is more than three miles as the crow flies from the centre of Oxford. The challenge is therefore to ensure that it would be well integrated with the rest of the city at the same time as forging its own identity, sense of place, and complimentary local centre. This could be based around a mix of uses including employment and local facilities – an Edge City rather than a suburb – to ensure a degree of self-containment and to avoid becoming merely a dormitory from where people would commute around the (already congested) ring road.



Local centres Important employment sites

Connectivity

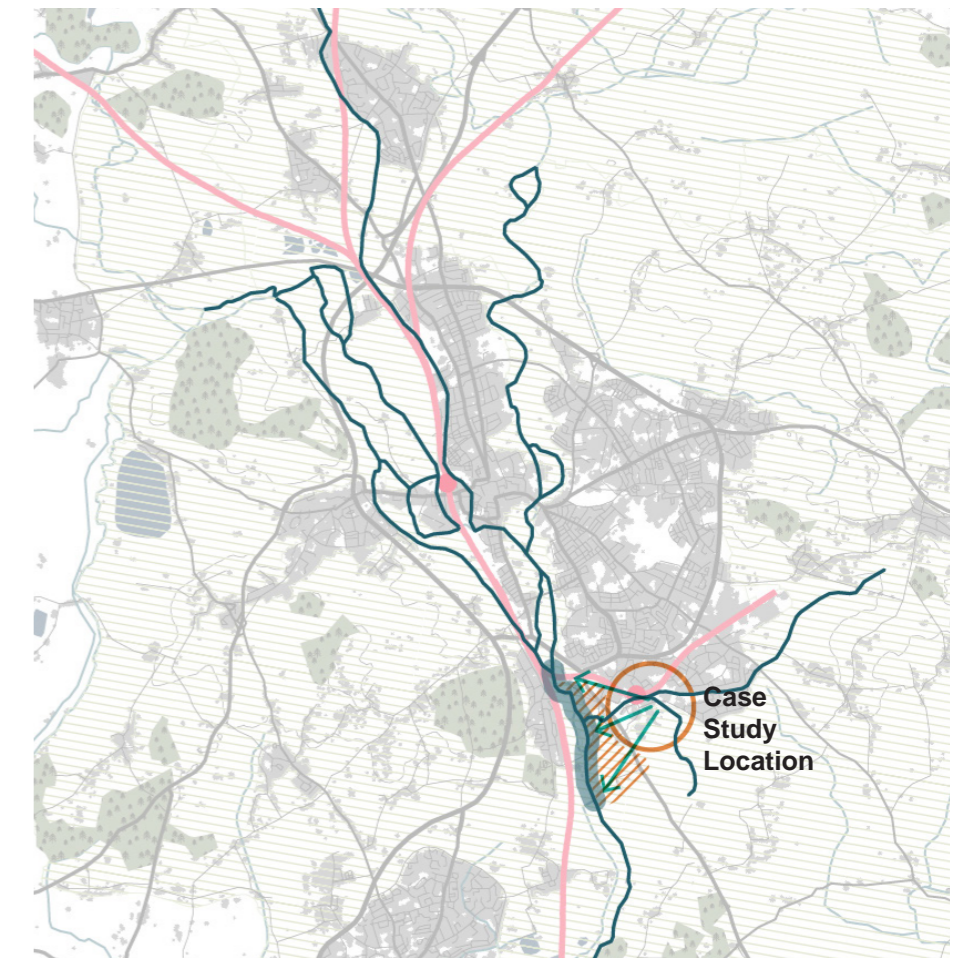
The existing Local Transport Plan proposes a series of high-quality rapid transit routes to better link residential areas in and around the city with its key employment sites. There are two proposed routes that could potentially run via the case study location. The planning and delivery of these, in tandem with the development of new stations and the Cowley branch railway line, should be co-ordinated with proposals for the southern edge to maximise the opportunity.



Hospital cluster in east Oxford

Distinctiveness

The third key asset possessed by this case study location would be its relative proximity to the Thames. Oxford is a city defined by the presence of its rivers and their flood plains. The possibility of a primary connection from the site to the river and its riverside pub at Sandford should not be missed.



3.3. EDGE INTENSIFICATION ILLUSTRATIVE CASE STUDY

Green belt designation and political and policy differences between adjoining local authorities have constrained growth on the southern edge of Oxford (and around Oxford in general). Together with congestion on the Oxford ring road and A34, in turn reduced its attractiveness.

During the course of this study, Magdalen College and Thames Water have begun consulting on the idea of development on the southern edge of Oxford beyond the existing edge of the city and within the green belt (overview - right). Their initial proposals appear to perpetuate car-oriented suburban housing models for the residential component, and traditional low-density pavilions in car park/parkland office typologies for the employment areas.

Meanwhile, within the existing urban extent of the city, in areas free from green belt restrictions, there are large areas of unused or under-utilised space among and around the existing retail parks, utility compounds, and employment areas that line the southern edge of the city. These can be seen in the figure/ground plan below. The coarse grain of these sites, along with the severance of the railway line and ring road, currently form a barrier to

connections into the rest of Oxford to the north. The public realm is variable in quality, but it is mostly lifeless and engineered for vehicle movement rather than walking and cycling, making it an inhospitable environment.

Despite these challenges, the Oxford Science Park has successfully attracted a range of technology users over a period of 25 years. This was primarily in the areas of bioscience (40% of occupiers, including Circassia, one of four bioscience companies in Oxfordshire valued at over US\$1bn), and computer hardware and software companies (30% of occupiers, including for example Sharp laboratories). It now has around 50,000 m² of developed space and some room for additional development. The available area could be substantially increased if a more urban development model were adopted as per this typology.

The prospect of a major improvement in connectivity afforded by the re-opening of the southern rail loop from Oxford station for passengers could be a catalyst for the expansion and intensification of this area.



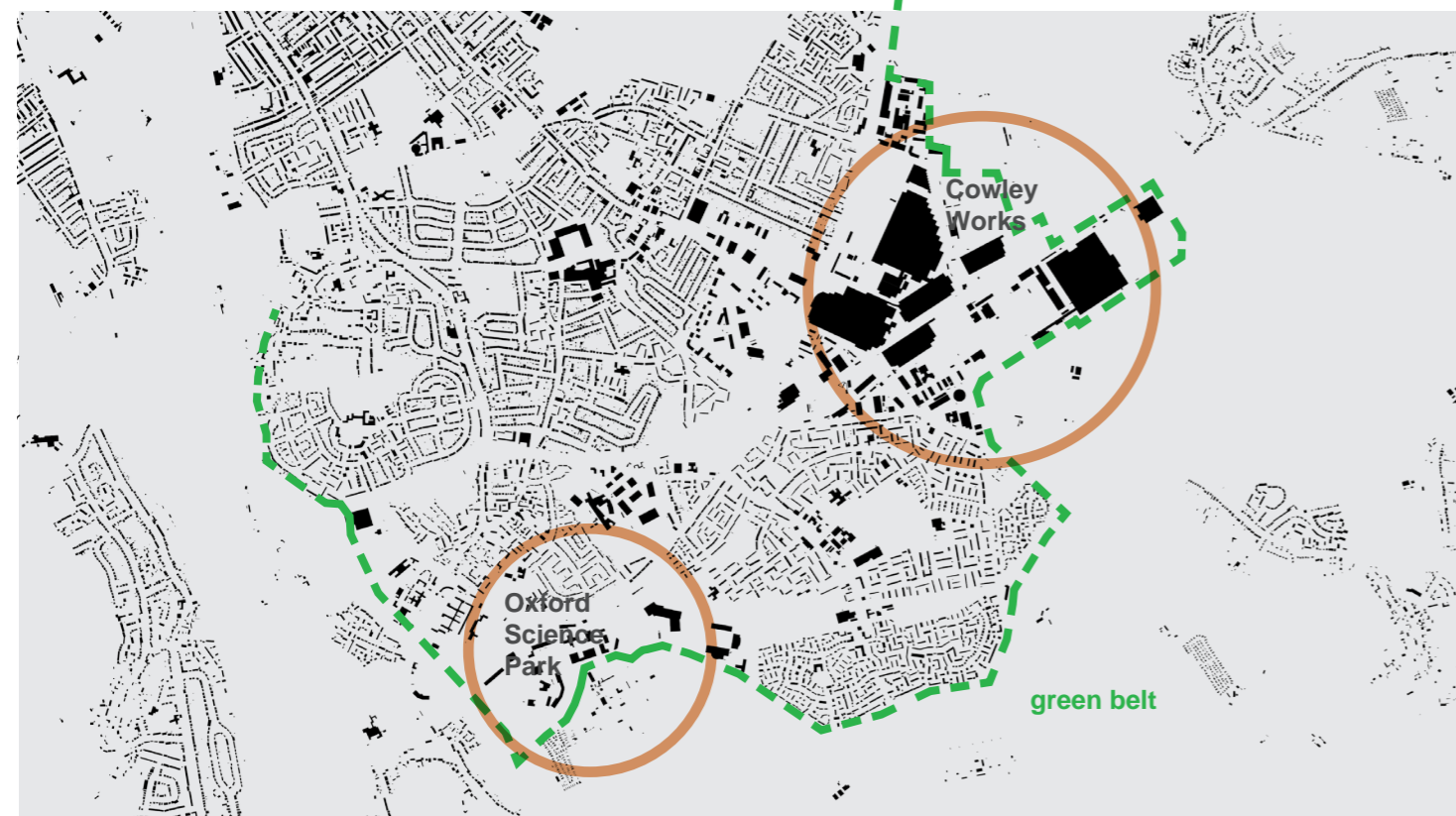
South Oxford Science Village consultation image: "An impression of what South Oxford Science Village could look like"

Source 06: SOSV, (2017)



Car park near the Kassam Stadium - looking towards the greenbelt, beyond the trees. Google Maps, (2016)

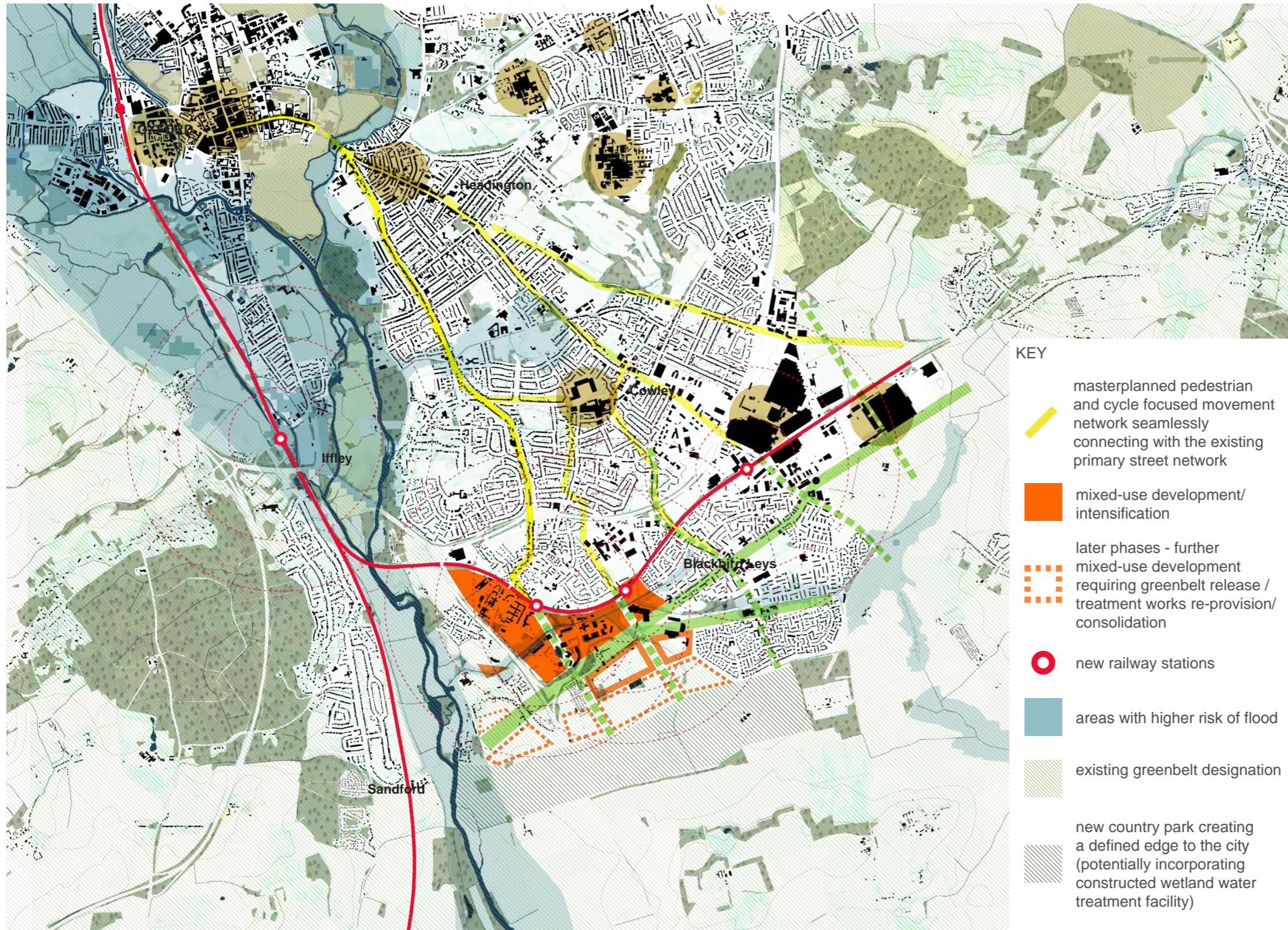
Source 07: Google Maps, (2016)










Oxford Science Park main roundabout street view. Google Maps, (2016)

Source 08: Google Maps, (2016)

3.3. EDGE INTENSIFICATION ILLUSTRATIVE CASE STUDY



- KEY**
-  masterplanned pedestrian and cycle focused movement network seamlessly connecting with the existing primary street network
 -  mixed-use development/intensification
 -  later phases - further mixed-use development requiring greenbelt release / treatment works re-provision/consolidation
 -  new railway stations
 -  areas with higher risk of flood
 -  existing greenbelt designation
 -  new country park creating a defined edge to the city (potentially incorporating constructed wetland water treatment facility)

New innovative environments for high tech firms are increasingly built at much higher densities and in a mixed-use setting. Such approaches encourage the scope for retail, restaurants and other services to be available on the site. These environments are relatively rare across the corridor at the moment. Hence, providing these sorts of environments would be vital in terms of ensuring future competitiveness on the global stage.

Retrofitting of the low density Oxford Science Park and the retail and leisure park around the football ground could form the nucleus of a new mixed town centre. Connectivity with the city centre, hospitals and Culham/Didcot/Harwell to the south could be strengthened with a new station on a reopened Cowley Branch and an interchange with stops on the County Council's proposed transit network. This location would therefore become another key node not dissimilar in scale to the historic core, within the polycentric city that Oxford has become.

Higher density residential development would be justified given the mix of uses and access to public transport. This means that a quantum of development equivalent to that in South Oxford Science Village proposals could be achieved in a smaller area. The result would be lesser greenbelt impact and making neighbourhoods better suited to walking and cycling.

A similar approach could be taken to the area around the BMW Mini Plant, much of which is extensive open storage/parking areas. This open storage could be potentially re-accommodated in spectacular parking structures beside the road. Structures similar perhaps to those at the Volkswagen factory in Wolfsburg (image below) would free up areas for alternative uses without incursion into the green belt.



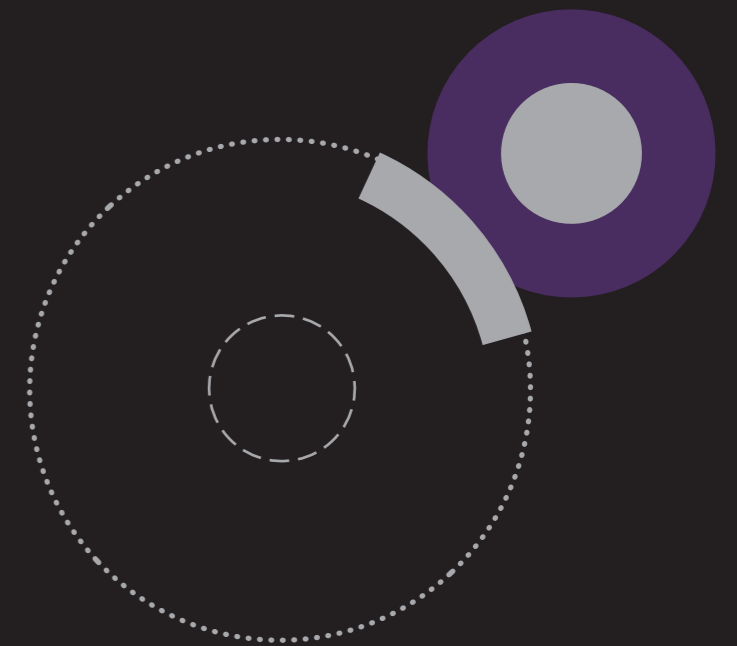
Source 09: Bernd, (2009)

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3.4: STRONG EDGE
AND SATELLITE



3.4. STRONG EDGE AND SATELLITE INTRODUCTION


This type of development is a satellite settlement distinct from, but closely linked to, a neighbouring existing place. The distance out may vary, but the quality of the connection to the city is vital. The separation of the settlement, as opposed to it being directly connected to the host city, may be due to constraints on growth at the edge of the city itself. Some examples are flood plains or green belt designation, or because of the suitability of particular locations of radial public transport routes.

As with the Edge Intensification / Edge City typology, it is important that locations developed according to this typology have their own identity, sense of place, and local facilities (appropriate for the scale of the settlement) within walking/cycling distance, as well as having a primary connection to key locations within the host settlement..

Over the following pages we illustrate the key features and potential of an approach of this type with reference to a particular location. In this case the area used as a case study is to the north of Oxford, as indicated on the drawing here.

The drawing alongside also identifies, illustratively, a number of potential locations where this typology might be applied. These locations are speculative, based only on an initial appraisal of their fit with the essential characteristics of this typology. A comprehensive assessment of these sites has not been undertaken and would be required to validate them. Equally, this initial search is not exhaustive.



 potential locations

3.4. STRONG EDGE AND SATELLITE ILLUSTRATIVE CASE STUDY

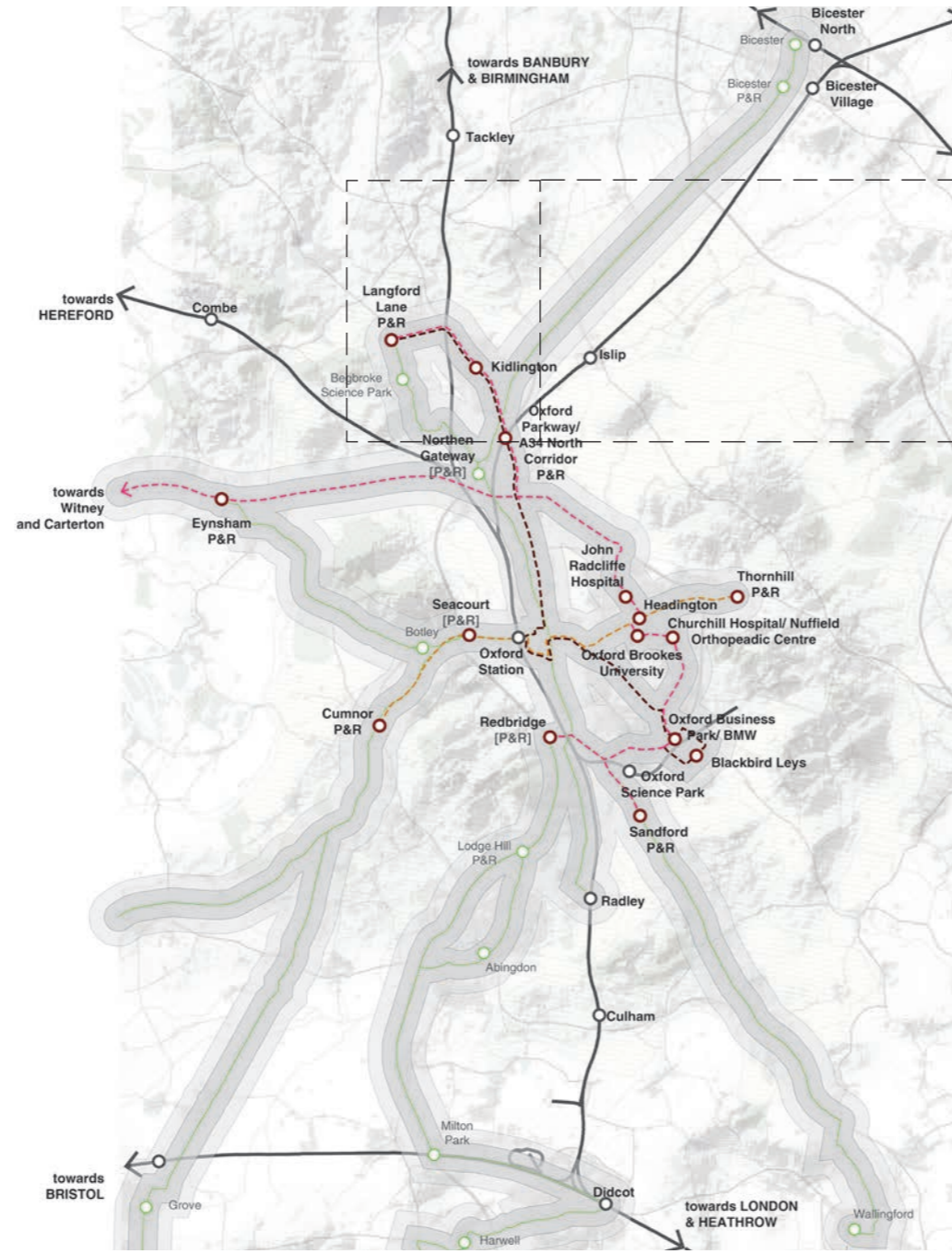
Oxford North has outstanding potential to support growth of Oxfordshire's science and technology cluster. The cluster is already large, diverse and dynamic, and comparable in scale to the Cambridge cluster. The economic benefits that could be derived from developing Oxford North for a mix of employment and housing uses result from:

- The area's proximity and accessibility to the two universities and two major teaching hospitals in Oxford. The area may be particularly suited to meeting the long term expansion needs of Oxford University;
- The existing assets to support the technology cluster already located in the area, including Begbroke Science Park, the new Oxford Parkway station, Oxford airport and Oxford Technology Park;
- The planned development of the Oxford Northern Gateway site (which now benefits from an approved Oxford City Council Area Action Plan), and Eynsham Garden Village (which has the active support of West Oxfordshire District Council), both for a mix of high density research and residential uses;
- Land ownership in the area is mainly in the hands of Oxford University and its Colleges, which should be supportive of appropriate development;
- Relatively supportive governance – Oxford City and primarily Cherwell Council are both supportive of growth, though cognisant of significant green belt and environmental constraints in this area.

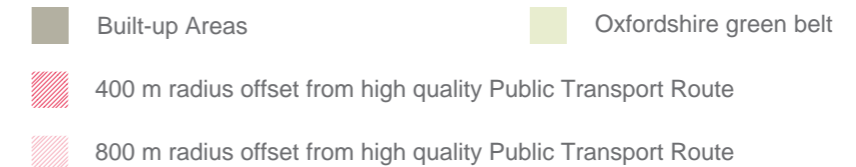
This background, combined with the County Council's proposals for high quality transit routes to run from the airport into Oxford, would make this area an ideal location for development were it not for its designation as green belt.

This typology is therefore relevant because, in avoiding continuous concentric or linear urbanisation and sprawl, it may be possible to insert the satellite typology into sensitive landscape or green belt locations without undermining the function of the green belt or compact nature of the host city. Versions of this strategy already form the basis of a proportion of historic and planned growth around Oxford and Cambridge, with more or less success in terms of providing supporting public transport infrastructure.

POTENTIAL FUTURE PUBLIC TRANSPORT NETWORK...



...OVERLAID ON THE GREEN BELT

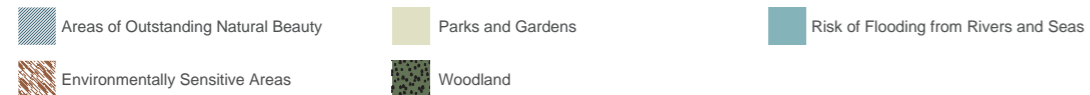
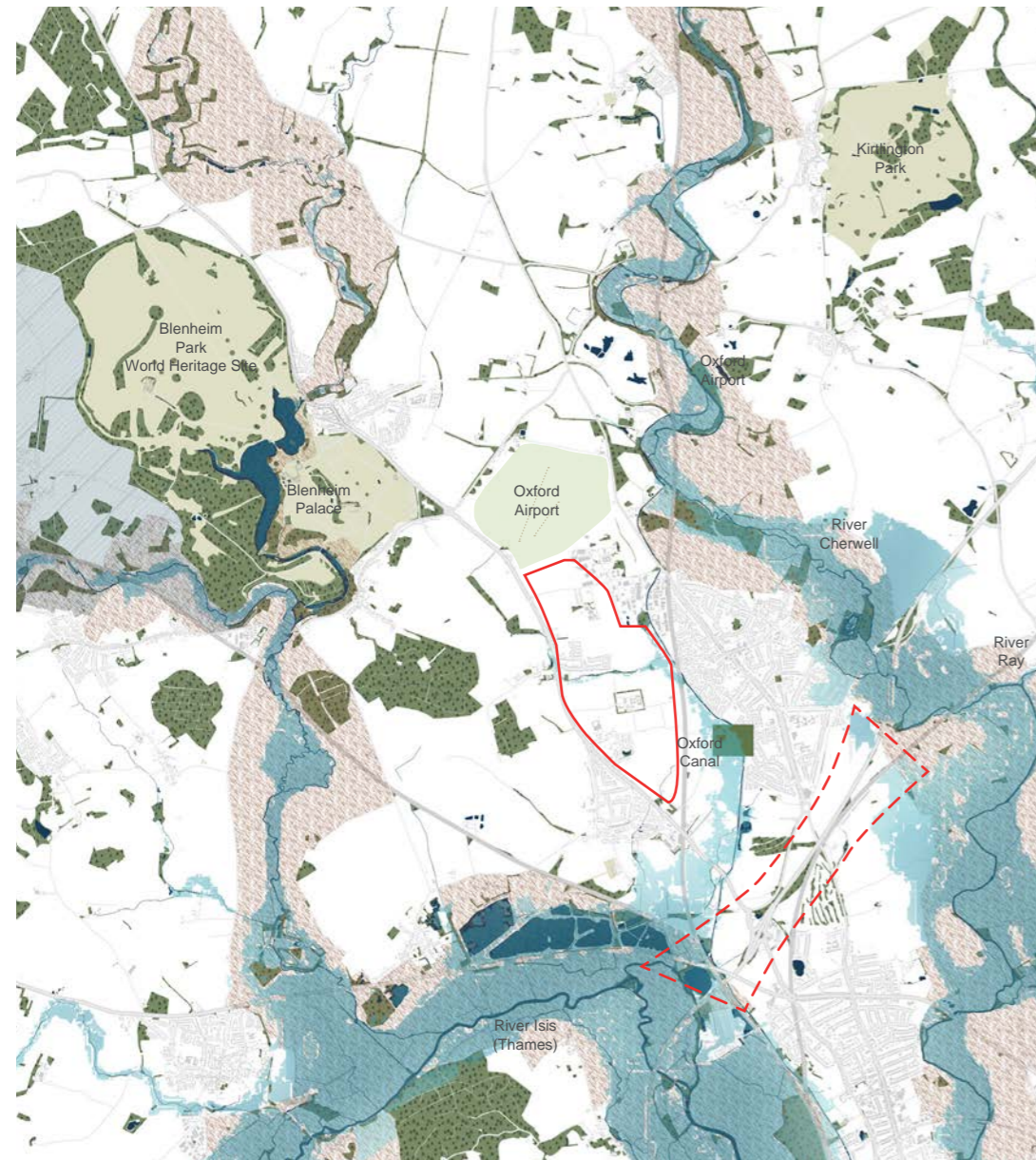


3.4. STRONG EDGE AND SATELLITE ILLUSTRATIVE CASE STUDY

Despite the contentious nature of this issue, we shouldn't negate rational discussion of strategies regarding this topic, particularly when similar approaches have been successfully deployed elsewhere. Cambridge's Southern Fringe is the prominent example, which is also part of the corridor geography under investigation in this study.

The concept on the following page was developed out of an understanding of the landscape context, its associated constraints and opportunities, and a spatial (design- and landscape-led) assessment of where intervening in the green belt would not negatively impact, and indeed could provide a net benefit, on the function of the green belt.

NATURAL ASSETS AND ENVIRONMENTAL CONSTRAINTS



ANALYSIS



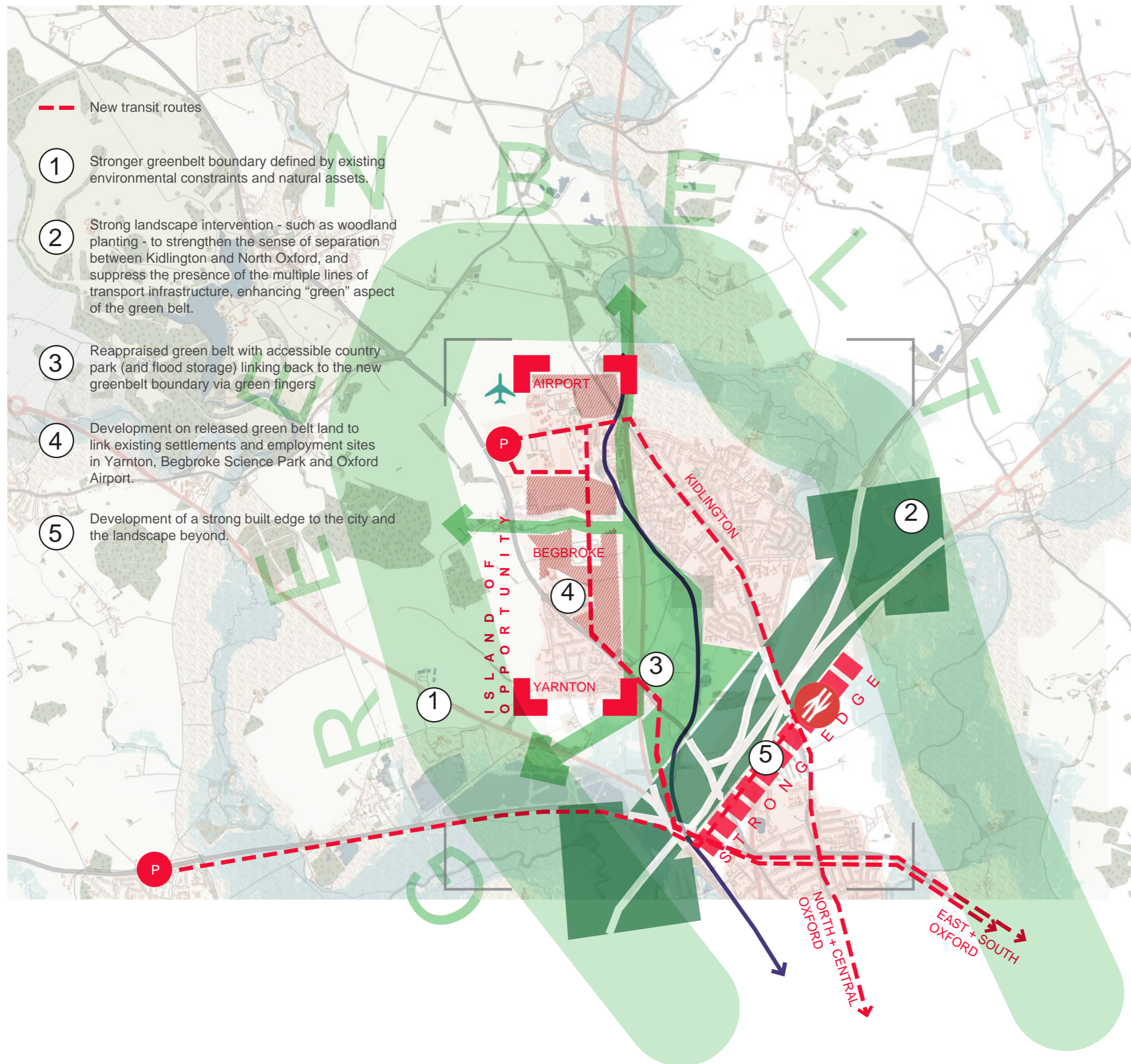
- 1 Fragmented and enclosed greenbelt area
- 2 Greenbelt purpose superseded through the imposition of multiple lines of infrastructure



1. Aerial view of Yarnton towards the north
Source 10: Google Maps, 2016



2. Aerial view of the infrastructure-fragmented edge and area between Oxford and Kidlington.
Source 11: Google Maps, 2016



- New transit routes
- ① Stronger greenbelt boundary defined by existing environmental constraints and natural assets.
- ② Strong landscape intervention - such as woodland planting - to strengthen the sense of separation between Kidlington and North Oxford, and suppress the presence of the multiple lines of transport infrastructure, enhancing "green" aspect of the green belt.
- ③ Reappraised green belt with accessible country park (and flood storage) linking back to the new greenbelt boundary via green fingers
- ④ Development on released green belt land to link existing settlements and employment sites in Yarnton, Begbroke Science Park and Oxford Airport.
- ⑤ Development of a strong built edge to the city and the landscape beyond.

ILLUSTRATIVE CASE STUDY

This case study illustrates development in one of the few areas around the city that are not subject to fluvial flooding: historically the dominant determinant of urban form in Oxford. It is also located where there could be significant potential to reappraise the greenbelt to better support its core functions through spatial/design-led approach to landscape.

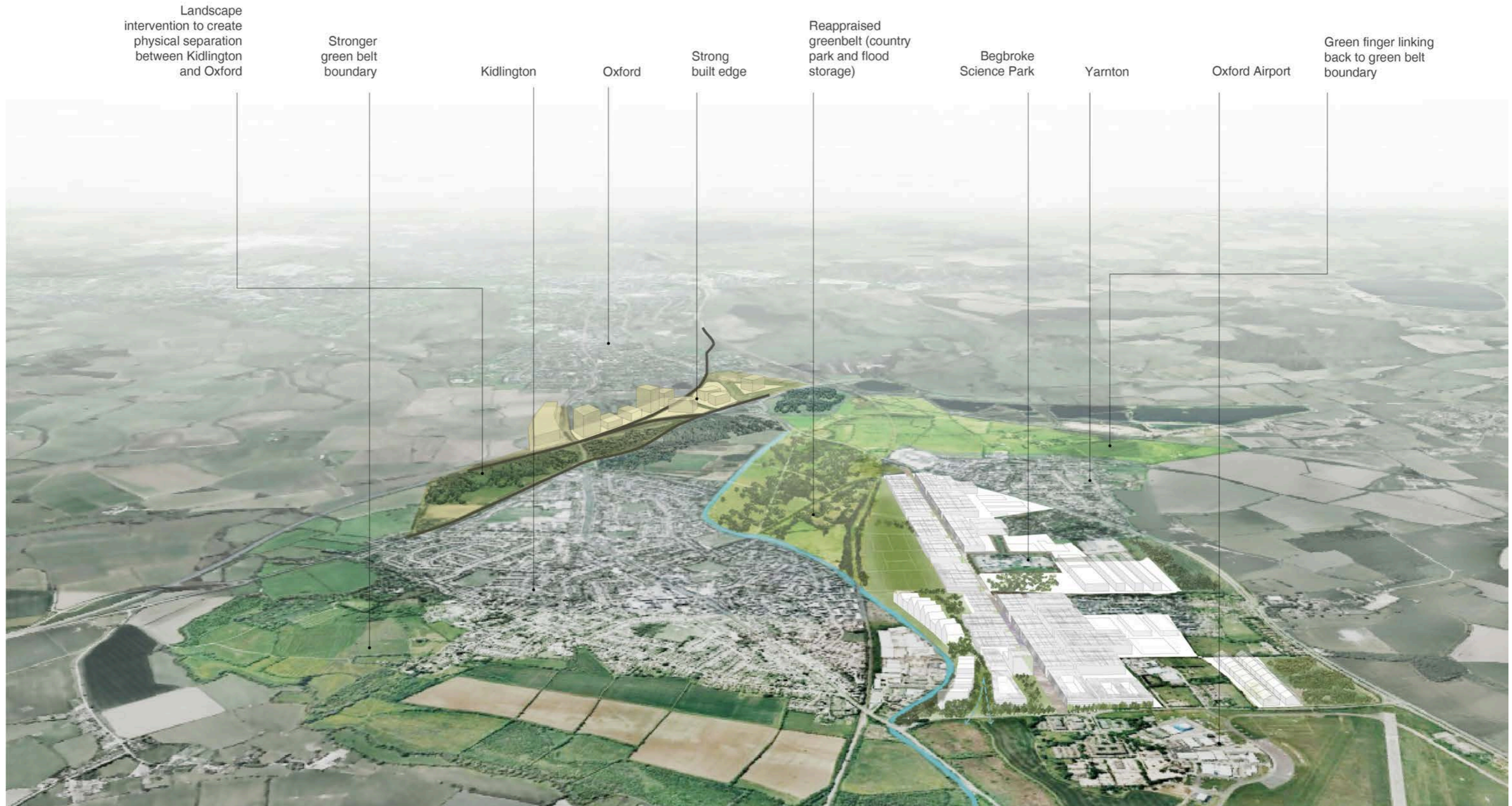
The settlement typology is based on aspects of the Riesefeld and Cambridge Southern Fringe best practice examples detailed in [Appendix D](#):

- The settlement would be structured around a central public transport street, with high quality services linking to key areas in the neighbouring host city provided from the outset;
- Most public / active uses would be located along this spine route with a simple network of streets running perpendicular from this spine to quieter residential areas either side;
- A deliberately urban character to the built area set in contrast to the open spaces of an accessible country park beyond;
- In both cases a simple, over-arching master plan would allow the creation of a legible, permeable and efficient transport and street network.

Any settlement would co-opt and allow the expansion of the existing employment areas around the airport and Begbroke Science Park. Creating a mixed-use district would build sufficient critical mass to support a high quality transit connection to the new parkway station, the city centre and the employment cluster in east Oxford. It would ensure that the settlement could operate as an integral part of the wider city, while remaining physically distinct from it.

The aim of the landscape strategies outlined in the drawing alongside would be to maintain or strengthen the function of the green belt. Despite carefully selected areas being removed from it, the strategy would seek to make parts of the remaining green belt more accessible and useful for existing and new residents. No net loss of greenbelt could potentially be achieved, if justified, by newly designating sensitive areas elsewhere.

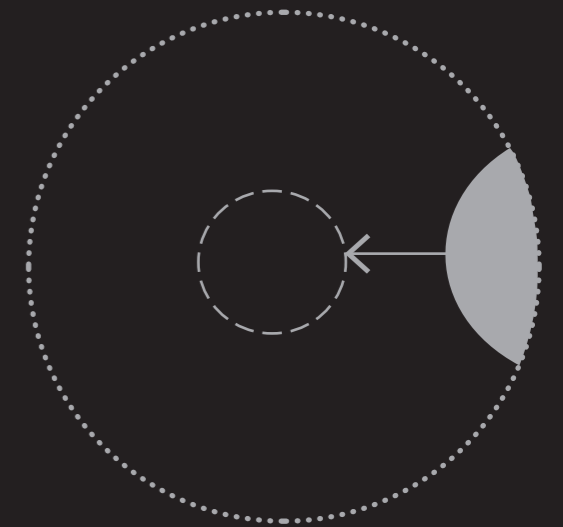
3.4. STRONG EDGE AND SATELLITE ILLUSTRATIVE CASE STUDY



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**3.5: COMPACT CITY -
URBAN EXTENSION**



3.5. COMPACT CITY - URBAN EXTENSION

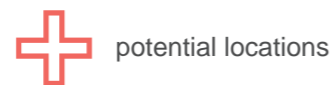
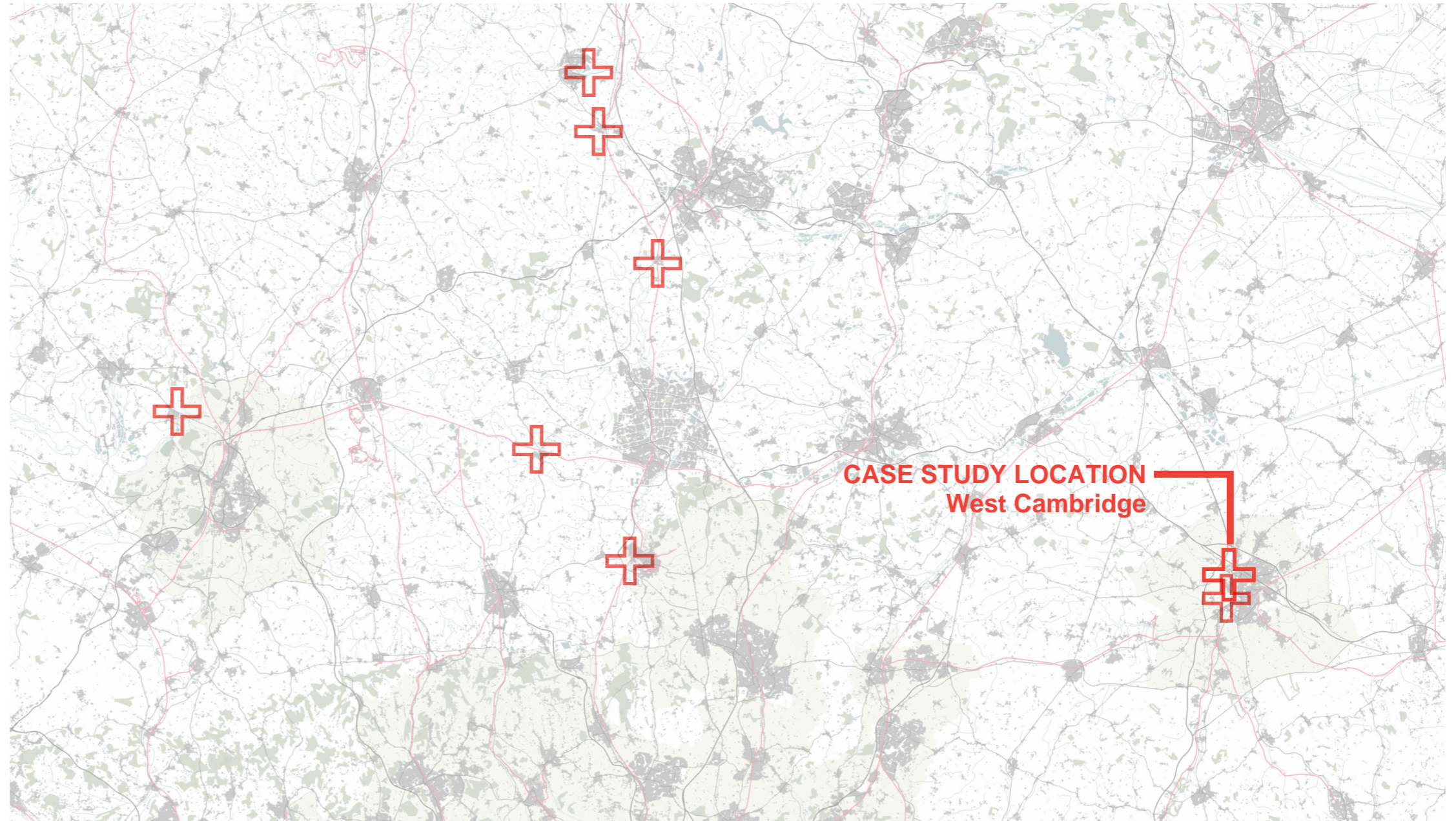
INTRODUCTION

This typology is a direct extension of an existing town or city. Most contemporary urban extensions are, following successive waves of expansion, far away from the centre of the host place, and often separated by tracts of impermeable suburban development. This is problematic because the degree of integration between the two is a key factor in determining, for instance, the likelihood of residents establishing more sustainable and healthier patterns of movement around the city (i.e. not having to rely on the car).

While there are probably relatively few opportunities of this sort left, the potential of this typology is to engender a compact city model. A development linked to the existing town centre, principally by convenient and quick walking and cycling routes, that actively discourages motor transport.

Over the following pages we illustrate the key features and potential of an approach of this type, with reference to a particular location. In this case the area used as a case study is West Cambridge, as indicated on the drawing here.

The drawing alongside also identifies, illustratively, a number of potential locations where this typology might also be applied. These locations are speculative, based only on an initial appraisal of their fit with the essential characteristics of this typology. A comprehensive assessment of these sites has not been undertaken and would be required to validate them. Equally this initial search is not exhaustive.



3.5. COMPACT CITY - URBAN EXTENSION

ILLUSTRATIVE CASE STUDY

The University's expansion into the West and North West Cambridge sites is a huge driver for growth, particularly of research-based businesses with links to the science and engineering departments that are being relocated to the West Cambridge campus. The area already accommodates Schlumberger's European research facility and has attracted Microsoft Research to co-locate alongside the new University Computer Laboratory. The proximity of this area to the Addenbrooke's site is also important. This site has become an extraordinarily successful magnet for bioscience firms and research institutes, though orbital public transport needs to be improved. Excellent access to the M11 is also a major attraction for firms, particularly given Cambridge's reputation for congestion.

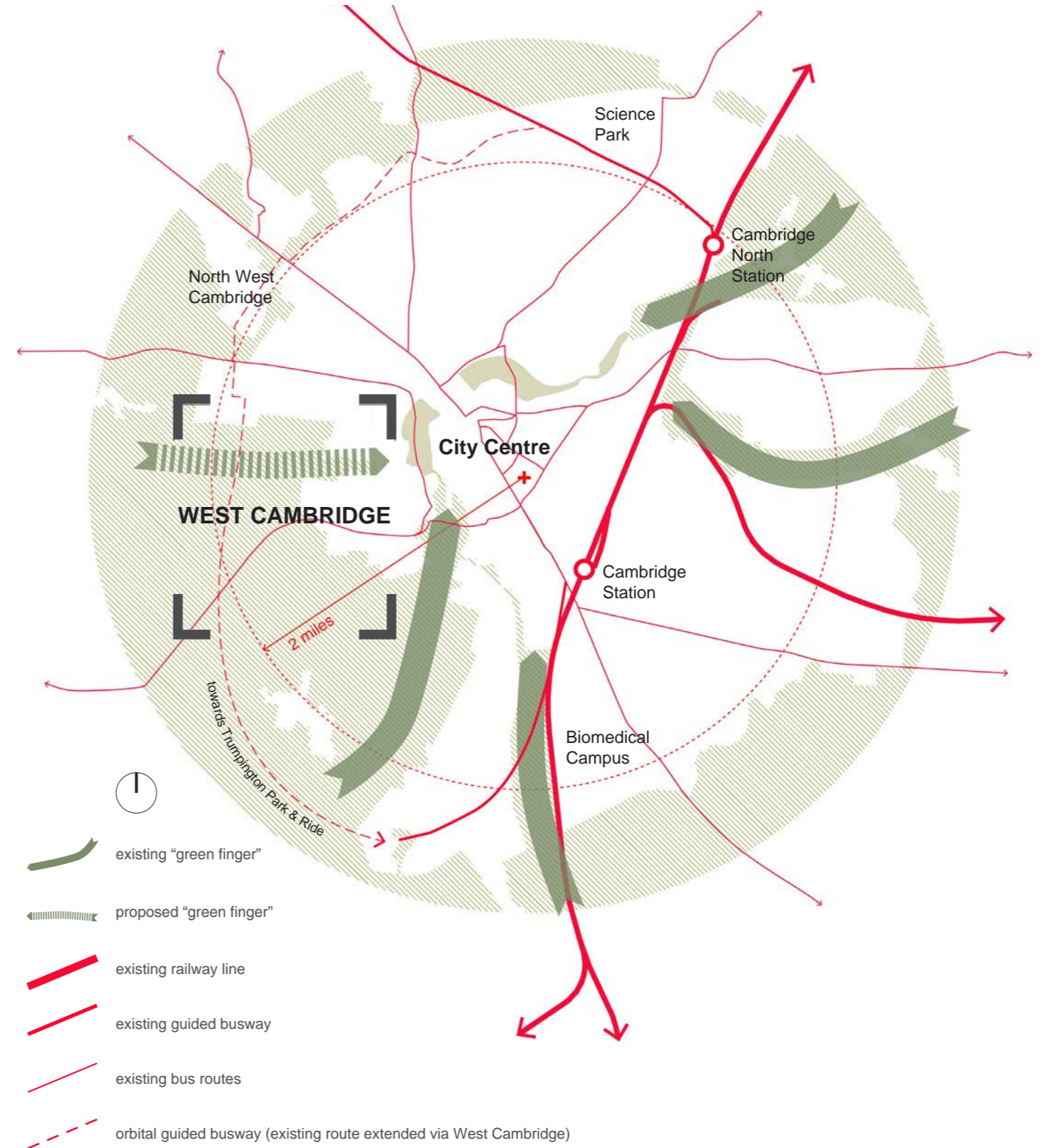
However, if west Cambridge was to accommodate additional housing and economic development, then lessons would need to be learnt from the existing West and North-West Cambridge sites. In particular, the low density and layout of development in West Cambridge proved unpopular, as demonstrated by Microsoft Research's move from the site to a new office in CB1. A major motivation for that move was the ability to offer a livelier working environment and closer transport links for Microsoft staff.

The drawing here shows that while Cambridge has grown relatively evenly outwards to the north, east and south, this is not the case to a distance of between 2 and 2.5 miles to the west and south-west of the city centre.

Previous iterations of the Local Plan brokered an adjustment of the green belt boundary on the southern and eastern edges of the city in order to deliver sustainable development sites close to the city. In these cases, the loss of green belt area was compensated through the definition of "green fingers" in the tradition of the commons and meadows that are part of Cambridge's historic urban form. These "green fingers" penetrate the city from the countryside and are formed of publicly accessible linear country parks.

This case study investigates the possibility of applying a similar approach to the green belt west of Cambridge.

The drawing alongside also shows how, in addition to direct connections into the city centre via a new "green finger", the site could also utilise and complete an orbital public transport connection linking the site to other key employment sites (North West Cambridge, the northern fringe and the Biomedical Campus) and transport interchanges (Cambridge North station and a future station at Addenbrooke's).



3.5. COMPACT CITY - URBAN EXTENSION ILLUSTRATIVE CASE STUDY



West Cambridge isn't without its challenges, foremost the purpose of the greenbelt in protecting the setting of the city and the proximity of the historic core to the countryside.

The proposals draw on the example of Hamburg's Hafen City, one of the best practice examples included in **Appendix D**. With the relocation of the city's working docks, an area immediately adjacent to the city centre became available for development. A high density mixed-use scheme with excellent walking and cycling connections to the original city centre is being delivered. This completes its concentric city form, while strengthening its relationship with, and access to, the waterfront that had previously been inaccessible.

In an analogous way development, to the west of the city centre could – by means of a design- and landscape-led masterplan – create a more concentric arrangement to the city. It would also make the most of areas within a short walk of the city centre. It would simultaneously enhance people's experience of the relationship between the city centre and the countryside.

The university rugby ground might be relocated to the West Field to allow the creation of a green finger, akin to the backs, running from West Road outwards to the West Field. The removal of some areas from green belt designation would be offset by the protection of the new green finger as green belt. The West Field itself is mostly in agricultural use at present and largely inaccessible. It could be restored as an open area for public enjoyment, biodiversity and sport, as well as accommodating excess water from Bin Brook in times of flood. Improvements to existing links would allow Cotton Countryside Reserve and the West Field to form a circuit spanning the M11, further breaking down perceived barriers between the city and its surrounding landscape.

Medium to high density development would be arranged at the edges of the West Field, preserving important long-distance views to the city (as per the view on the next page) while maximising valuable plots overlooking the open space.

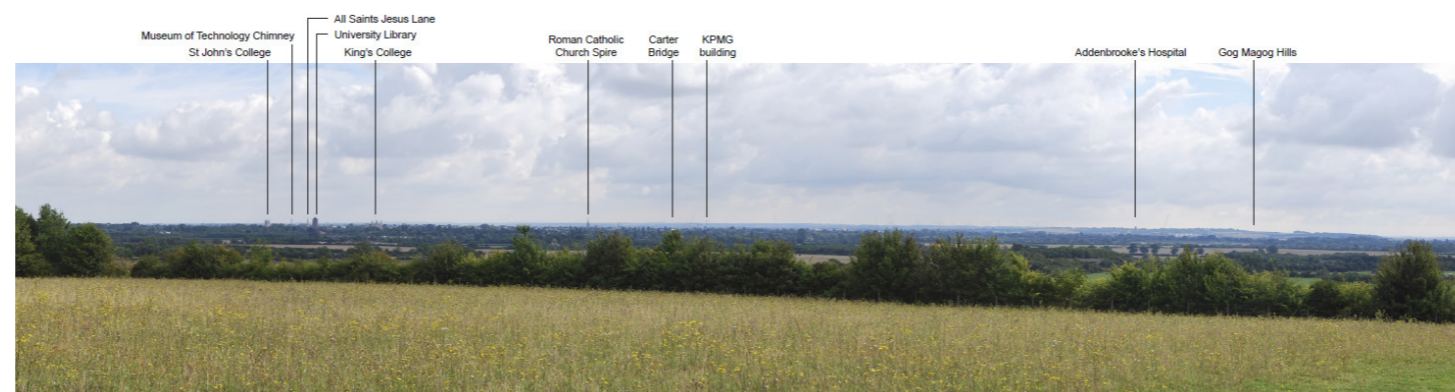
Sensitive edge relationship to existing residential areas would need to be carefully managed. The edge to Barton Road would be screened from the road by the existing shelter belt of trees. To the north, the street grain would integrate directly with the West Cambridge street pattern to the north.

3.5. COMPACT CITY - URBAN EXTENSION ILLUSTRATIVE CASE STUDY



The built areas would accommodate a priority bus route, forming part of the proposed western orbital route as outlined on the previous page. The layout is such that the bus route would have minimal impact on the West Field itself. It would instead be routed via a new local centre located at the point at which the green finger opens out into the West Field.

Rather than imposing on the rest of the city, the provision of social infrastructure requirements, including some that might diversify and strengthen the city's overall offer, would ensure that the urban extension becomes an integral part of the wider whole.



Above: Overview from the west, showing a restored West Field bracketed by new development, but with the direct relationship between the countryside and the historic core of the city preserved.

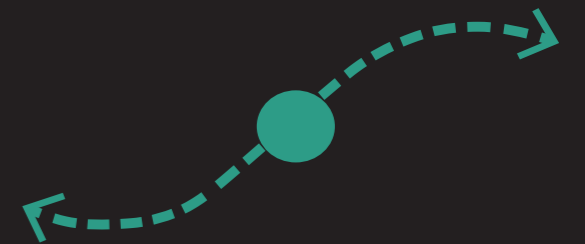
Left: Extract from LDA Design's green belt study - highlighting key aspects of the role of the green belt in this location

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3.6: NEW SMALL
SETTLEMENT



3.6. NEW SMALL SETTLEMENT INTRODUCTION

Recent proposals for garden villages emphasise that such a model is more deliverable because it avoids the large upfront infrastructure costs that one might expect with larger-scale development. Requirements for the higher-order services, transport services and infrastructure that are, in aggregate, still needed, are effectively externalised which could be problematic. If, for example, 25 large villages had been built over the last 50 years instead of Milton Keynes where would the general hospital, or the regional shopping centre have been built, and how would it have been paid for? Where would the residents of those villages have worked and how would they have got there?

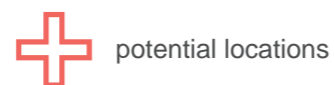
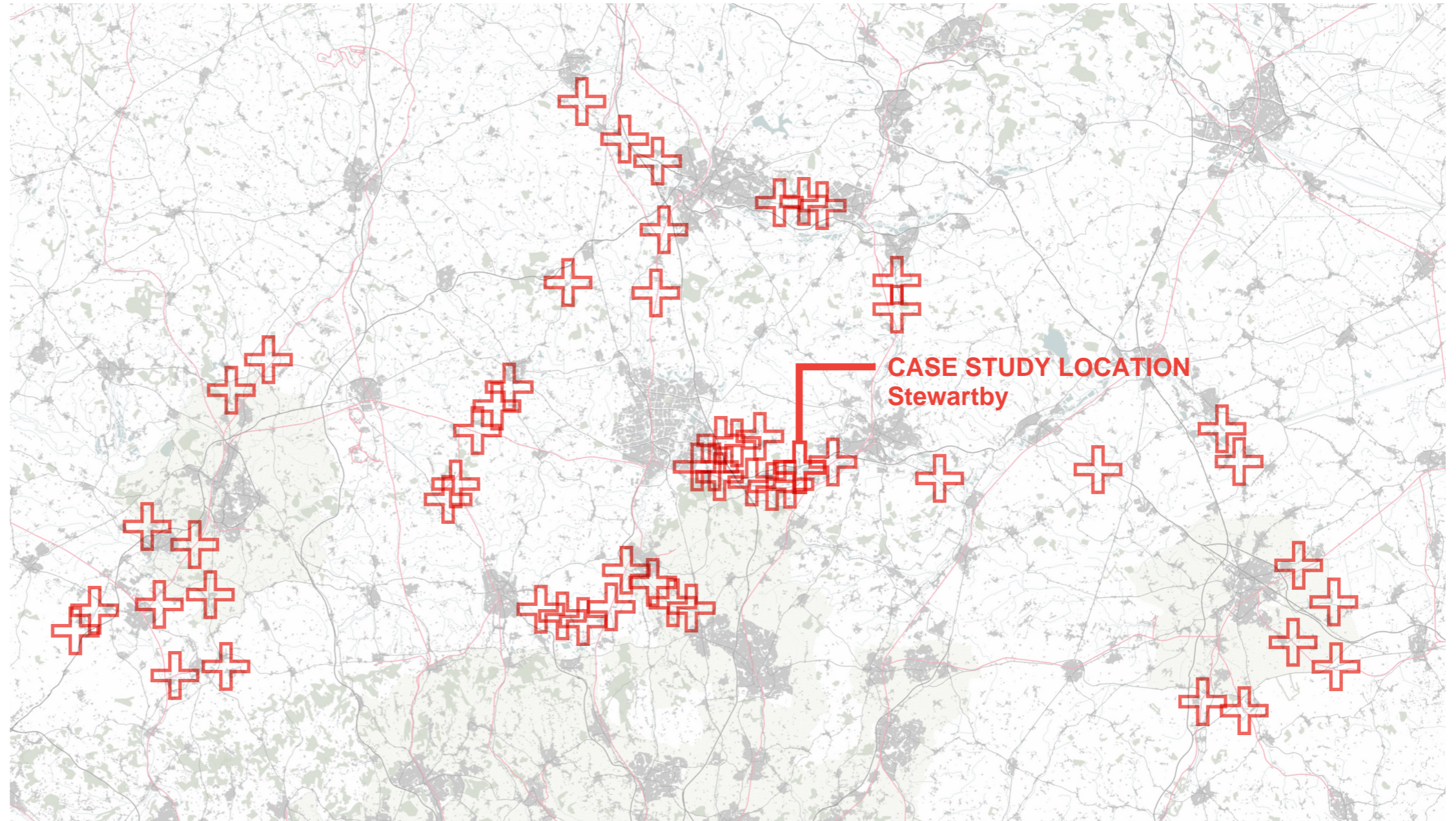
Transport is a particular challenge, with public transport services to existing and new villages often being poor (and, without public subsidy, often unviable). This is due to the inherent inefficiency of running public transport services to a disparate population and the vicious circle of low patronage, leading to reduction in services which compounds lack of use. Villages, in the context of the Oxford to Cambridge corridor, are likely to produce a proportionally greater amount of out-commuting, with a larger proportion of those journeys being by car, than the other typologies considered in this study.

In spatial terms though, there is clearly much to commend village life; people enjoy the tight-knit sense of place and community that they can engender, and a very direct relationship with surrounding countryside (even if this is often largely inaccessible).

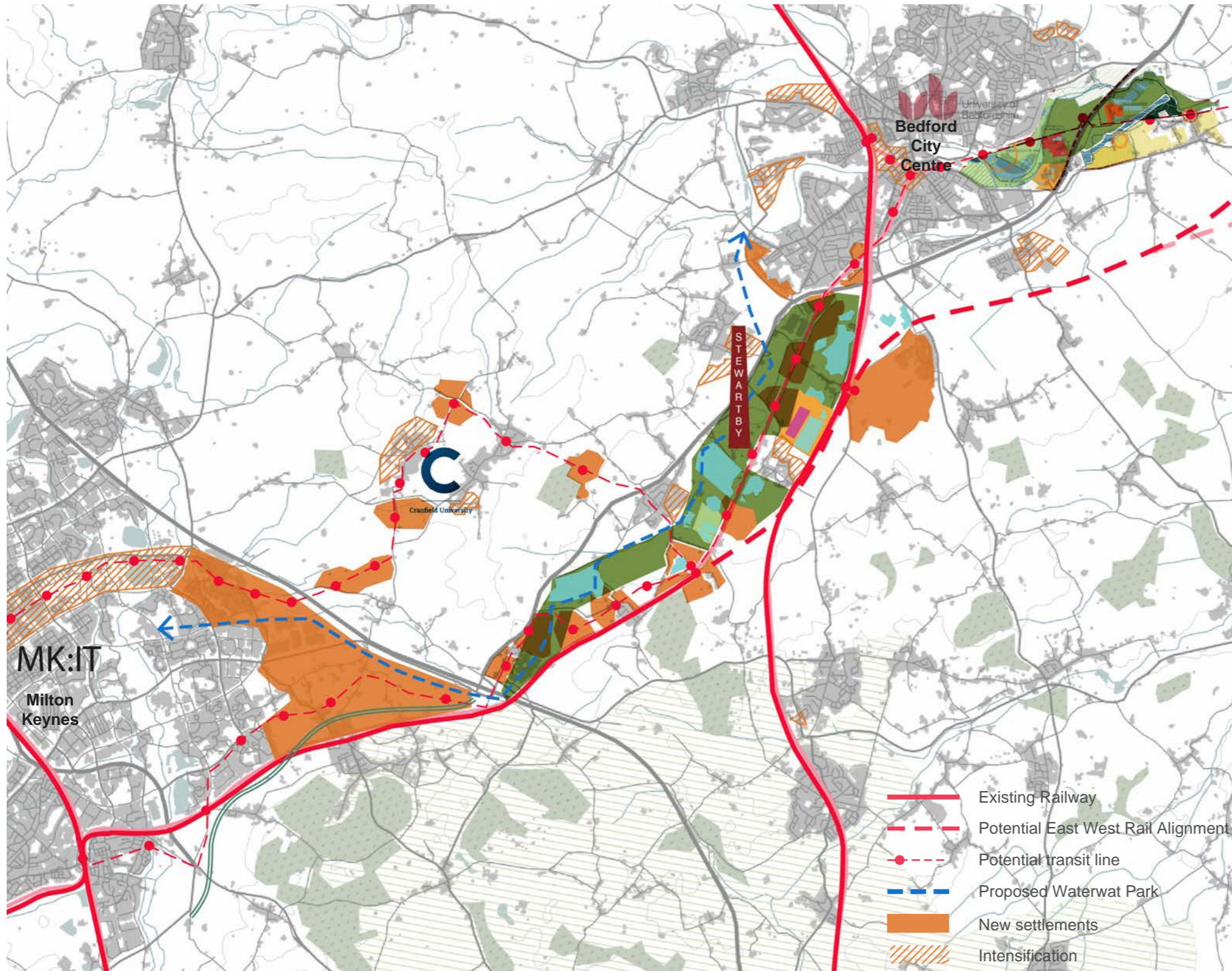
The challenge of this typology is therefore how the best of both situations can be secured. That is small-scale, deliverable settlements with a strong sense of identity and community and easy access to the countryside. A settlement that could also benefit from the economies of scale necessary to make good transport infrastructure and access to higher-order functions affordable and sustainable.

The drawing alongside identifies, illustratively, a number of possible locations for co-ordinated clusters of small settlements – generally on transport corridors linked to larger population centres, including the location of the specific case study at Stewartby, in Marston Vale.

These locations are speculative, based only on an initial appraisal of their fit with the characteristics of this typology set out at the start of this chapter. A comprehensive assessment of these sites has not been undertaken and would be required to validate them. Equally, this initial search is not exhaustive.



3.6. NEW SMALL SETTLEMENT ILLUSTRATIVE CASE STUDY



Delivering small settlements intimately connected with their surrounding countryside, while also providing the infrastructure necessary for their support in a sustainable and affordable way is a challenge. In Marston Vale, the resolution of this challenge lies in the creation of a co-ordinating framework within which several smaller settlements could co-locate to make efficient use of available infrastructure.

Development in this area is already anticipated, but there are potentially much greater benefits to be gained through co-ordination, in terms of:

- sharing the cost of essential infrastructure;
- reaching a tipping-point in terms of public transport services, achieving a frequency/quality that justifies still higher levels of development;
- combining the individual open space requirements of multiple developments to create a park space of regional or national significance - including the completion of the Bedford to Milton Keynes waterway as its centrepiece.

Linear Infrastructures

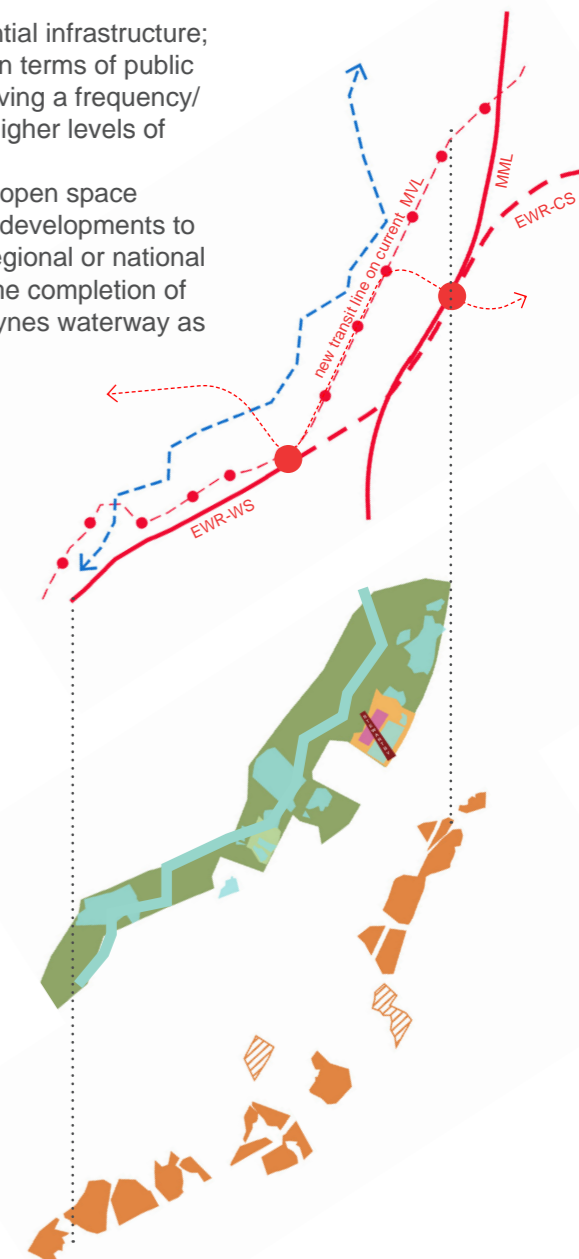
The new EWR central section could be routed to allow the creation of a complementary, high-frequency link from Central MK via stops serving development locations in Marston Vale to Central Bedford.

Rich Landscapes

The proposed canal link that parallels the transit line would form the centrepiece of collection of accessible landscapes – similar to the Emscher Park, which is one of the best practice examples included in Appendix C.

Diverse small settlements

A collection of new, small, linked settlements, each with its own distinct character and sense of place - set within the wider connective regional park.



3.6. NEW SMALL SETTLEMENT

ILLUSTRATIVE CASE STUDY

Marston Vale was a major centre for brick making for the surrounding region, and it retains some of that industrial legacy and degradation. There are also extensive waste disposal and reclamation sites and some attractive recreational areas created in the former brick pits. Some sites near the M1 and on the edge of Bedford accommodate major warehouses for occupiers such as Amazon and Asda.

The economic role of a number of expanded and new small settlements in this area is likely to be, at least in part, as commuter settlements for Bedford and Milton Keynes. Potentially the AV route between Milton Keynes and Cranfield, as discussed in **Typology 3.2 Suburban Intensification**, could be extended to Bedford to complement the rail route and provide far more intermediary stops.

However, there is also an opportunity to expand the current economic activities in different parts of Marston Vale involving recreation and leisure, and logistics. In relation to recreation, this could be entirely complementary to the roles of Milton Keynes and Bedford. It could provide more active rural leisure pursuits, mainly based around a series of lakes, some of which already exist, and others which could be readily formed from former brick workings. Some of the settlements could be designed around attractive waterside locations and lakes in this area.

The history of clay extraction and brick making has left a series of remarkable and unusual post-industrial landscapes

As with the Emscher Park in Germany this unique inheritance could be celebrated, rather than normalised, and form the foreground to a series of new development sites.

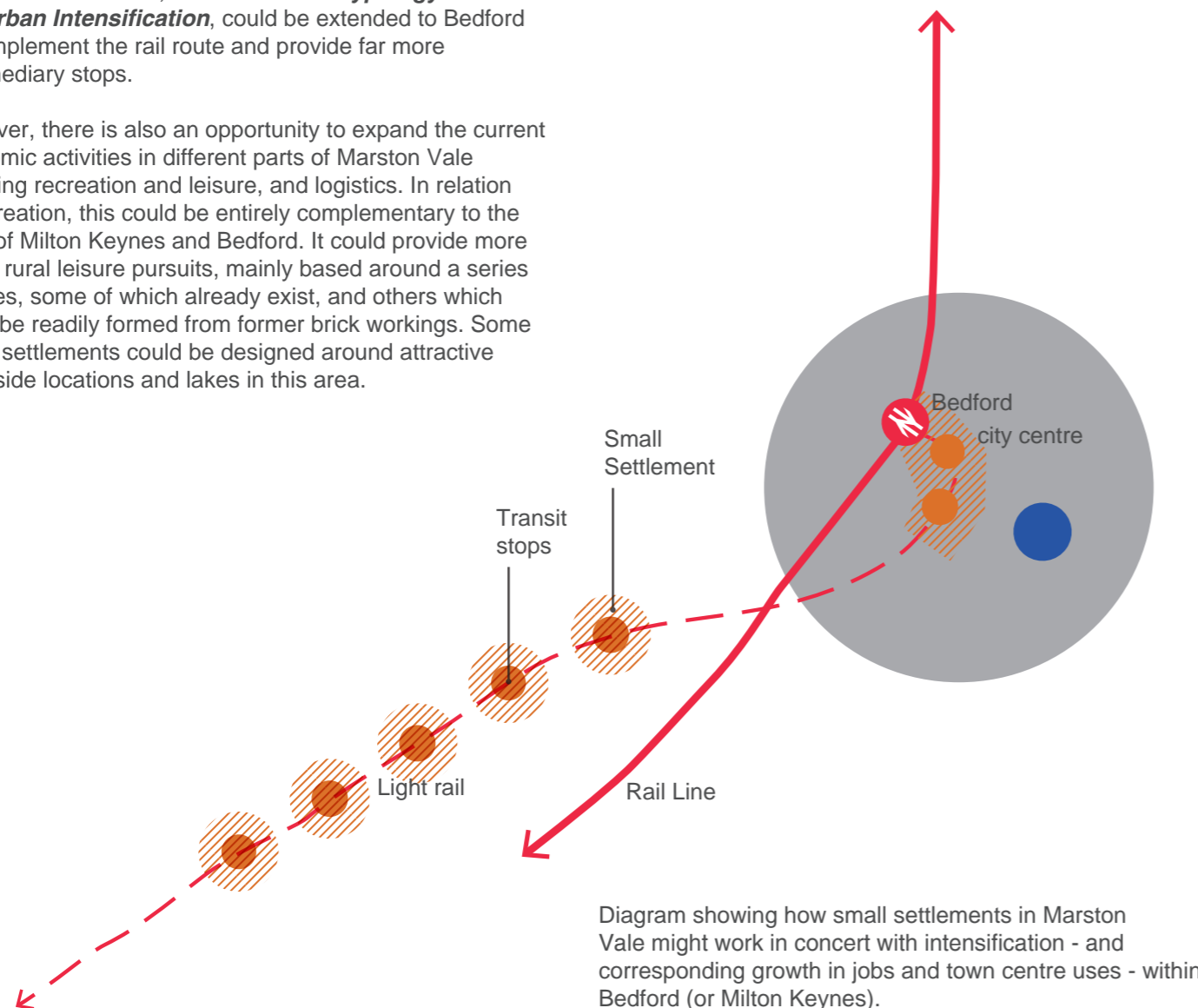


Remnants of the brick making era.

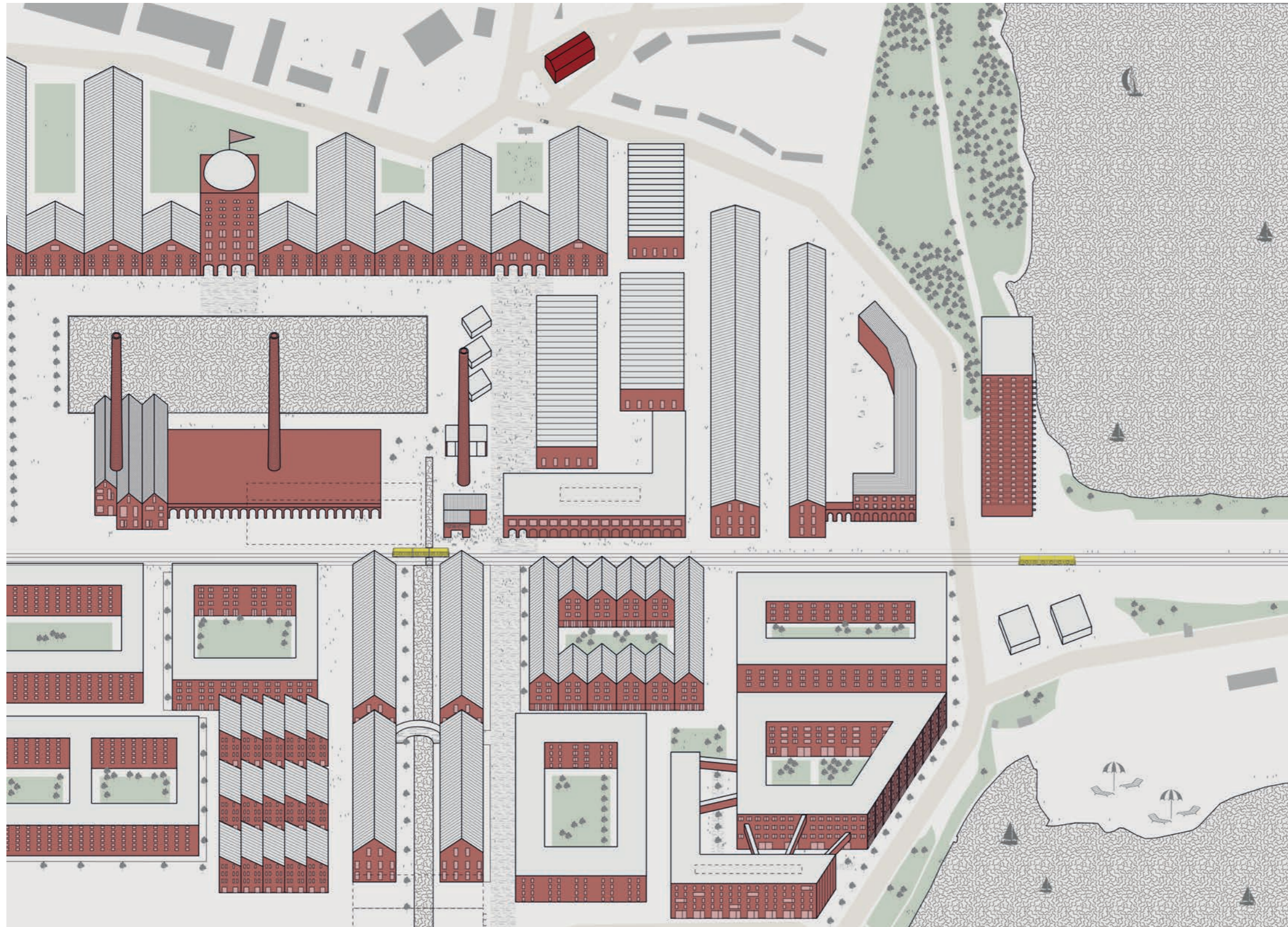


Aerial of forest of Marston Vale Solar PV Farm

Source 12: LHW Partnership, (n.d.)



3.6. NEW SMALL SETTLEMENT ILLUSTRATIVE CASE STUDY



The concept for a new village at Lower Stewartby is suggested as a counterpoint to the tendency for new development to seek out the emptiest and most neutral of sites for development.

The lakes that occupy the former brick pits provide a spectacular waterside setting. The Listed Brick Kilns and Chimneys, which could well be perceived as a liability, in fact provide an incredible and unique sense of place that should be capitalised on.

Re-appropriation of the former kiln and factory structures as workspace, the intensive utilisation of waterside locations, and infill development of a scale and character that responds to these industrial buildings, would help create a place of intensity as a foil to the extensive landscapes beyond.

Not all of the new villages in Marston Vale would be like this though. But one of the opportunities of building multiple smaller settlements is the potential for each to have a unique identity. The creation of a shared framework would allow a diversity of developments, at a range of scales, to be involved in its implementation. Some would be more like Stow-on-the-Wold and others more like Saltire, therefore providing for a variety of needs and personal choice.



Close-up of the kiln.
Source 13: Penmorfa, (n.d.)

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3.7: NEW TOWN



3.7. NEW TOWN

INTRODUCTION

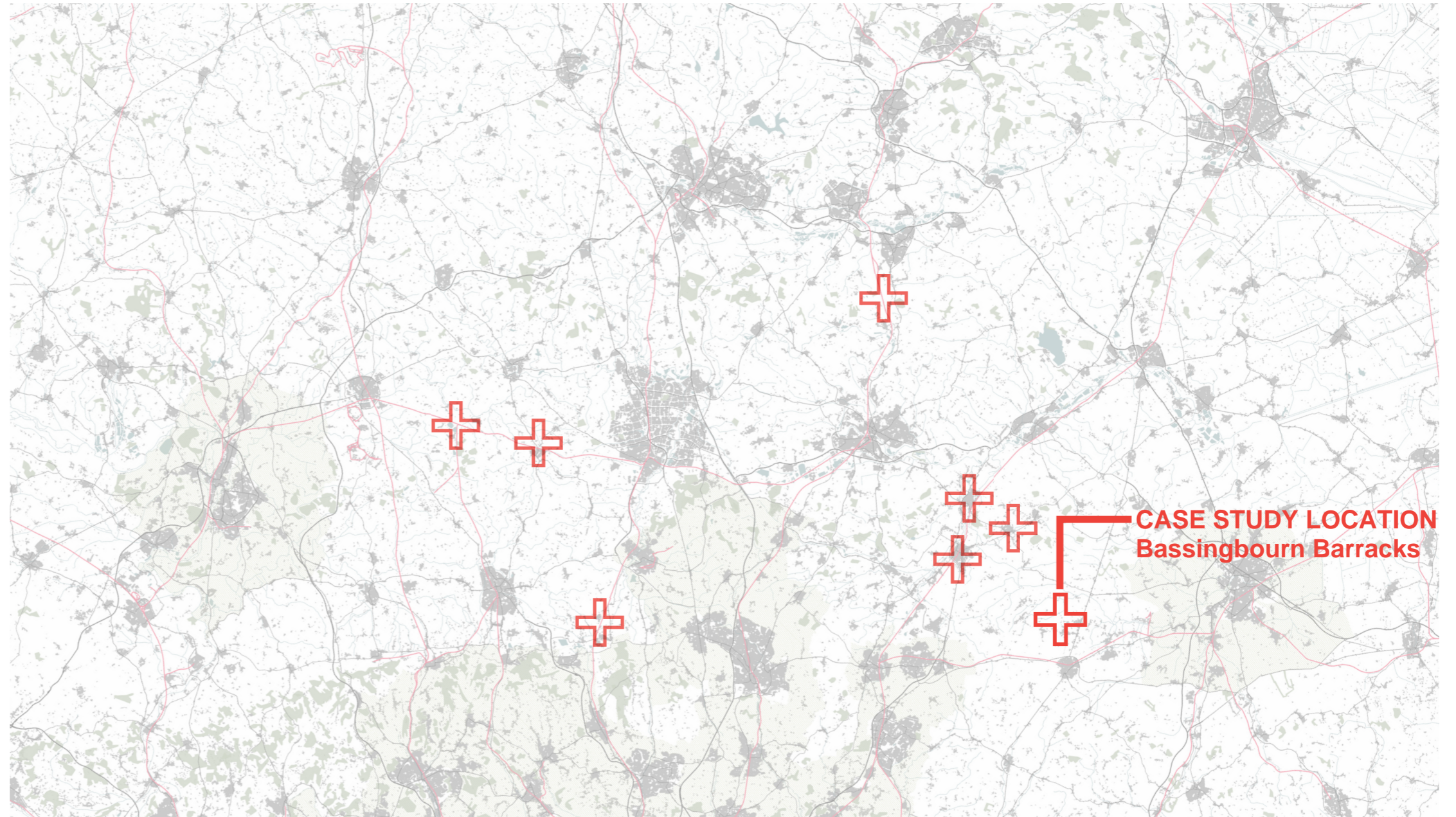
Scaling up from the village typology we come to a place large enough to be considered a town. A population of 40,000+ would be self-contained in terms of many day-to-day activities and facilities (in a way that a village generally is not) and have a relatively diverse economy. Many higher-order services would still not be supported at this scale though, so a settlement of this sort would need to be established in a mutually supporting role with nearby cities.


In line with the predominant traditional form of towns within the UK, this typology assumes that the settlement is concentrically arranged around a single, multifunctional town centre surrounded by mainly residential areas bounded by countryside. This relatively compact form with a singular central focus is taken as the essential characteristic of the town typology, as evident in the two most relevant best practice examples included in **Appendix D**: Letchworth Garden City (pop ~30,000); and Nieuwegein, Holland (pop. ~60,000).

The premise of this typology is that the population is large enough to justify a station on the national rail network, with the station being a defining feature of the place, but small (and compact) enough that walking and cycling are able to provide for most internal journeys. Specifically in terms of the chosen case study location, it is assumed that the settlement would justify a new station on East West Rail, even if the line is delivered as a fast regional line with relatively few stops – in a way that multiple smaller settlements could not.

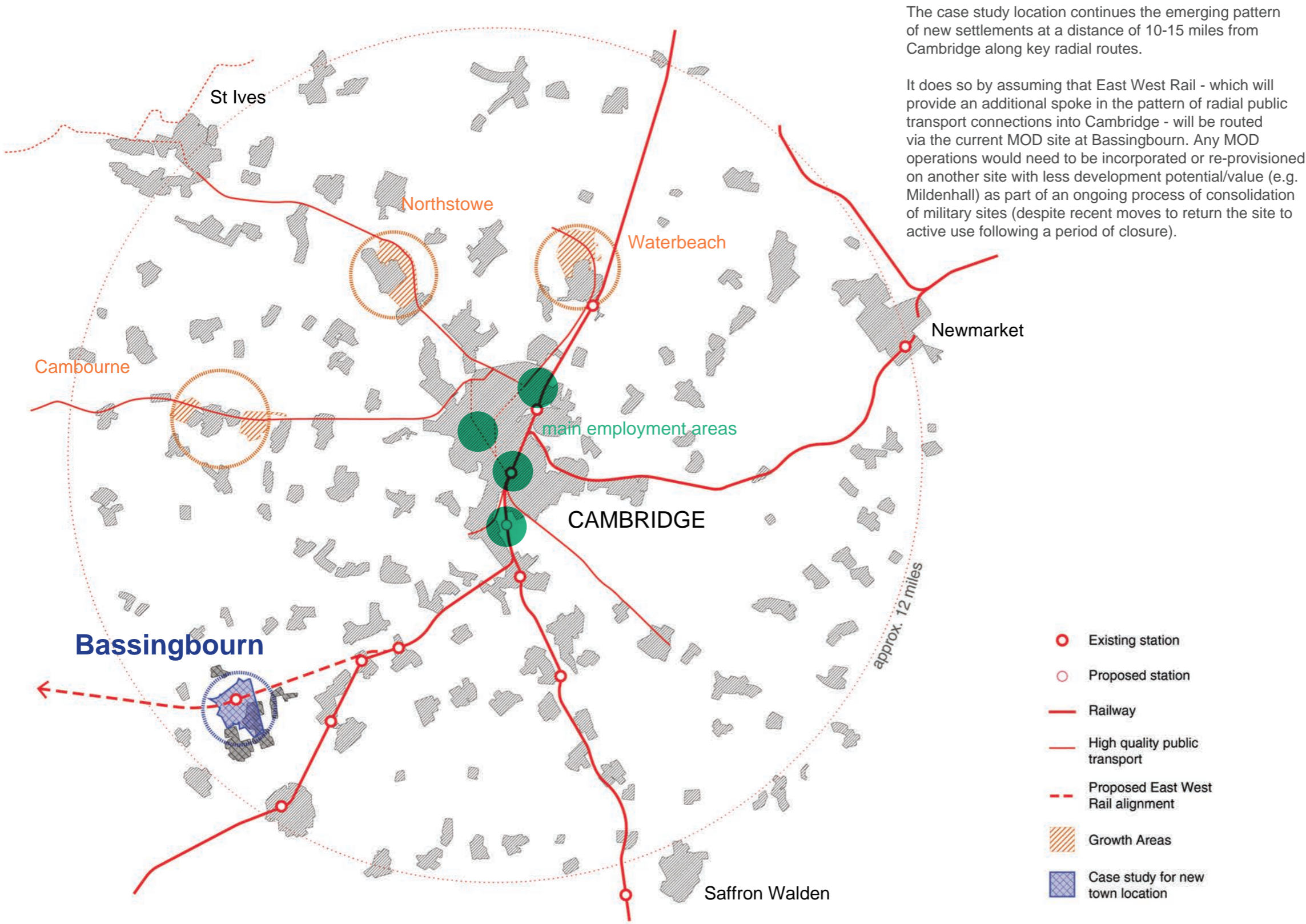
Locations along existing or potential new railway lines that also have access to the national/strategic network via appropriate existing roads, or via new roads without prohibitive cost/environmental impacts, are relatively rare across the corridor – with many of these locations already occupied. The drawing here identifies, illustratively, the few locations where this typology might be applied. The location selected for the purpose of examining this typology is at Bassingbourn Barracks, near Royston, a site currently owned by the Ministry of Defence (MOD). There are other areas of publicly owned land in the zone between Sandy and Cambridge, and consideration of these, alongside the feasibility of different rail alignments, would need to need to take place.

These locations are speculative, based only on an initial appraisal of their fit with the characteristics of this typology set out at the start of this chapter. A comprehensive assessment of these sites has not been undertaken and would be required to validate them. Equally, this initial search is not exhaustive.



 potential locations

3.7. NEW TOWN ILLUSTRATIVE CASE STUDY



The case study location continues the emerging pattern of new settlements at a distance of 10-15 miles from Cambridge along key radial routes.

It does so by assuming that East West Rail - which will provide an additional spoke in the pattern of radial public transport connections into Cambridge - will be routed via the current MOD site at Bassingbourn. Any MOD operations would need to be incorporated or re-provisioned on another site with less development potential/value (e.g. Mildenhall) as part of an ongoing process of consolidation of military sites (despite recent moves to return the site to active use following a period of closure).

As a satellite settlement of Cambridge – and as part of the symbiotic relationship already discussed – part of any new town’s economic role would be to accommodate some of the relatively low value activities. These are being squeezed out of Cambridge due to increasing costs and the loss of industrial land to housing. They include local service industries, building suppliers and storage sites for the construction industry, local logistics operations and car showrooms (BMW’s move from Cambridge to Cambourne is illustrative of this dynamic). The town would therefore have a distinct and effective role within the city region.

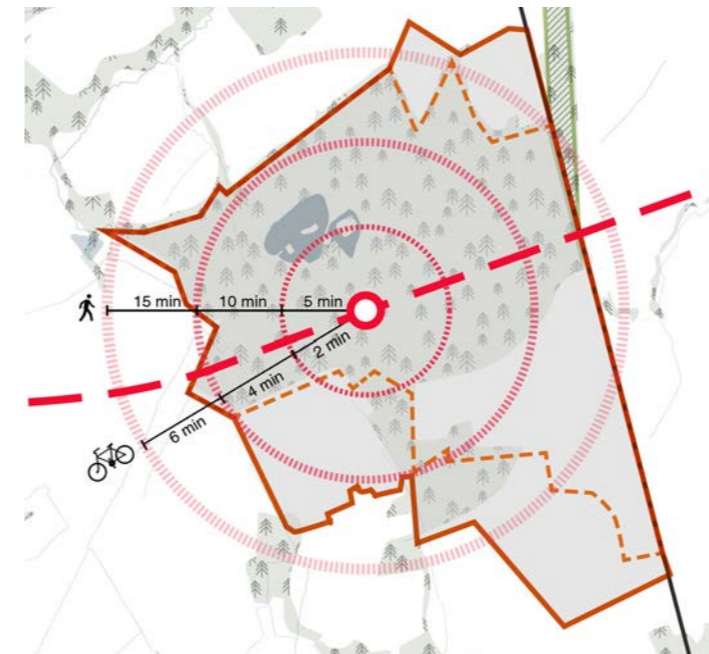
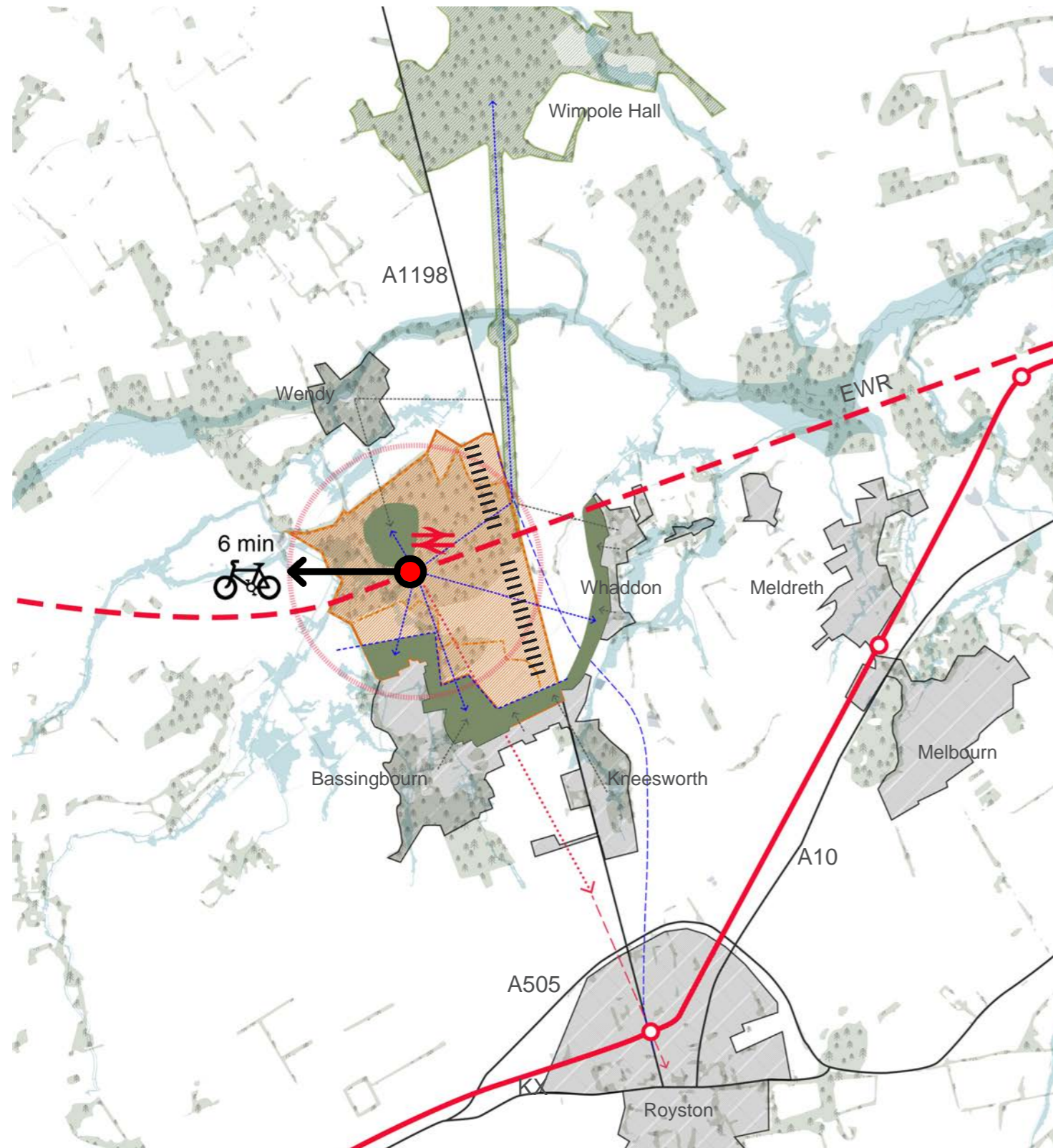
A further role could be to accommodate the growth of medium-sized, expanding and spin-off bioscience firms forming part of the Cambridge cluster, which is focused to the south of the city around Addenbrooke’s and Granta Park. Bassingbourn has the added attraction of being accessible from GSK’s research campus at Stevenage and the linked BioCatalyst (an incubator, to be expanded into a bioscience park on the GSK campus).

Its location would therefore be in the heart of one of the biggest specialist bioscience labour markets in Europe. It should make it an attractive location for firms expanding out of incubator facilities in Cambridge or Stevenage, or moving into the area, but not needing to co-locate with the hospital and research facilities in these two main urban areas.

A new town here would also undoubtedly act as a commuter settlement for London (Royston station on the line to Kings Cross is only 10 minutes away) and Cambridge with direct trains to the three main employment areas in the city (existing and proposed) and walking, cycling and busway services linking to other areas of the city.

One key lesson to learn from Cambourne, a previous new town development of similar scale and distance from the city, is the need for high quality public transport options to be available from the very beginning,

3.7. NEW TOWN ILLUSTRATIVE CASE STUDY



Site Area: 443ha
Population c.31,000

@7000p/sqkm

- - - Potential alignment of East West Rail
- Existing railway lines
- - - MOD Site Boundary
- Existing settlements
- Enhanced landscapes acting as buffer zones
- Proposed area to be developed
- Proposed new station on East West Rail
- Existing train stations

The design strategy seeks to maximise the benefit of a new station by adopting a compact form. Most of the settlement should be within 15 minutes walk of the centrally located station.

Internally, there should be a permeable network of streets with short distances, high quality public realm and a presence of local shops and other facilities within the heart of the community (rather than on edge of town retail parks). All this would contribute to walking and cycling being the natural choice for short journeys. This urban arrangement would be attractive, and would provide an alternative to the more suburban/village character of most development in the hinterland of Cambridge, for millennials and younger families who would otherwise be looking to live in London or Cambridge itself.

The town abuts the A1198, a main road that compared to others in the Cambridge region is lightly trafficked. The road does not connect directly into Cambridge (unlike the A428 in the case of Cambourne or the A10 from Waterbeach) which would help to discourage commuting to Cambridge by car, and adding to the burden of traffic on other routes, in favour of public transport.

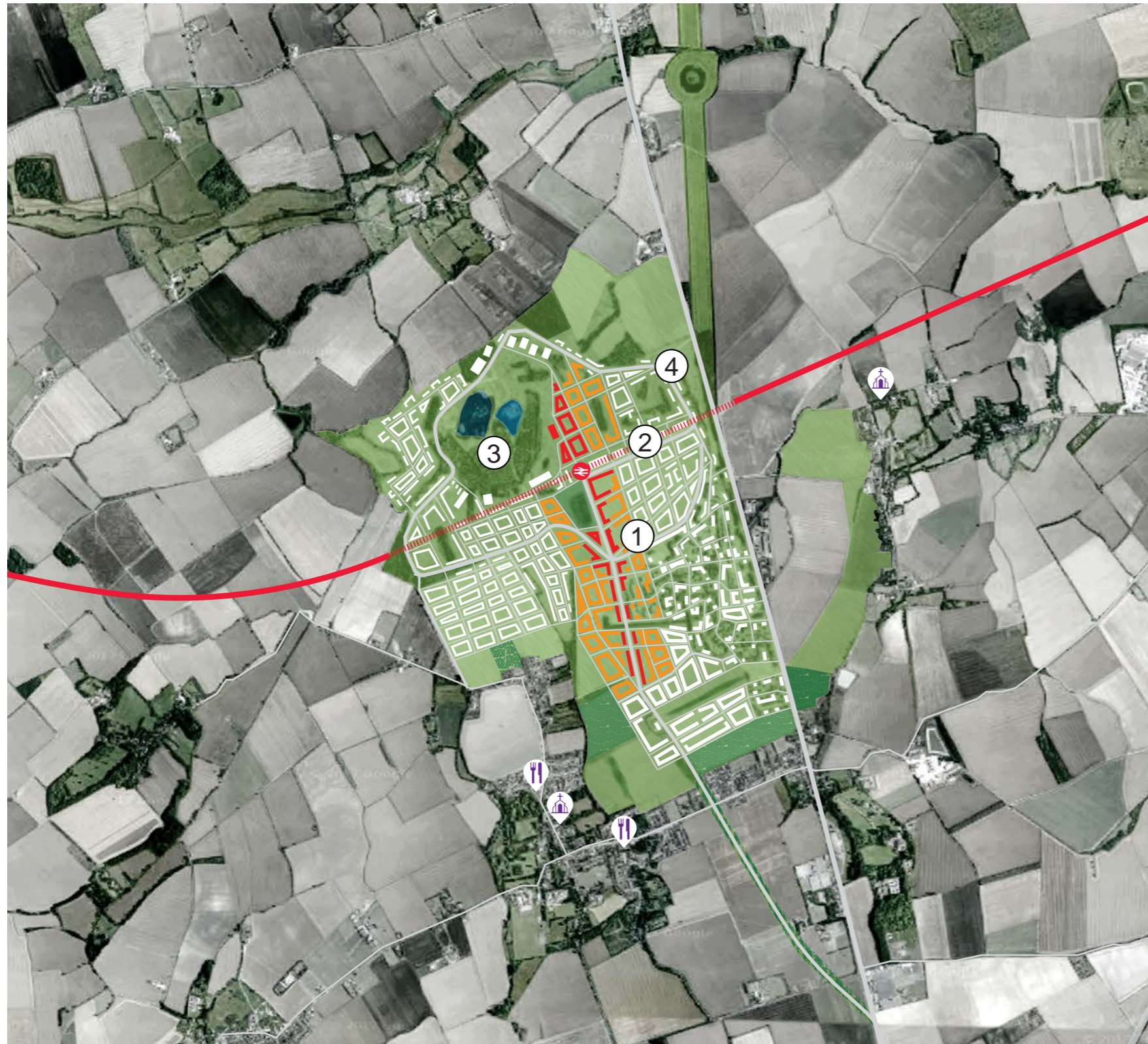
It is envisaged that the edge of the settlement facing the road would accommodate some of the industrial / low value uses that are outlined on the previous page. By doing so, it enables heavy vehicles to access the road directly without passing through the remainder of the settlement, while still being accessible from the mixed/residential areas to the west.

As the illustrative plan on the following page shows, the densest and most active areas would be in the central area near the new East West Rail station and on a high street spine linking to Royston.

In order to maximise the use of land around the station, open space is generally pushed toward the periphery. A move that also provides separation from neighbouring pre-existing settlements. The exception to this is where existing landscape features are retained and re-framed as a key asset for the town. This might happen with the existing lake and woodland towards the north of the current MOD site.

The images on the following page show an illustrative plan of a new town in this location - highlighting some of the key moves to creating a healthy, sustainable, well designed and distinctive built environment to support and prioritise the quality of life of its citizens.

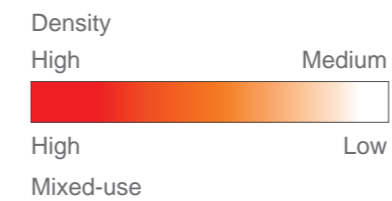
3.7. NEW TOWN ILLUSTRATIVE CASE STUDY



① Creating a strong high street as the focus of activity and movement



Plan of the village of Long Melford (above) organised along its High Street - shown at the same scale as the proposed plan of the new town (left)



② The railway as a meeting point rather than a line of severance



Viaduct Shopping Centre in Zurich, Switzerland. (Hut, n.d.)

③ Making the most of found site features - such as the existing lakes and woodland



Hammarby Sjostad, Sweden. (Blanco, n.d.)

④ Co-opting the mature landscape and heritage features of the old barracks



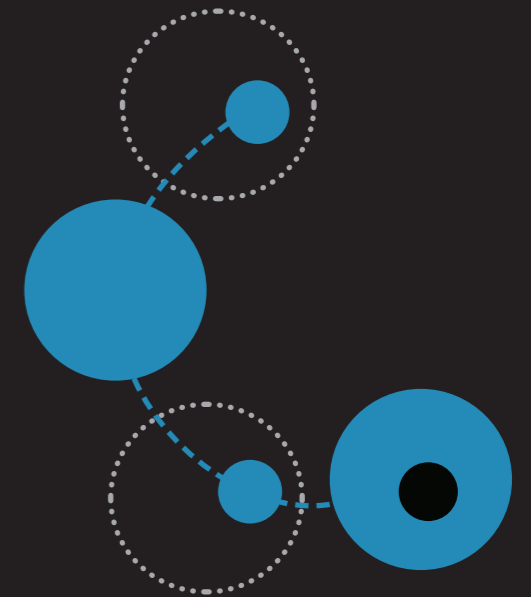
"A passing-out parade at Bassingbourn army camp", Kirton, (2002)

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3.8: STRING CITY



3.8. STRING CITY INTRODUCTION

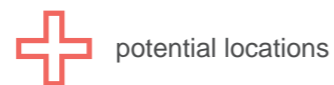
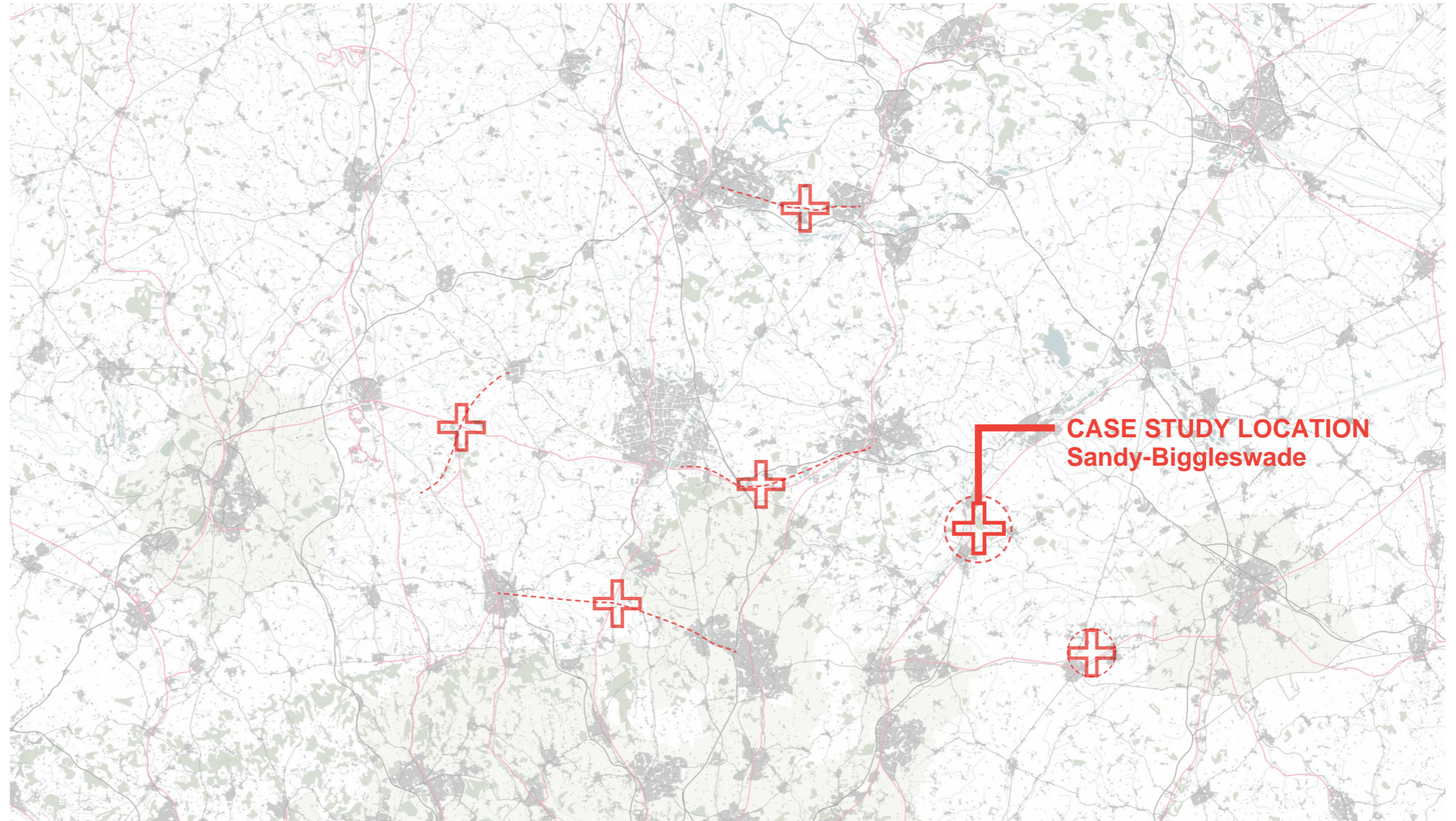
Similar to the Marston Vale case study this typology examines the potential of a number of smaller linked settlements. However, in this case these smaller settlements are assumed to aggregate together to create a place of sufficient scale to be thought of as a city, rather than connecting to, and remaining subservient to, an existing larger-scale “central place”. This typology is therefore based on the new agglomeration having, over time, a large degree of self-containment, its own higher order services and a greater degree of national connectivity than the preceding “new town” typology.

The component parts of this typology might vary in scale and in character, and might include existing places as well as new ones. Their totality would be defined by the high degree of connectivity between them. This would most likely be achieved through a new, and in the case of existing towns or villages retro-fitted, high quality public transport network.

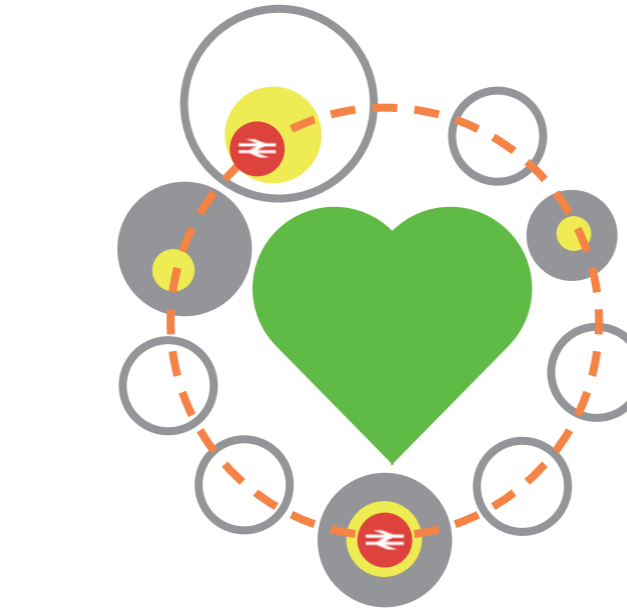
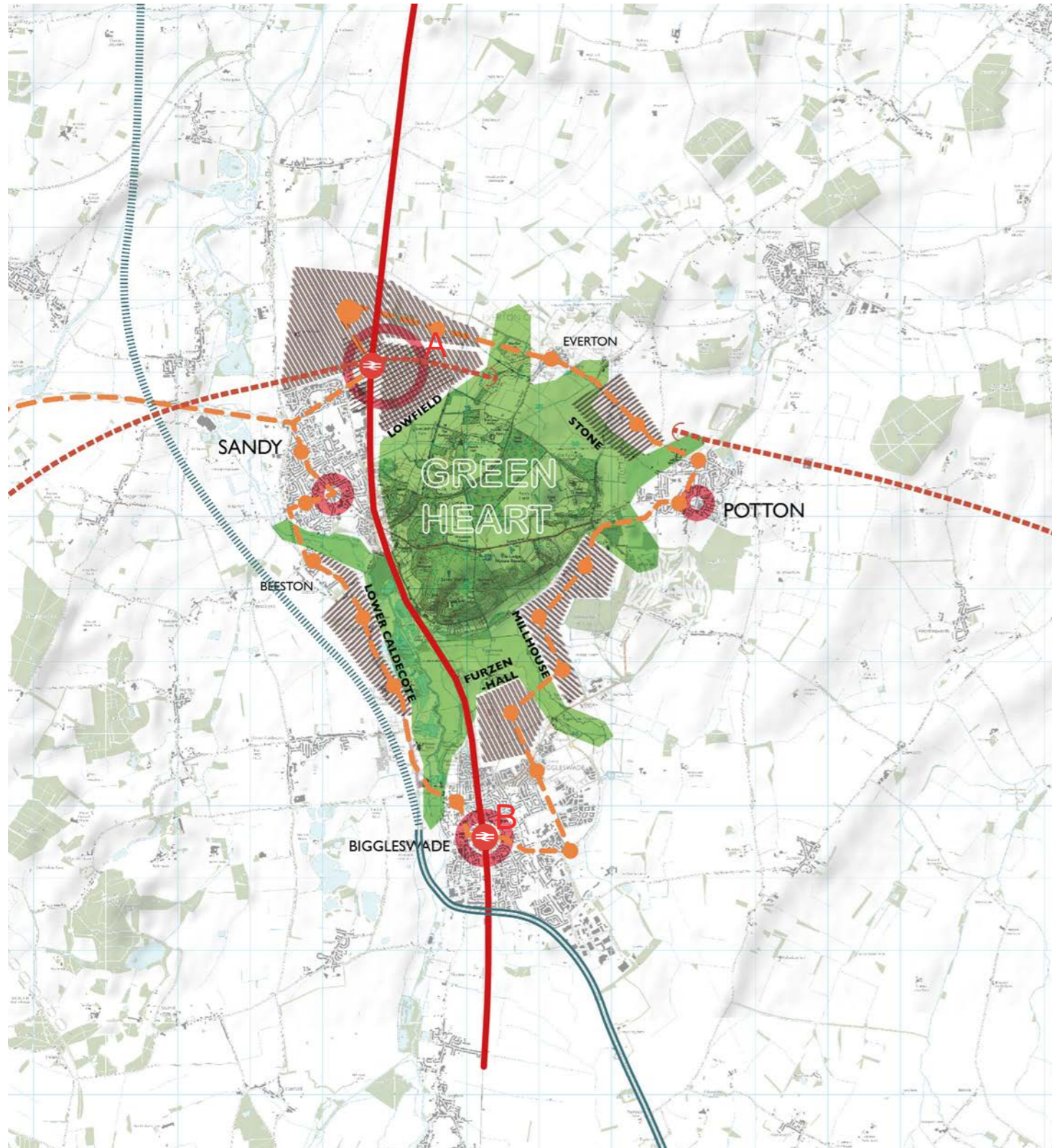
This drawing identifies a number of potential locations where we have identified that this typology might be applied. The dashed line, whether in a ring formation (as shown around Sandy and Royston) or a linear form (as shown in Marston Vale, extending east and west from Cheddington, north-south from Calvert, and between Northampton and Wellingborough) indicates the potential alignment of a high-quality transit route that would provide the string along which beads of settlement might be threaded.

The chosen case study location is at Sandy, where planned investment in improving the A1, and the likelihood of a new interchange station between East West Rail and the East Coast Mainline, presents a key opportunity for co-ordinated planning of development and transport investment.

This location is speculative, based only on an initial appraisal of its fit with the characteristics of this typology. A comprehensive assessment of alternative sites has not been undertaken and site identification outlined is not exhaustive.










3.8. STRING CITY ILLUSTRATIVE CASE STUDY



Above: Diagrammatic representation of how existing (solid grey) and new (grey outlined) places would be linked together by a public transport loop (orange dashed line) around a protected and accessible green heart, that would incorporate Sandy Warren and Biggleswade Common. Existing and new local centres (yellow) would work in combination to serve the needs of the enlarged population.

Left: Illustrative proposal

-  East Coast Main Line
-  New East West Rail connection
-  Rapid, reliable, regular public transport loop serving existing and new settlements
-  A1 bypass - freeing the former (sub-standard) alignment to be urbanised
-  A. New interchange station (replacing the existing station)
-  B. Biggleswade Station
-  New compact settlements with nowhere more than 5 minutes walk from countryside

The case study looks at the location where a reinstated railway line from Cambridge to Bedford would cross over and permit passenger interchange with the East Coast Mainline.

Three small towns are already here, arranged around Sandy Warren and Biggleswade Common: two important areas of landscape and nature conservation.

The A1 runs to the west of these towns, and there are proposals to upgrade the A1 on a new alignment away from the existing sub-standard road.

The strategy connects the existing towns with a high quality and efficient to run public transport loop, also linking to the new interchange station and the existing Biggleswade station.

This loop becomes the armature for a string of new neighbourhoods linking to existing centres and new facilities and workspaces around the ring. However, each would also be just a short walk away from the preserved "green heart" of Sandy Warren and Biggleswade Common.

Several of the best practice examples reviewed as part of this study (see [Appendix D](#)), such as the Dutch Stedenbaan proposals and the Australian CLARA plan, are based on transit oriented development of this sort. In addition to this approach the Emscher Park in the Ruhr, Helsinki Vision and Stockholm best practice examples also emphasise the creation of a network of green spaces as a primary determinant of the urban form at the largest scale.

The Department for Transport (DfT) and Highways England (HE) have recently undertaken the A1 East of England Strategic Study. This shows that the existing route of the A1 through the western edge of Sandy is particularly in need of improvement. The study goes on to identify high level options for localised improvements or the creation of a new motorway standard route off-line. The DfT/HE have not yet indicated a route or route options for this option. This case study shows an illustrative new alignment to the west as a means of investigating how a new bypass route would open the possibility or re-appropriate part of the old alignment for public transport and urbanisation as part of the ring. It is assumed that improvements to the A1 of some sort or another and appropriate access junctions to serve both existing and new populations would be necessary to support development.

3.8. STRING CITY

ILLUSTRATIVE CASE STUDY

With new settlements arranged in a ring around its edges, the entire population would be within a short walk of the "Green Heart". Alongside the preserved landscapes of Biggleswade Common, Sandy Warren and Sandy Heath, there would be opportunities for new sport, leisure and productive landscapes adjoining the new neighbourhoods. All connected via a network of high quality walking and cycling routes.

The aerial photograph of the Green Heart below - as shown on the initial plan on the previous page - is shown for comparison at the same scale as a series of other open spaces, that are well known for being the focal point for their respective surrounding cities or districts.

The comparisons show that the process of aggregating the open space requirement of the various new surrounding neighbourhoods serves to create a unique new green space. This space will be far larger than all of these iconic large parks, which each serve a much greater and denser catchment than would be the case at Sandy. It would moreover frame (and preserve) the existing sensitive landscapes of the Warren and Common.



Sandy Warren and Biggleswade Common



Hampstead Heath, London



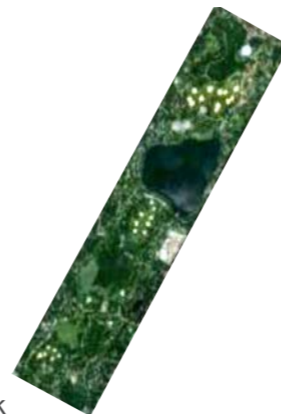
Royal Parks, London



Tiergarten, Berlin

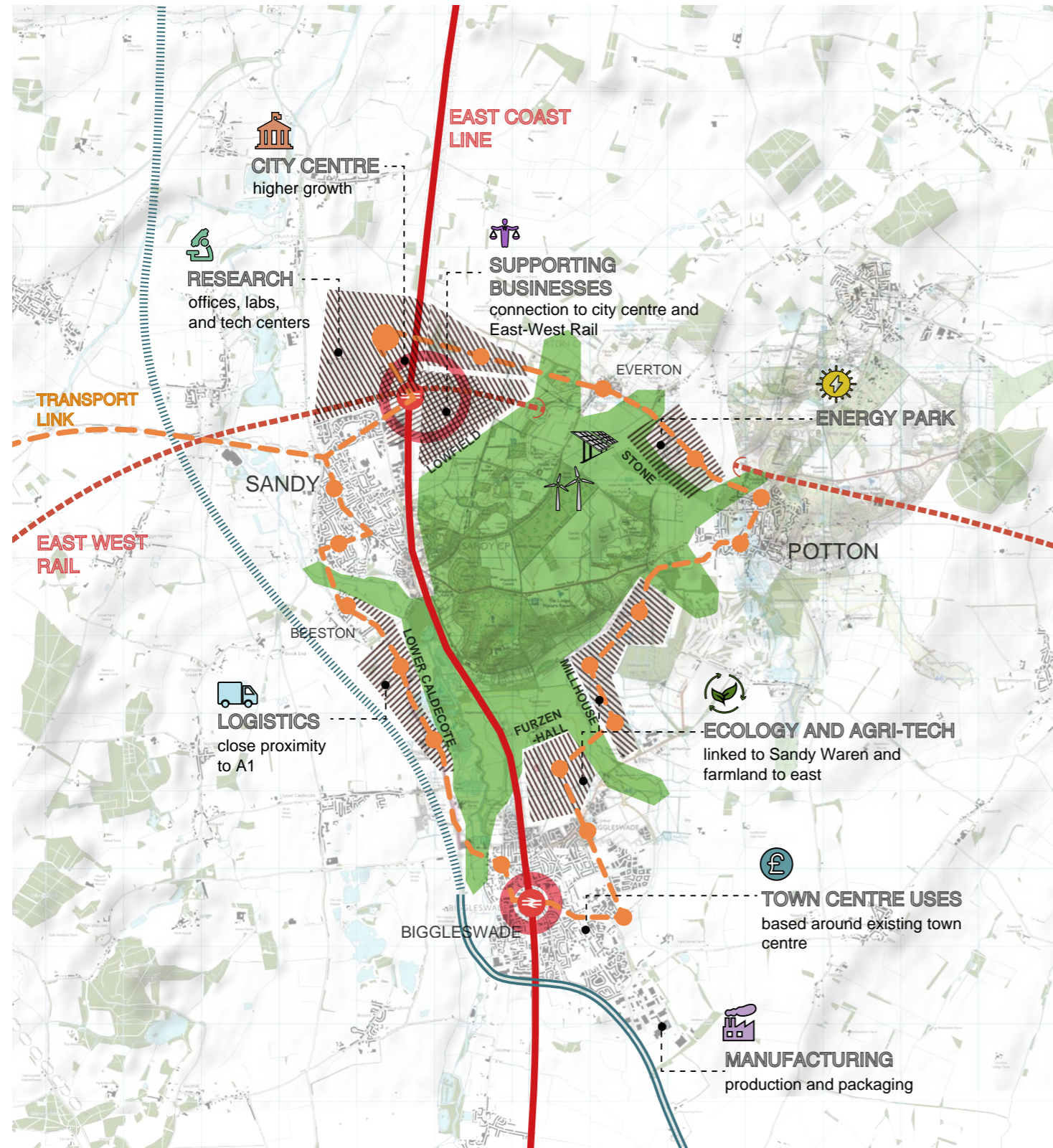


Central Park, New York



Sandy Warren

3.8. STRING CITY ILLUSTRATIVE CASE STUDY



-  East Coast Main Line
-  new East West Rail connection
-  rapid, reliable, regular public transport loop serving existing and new settlements
-  A1 bypass - freeing the former (sub-standard) alignment to be urbanised
-  A. New interchange station (replacing the existing station)
-  B. Biggleswade Station
-  New compact settlements with nowhere more than 5 minutes walk from countryside
-  Research and Development Zone
-  Logistics Zone
-  Main Economic Zone
-  Manufacturing
-  Supporting Businesses
-  Energy and Logistics Park

The area also has some distinctive economic strengths focused around logistics, food and drink and related industries (e.g. agricultural engineering), and some outstanding environmental assets. The Sandy Warren is such an asset, which is the location of the headquarters of the RSPB and would be at the heart of the new ring city.

The different settlements within the area would each need a distinctive and complementary economic role. They also need to be very well interconnected by public transport if they are to function as a ring city rather than as an unrelated cluster of expanded towns and villages.

The “Food Enterprise Zone” (one of only six in the country) around Biggleswade should attract more businesses in the agri-food sector, particularly if combined with initiatives such as a specialist food incubator facility and if linked functionally to Colworth Park, Unilever’s global R&D centre to the north east of Bedford.

In addition, one of the settlements (logically Sandy, if it is actually at the rail/road intersection between east west and north south rail and road routes) should develop higher order functions to serve the new city’s population as well as a wider catchment.

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3.9: NEW CITY



3.9. NEW CITY

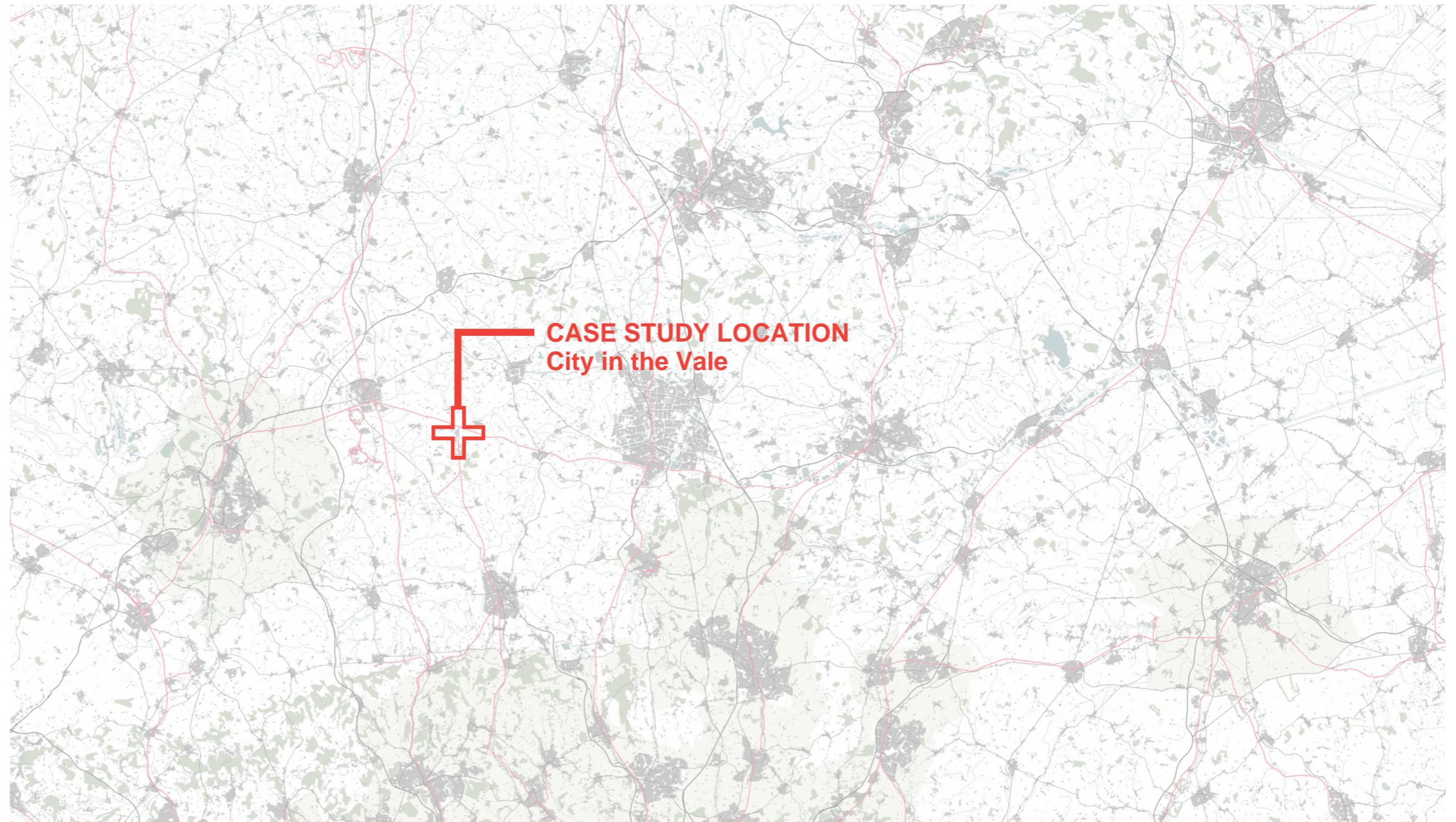
INTRODUCTION


The final typology considers an approach where growth is sustained over a longer period of time and/or at a faster pace in one location, such that the eventual size of the settlement constitutes a new city. It is envisaged as a stand-alone settlement begun from scratch in a relatively isolated and sparsely populated location, hence without the initial support and context that the pre-existing towns of the previous, *String City* case study provide. As such it would in time have a population of at least 250,000 - similar to Milton Keynes today - and would be largely self-contained in terms of jobs and services, serving as a new regional centre for its hinterland.

While not included in the best practice example, Milton Keynes is a useful comparator, as detailed further over the following pages, especially in terms of delivery models and the managed, incremental development of a city over time – in the case of Milton Keynes at an average population increase of around 4000 people per year over the 50 years since its creation.

Such a city would need to be a key transport node, with good rail connections to other regional and national centres of population, and good access to the national highway network, as well as being the focal point for a series of more local connections. The creation of places with the connectivity needed to sustain a larger settlement is central to the CLARA proposals – one of the selected best practice examples detailed in [Appendix D](#) – which proposes the creation of a number of new cities linked to the development of a new (in that case High Speed) rail corridor between Melbourne and Sydney in Australia. That example highlights, as was also the case with the development of Milton Keynes, the importance of value capture to providing the necessary infrastructure in a sustainable way.

For the purpose of developing a case study, and given the existing spacing of towns/cities along the East West Rail corridor, we have identified just one location where the introduction of new east-west infrastructure would have a transformative effect with the potential to catalyse and support a large new settlement. This location is around the junction of East West Rail and the railway line via Aylesbury to London, in the zone between Bicester, Buckingham and Aylesbury - as shown on the drawing alongside. It should be noted however that this location is speculative, based only on an initial appraisal of its fit with the characteristics of this typology. A comprehensive assessment of alternative sites has not been undertaken and site identification is not exhaustive.



 potential locations

3.9. NEW CITY

ILLUSTRATIVE CASE STUDY

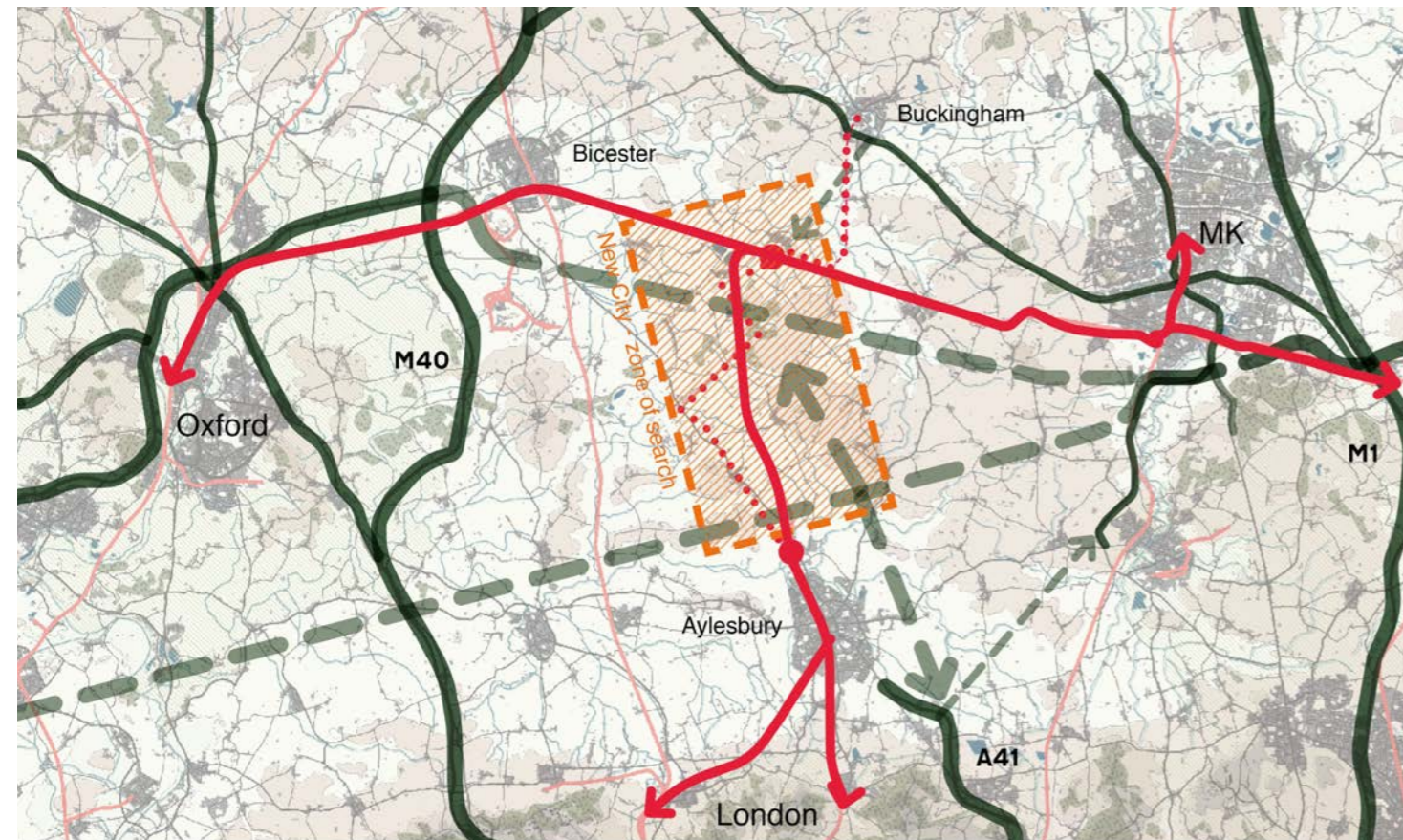
INFRASTRUCTURE

East West Rail and the Oxford to Cambridge Expressway would, if delivered, and depending on their final routing, have the potential to provide access able to support development at the scale of a city in the zone between Bicester and Milton Keynes. This area is, compared to other locations in the corridor, relatively unconstrained¹.

A direct link to Central London from this location is proposed as part of the Milton Keynes to Marylebone aspect of East West Rail², and Milton Keynes and Oxford would both be less than 20 minutes away by train once the Bicester to Bletchley section is completed.

A stop on HS2, which passes through the area, might be possible when the eventual scale of the city is realised, and this population is combined with the additional patronage that an interchange with East West Rail, and a parkway station linked to the Expressway, might generate³.

The alignment of the Expressway is not yet determined, and this would need detailed investigation in tandem with a study into how and where a new city might best be precisely located within the zone of search identified on the drawing below.



- direct rail routes from Calvert (with EWR completed)
- existing roads
- - - O2CEW - broad route alignment alternatives + connections
- - - local transit network

LAND

With this scale of project it is assumed that government-supported mechanisms would be necessary to capture at least a significant proportion of the land value uplift, so that this can be used to forward-fund the foundation and infrastructure of the city – with the prospect of long-term payback.

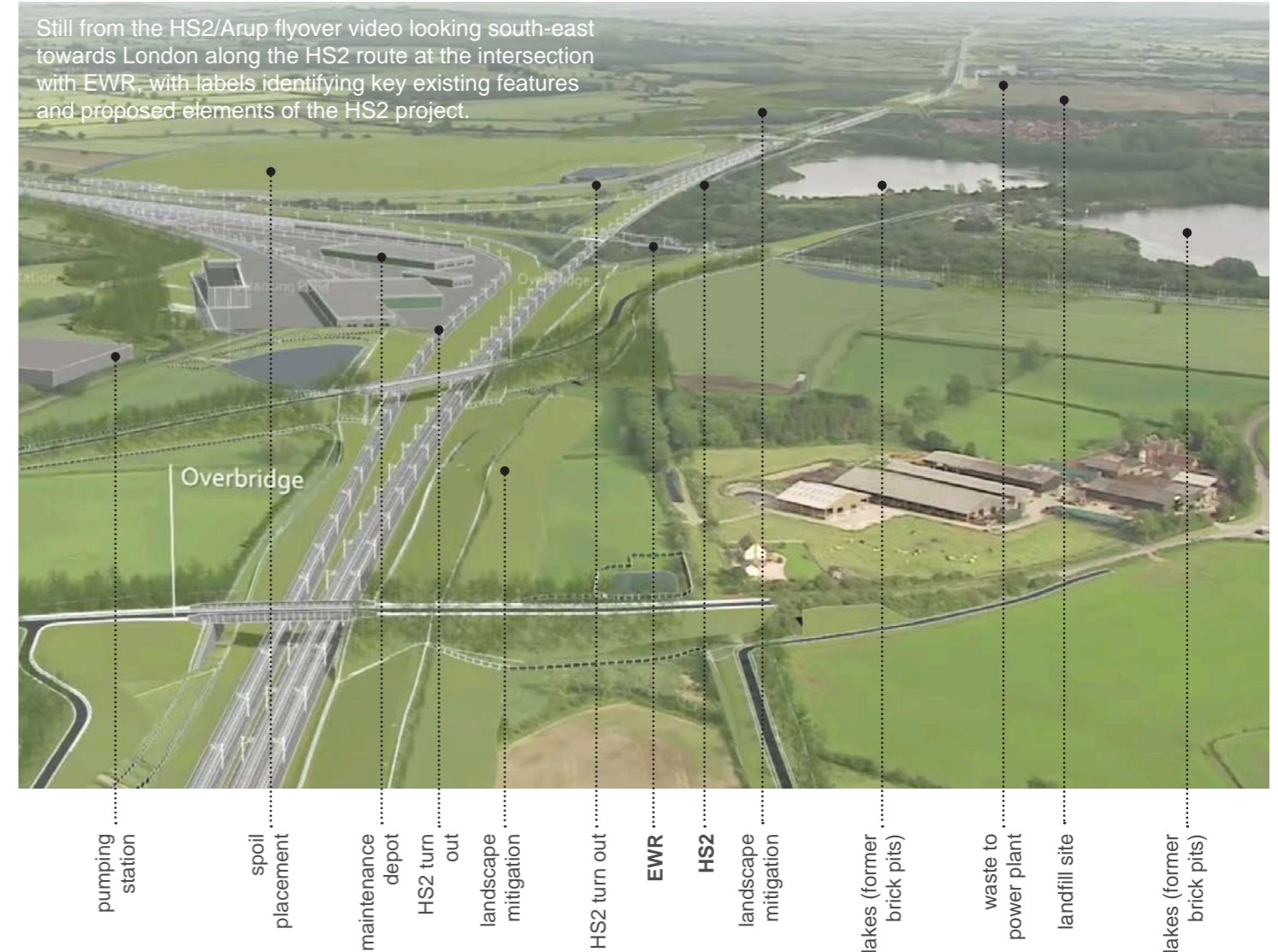
With significant land holdings via the HS2 project (the maintenance depot and environmental placement/mitigation areas along the route) the government already has a significant stake in the area.

Notes

¹ As shown in the high level constraints mapping in chapter 2 - noting that this assessment is not based on site specific environmental analysis which would need to inform any concrete proposals

² A journey time of under one hour seems plausible given the estimated 50 minute journey time from Aylesbury that a passing loop and line speed improvements on the Aylesbury to Princes Risborough line are estimated to provide - for further details see: http://www.londontravelwatch.org.uk/documents/get_job?id=3280&age=&field=file

³ A spur from HS2 to the maintenance depot / EWR is already planned and with further grade-separated link might allow the creation of an EWR interchange station allowing high speed services to/from the north utilising paths previously allocated to the Heathrow spur. This would improve links to the Midlands and North from the city itself, and the wider region via interchange from EWR and the line through Aylesbury, and via parkway access from the regional road network.



3.9. NEW CITY

ILLUSTRATIVE CASE STUDY

NURTURING A NEW CITY

An entirely new city is the most challenging of the typologies from the perspective of developing an economic role, because by its nature it needs to be created and nurtured from nothing – although it also has the potential to be genuinely transformative in the long term.

Relatively poor connectivity and lack of scale in early years is likely to constrain employment growth, and realistically the strength of employment opportunities in Oxfordshire and Milton Keynes is likely to lead to substantial out-commuting in the early stages. In the short term, this should be looked on positively as a way to help overcome the severe labour supply shortages in Oxfordshire in particular.

However, in the long term, high levels of out-commuting, even if mainly by train, are unsustainable. To counter this as a long term outcome, it is important to identify one or more “anchor institutions” for the new city – similar to the role the Open University played in the early stages of Milton Keynes – to act not just as a significant employer, but also to help put the new city on the national and international map. This could be a new research institute or centre of excellence, a university campus, a government department or agency, a high profile corporate, or similar.

Also, as with Milton Keynes, new facilities and functions should be added to the new city at frequent intervals, to increase its attractions and create the image of a lively, ever changing urban environment. See the box to the right.

The long term economic potential of the city could be closely linked to successfully building on the growth and diversification of the high technology engineering and motorsport cluster within which the new city will be located. A recent report by SQW on this cluster demonstrated its growth potential, and the extent of diversification out of core engineering products and markets into related areas using the technologies developed in motorsport, such as composites manufacture, electronic control systems, and electric power trains. Much of this diversification has required a mix of skills traditionally found separately in the south Midlands (engineering) and greater South East (IT and electronics), which the city is at the geographical interface of. The benefits of focusing on the high technology engineering and motorsport cluster as a source of future jobs include the high levels of productivity, and its strong international profile and export performance.

Milton Keynes was the last new city built in the UK and turned 50 years old in 2017. In many ways it has been extremely successful. It has achieved its original goals for population and economic development, and it continues to grow. It was a financial success, using land-value uplift to forward fund infrastructure and pay back the original government loan.

The timeline below gives a sense of the stages in the development of a successful new city:

- 1967: MK new town designated with a target population of 250,000 (existing population in the area was 50,000);
- 1969: Open University (OU) established its HQ in MK – this was far more significant at the time than it appears now, because the OU was the new wave in higher education. It was obviously seen as an important early symbol of the new city’s status;
- 1974: First stage of the shopping centre – also very early in the new city’s development, so clearly seen as a key function for the new city – to provide a high level retail centre for both the city and the surrounding area;
- 1975: First office building in central MK;
- 1981: 123,000 population – more than doubled in 14 years since designation;
- 1982: Railway station opens – 15 years after designation of the new city;
- 1984: General Hospital opens, 17 years after designation;
- 1991: De Montfort University opens a new campus in MK. It was closed in 2003 when De Montfort got into financial difficulties, but then in 2008 “University Centre Milton Keynes” was opened, which offered foundation degrees, working as a “hub” with other universities including Oxford Brookes, Northampton University, Bedfordshire University and the OU.

Throughout the period there was a constant drip feed of new leisure facilities: e.g. MK Bowl in 1979, the UK’s first multiplex cinema 1985, Woughton marina and new aqueduct on Grand Union canal 1987-89, national hockey stadium 1996, MK theatre and art gallery 1999, Xscape 2000, MK Dons established (formerly Wimbledon FC) 2004, MK international festival 2010.

A NEW TYPE OF NEW TOWN

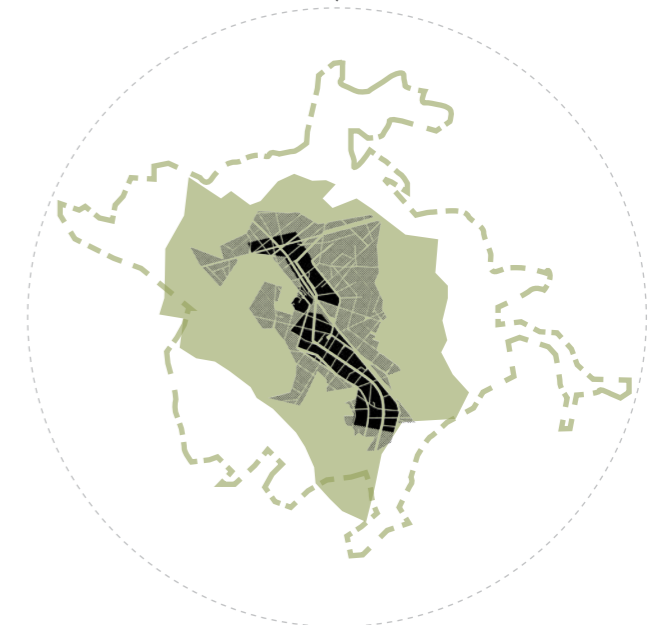
For all of its successes, Milton Keynes is a product of its time: a sprawling, low-density, car-orientated city. The low density model has made it difficult to run attractive public transport services sustainably. Walking and cycling paths are abundant and separated from traffic, but are unattractive for many given the long distances that the low density arrangement and indirect routings generate. These routes are generally pastoral in nature, with little natural surveillance and are perceived by some as unsafe. The amount of land that the city covers – much of it spent on creating a picturesque effect for those travelling through, with the inclusion of extremely wide landscaped road verges that effectively hide the city – is enormous, given the size of the population actually housed.

5th Studio’s 2014 Wolfson Prize entry paid homage to “*Civilia*”, published in 1971 as a critique and counter proposal to Milton Keynes, which was at the time only in its fourth year. Both “*Civilia*” and 5th Studio’s “*Calvert*” envisage a high-density, compact city that uses the topography (for instance by building on the hill that will be formed using spoil generated by HS2) and a complex built section, to create a buzzing, walkable, mixed-use and determinedly urban setting with spectacular views out of the surrounding parkland and countryside. A different sort of city from Milton Keynes, or indeed Oxford, Cambridge or Bedford, widening choice in the context of changing needs, an evolving economy, and shifting demographics.



Milton Keynes

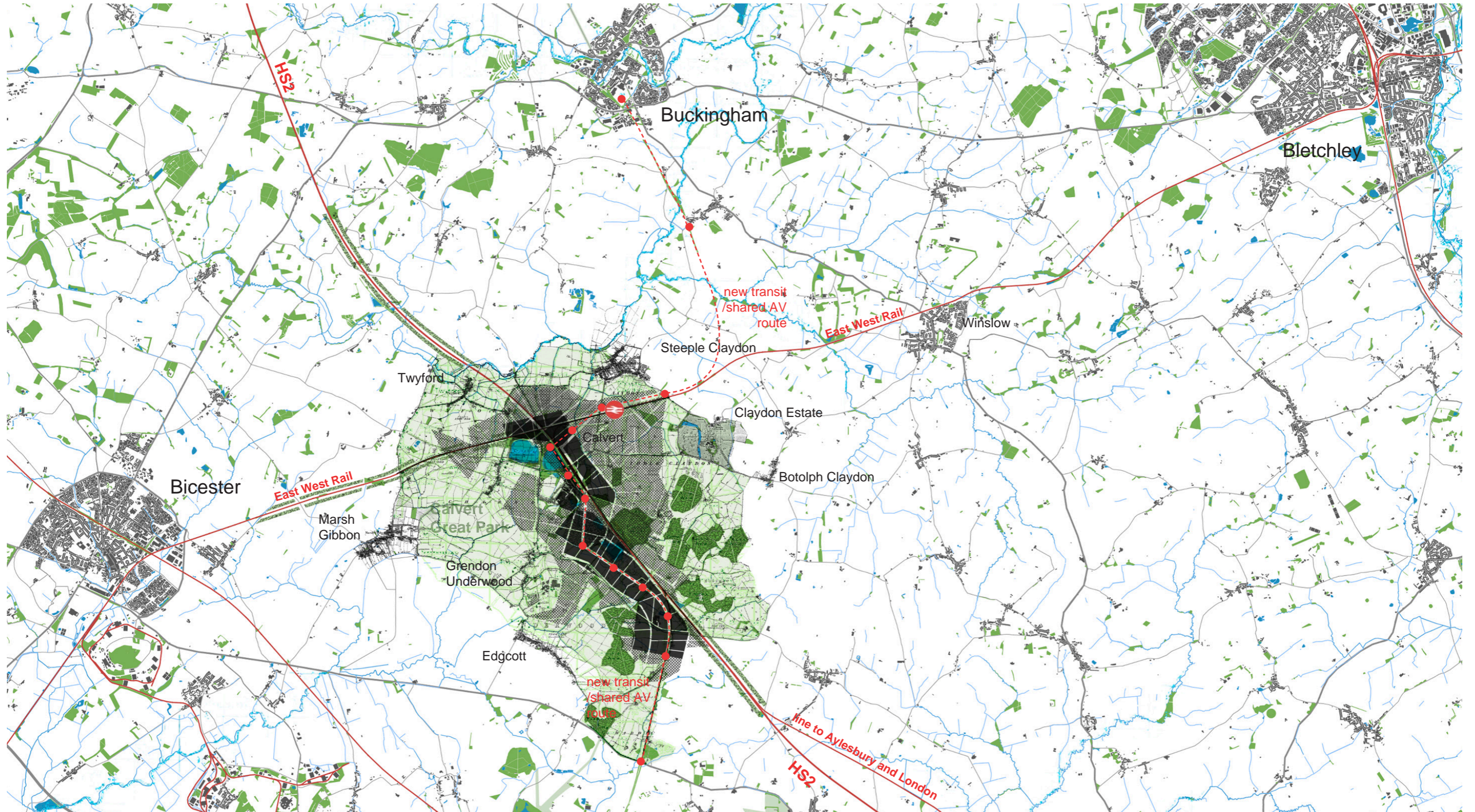
Low-density neighbourhoods widely distributed - with a matrix of greenspace within
Built area (black): 230,000 people at 2500 p/km²



Calvert

High-density compact city set in accessible countryside
Built area (black/grey): 230,000 people at 13,300 p/km²

3.9. NEW CITY ILLUSTRATIVE CASE STUDY



3.9. NEW CITY

ILLUSTRATIVE CASE STUDY

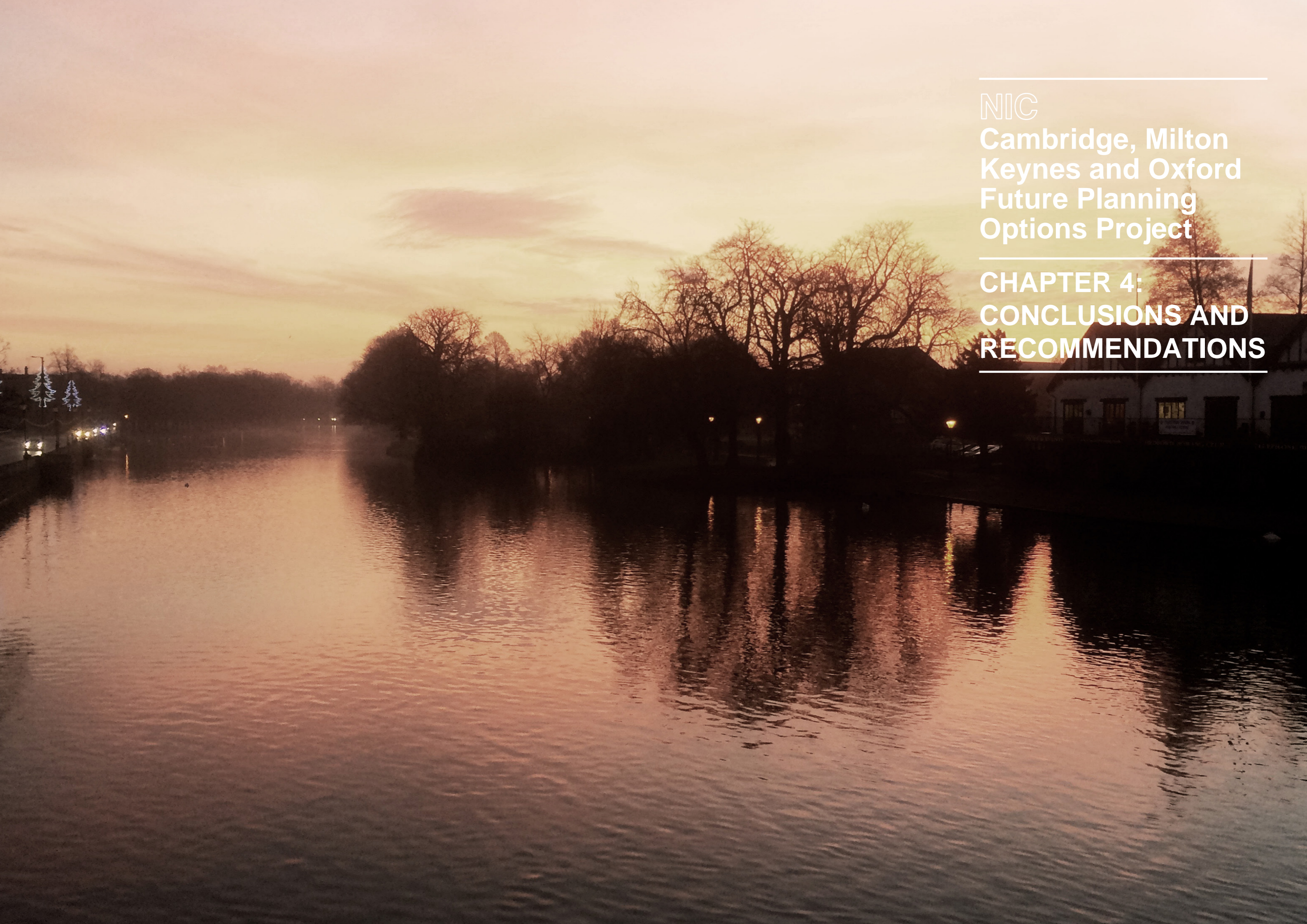
The drawing on the previous page shows a compact city form focused around a transit corridor linking Buckingham in the north via a new station on EWR to the A41/Westcott Venture Park in the south. The form of the city is such that it could grow incrementally along this route without the occupied area ever feeling unfinished. The city is shown set in an band of accessible countryside with preserved agricultural and productive landscapes among a patchwork of other open space, leisure facilities and a range of different habitats. The precise form of the urban area adapts to maximise the use of previously developed land, and to preserve and capitalise on the presence of key landscape assets such as Grebe Lake and the various blocks of mature woodland that bracket (and help enclose) the site. The form of the city provides a direct relationship and easy access to the area of the *Great Park* surrounding the city that serves as the key open space resource for its inhabitants, while also preserving the setting of the ring of existing villages that surround the site of the new city.

The drawing alongside is a propositional view, looking across Grebe Lake, showing a dramatic vertical agglomeration at the northern end of city, accommodating a new university / research institute allied to spaces for high-tech engineering R+D and manufacturing. The latter of these could be housed within a plinth structure (alongside spaces for storage, logistics, water treatment and storage, vehicle storage/charging, recycling etc.) that in combination with the new hill (the “sustainable placement” for HS2 spoil) create the elevated ground of the city. These uses are co-located with new city centre uses (restaurants, shopping, leisure etc.) and housing – all overlooking the lakes and nature reserves around the former brick pits.



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CHAPTER 4:
CONCLUSIONS AND
RECOMMENDATIONS



CONCLUSIONS AND RECOMMENDATIONS

During the course of this commission we have developed a thorough understanding of the corridor, its issues and its potential, through a detailed literature review, site visits, limited consultation, extensive cross-corridor mapping, and spatial analysis.

Initial investigations found evidence of the severe neglect and under-utilisation of scarce land resources, together with continued use of outmoded models of development that perpetuate car reliance and the delivery of poorly designed buildings and neighbourhoods. Analysis of growth within the corridor over the last century shows that the “Transformational Scenario” that forms the basis of this study supposes year-on-year housing growth similar to the long term average, and well within the rate achieved in the period of fastest growth, but that the market has failed to provide anywhere near the levels needed to reach that target in recent years.

We have used this understanding to develop a proposition for a cost-effective and resource-efficient spatial framework that integrates planning of development and transport, while also respecting the character and constraints of the territory.

This framework is supplemented by a description of a series of settlement-scale development typologies in the form of site specific case studies – each of which may be applicable to a number of sites across the corridor. These typologies have been developed with reference to both best practice case studies (collated in [Appendix D](#)) and through in-situ testing, by examining how they might work in a real-world location within the corridor.

Based on this work, we have come to the conclusion that there is no “one-size-fits-all” development form that “best fit[s] the needs of the corridor”, but that a diversity of responses is likely to produce the best overall result, given the wide spectrum of conditions present in the corridor. To realise the scale of growth required by the “Transformational Scenario”, this would need to include larger-scale new settlements if the cumulative cost of infrastructure and impact on the countryside is to be limited.

Successful growth is therefore likely to be determined by a combination of two key factors, rather than the selection of a theoretical development typology. Firstly, how any particular potential growth location relates to the wider context, in particular its place within the transport network,

and its connections to other centres. And secondly, that the development itself, of whatever type (intensification, new village, urban extension etc.) be well designed and fulfil a number of basic criteria.

Our conclusions and recommendations in relation to each of these two key factors are as follows:

Key Factor 1

INTEGRATED SPATIAL AND TRANSPORTATION PLANNING

Principal Recommendations

- All new homes should be served by good quality (frequent, fast and reliable) public transport within a short walk or cycle. This is not currently being achieved despite the NPPF requiring that transport system be “balanced in favour of sustainable transport modes, giving people a real choice about how they travel”. Taking seriously the provision of access by means other than the car is likely to be the key factor in determining the overall spatial distribution of development (Transit Oriented Development).
- Developments of all scales should fully account for the need for infrastructure and access to higher-order services that they will generate. This may, for example, make remote small-scale settlements non-viable, as the cost of ensuring that high-quality public transport access is available, and the environmental impact of this, will be prohibitive. Instead, it may make necklaces of smaller-scale settlements, connected along high-quality public transport corridors into existing/expanded centres (that provide higher-order services) more attractive, because the necessary infrastructure cost can be more effectively shared – as the tram networks of Karlsruhe, Strasbourg and Montpellier demonstrate.
- Current disparate investigations into nationally significant infrastructure projects (the Oxford to Cambridge Expressway and East West Rail - both being progressed by the DfT but in separate teams), local transport planning/projects (e.g. Cambridge City Deal), and where to locate growth (multiple local authority Local Plan processes), need to be better integrated. For instance, the main infrastructure projects are being developed (as one would expect) principally with a focus on the outcomes for the regional or national network, but this risks potential synergies and opportunities that might come from examining the broader infrastructure need being missed.
- As such, an over-arching spatial framework should be developed, as a collaboration between local and national partners, to align infrastructure investment and development, including proposals for local transit networks that augment and extend the benefits that East West Rail would bring.
- A collaborative approach of this sort should allow local economic, urban development and transport drivers related to the overall spatial framework to influence the design of nationally significant infrastructure projects. A more holistic approach should allow local development and transportation goals to challenge, augment, adapt and refine emerging proposals so that they support local development and transportation goals alongside the DfT’s broader strategic goals.
- The role of city-regions should be strengthened, as the principal agents of integrated planning of urban, transport and economic development, with co-ordination between these regions focussed on the opportunities of east-west connectivity and on addressing the current gap between planning for national-scale transport infrastructure and the scale of regional/metropolitan networks: the meso-scale opportunities that are currently being missed. This co-ordination might be organised through a formal sub-national transport body, or by a continuation of a voluntary consortium arrangement, as originally established to promote EWR.
- In cases where existing governance and planning structures do not align well with functional city-regions, consideration should be given to instigating mechanisms, or reforming governance structures, to afford greater co-operation/integration (e.g. Bedford-Marston Vale-Milton Keynes).
- In order for public transport to compete with the door-to-door convenience of the private car, local and regional public transport networks need to be better integrated in terms of ticketing, information, timetabling, and the legibility and branding of the full network. Transport for London performs very well in these terms and a similar model may be appropriate for the corridor.

Aspects of these recommendations related to governance and the on-going definition and definition of key infrastructure projects across the corridor are covered in further detail on the following pages.

CONCLUSIONS AND RECOMMENDATIONS

Infrastructure choices: The role of East West Rail and the Oxford to Cambridge Expressway

Taken together the case studies and spatial framework demonstrate how the delivery of East West Rail and the Oxford to Cambridge Expressway, if routed and specified correctly, could enable substantial opportunities for the growth of new settlements between Bicester and Bletchley, in Marston Vale, South of Bedford (though, not precluding development in central Bedford), at Sandy, and between Sandy and Cambridge.

To maximise the potential of these opportunities, development work on these two infrastructure projects need to take account of their potential role in supporting sustainable growth.

The DfT are already examining route options for both the Expressway and the central section of East-West Rail, so the integrated approach outlined above needs to be adopted immediately, to ensure that opportunities are not missed, or decisions made without access to, or consideration of, a wider set of objectives or analyses.

With this in mind, there follows a summary of our tentative conclusions about the potential choice of Expressway and East West Rail routes that might best support growth in the terms established by the brief for this study, while also meeting the DfT's objectives for strategic/national-scale connectivity.

Where these differ from any of the already established route options, we recommend that the feasibility and performance of these new options also be investigated for comparison. Correspondingly the development potential of any already established route options should be assessed, so that this factor can form part of the options appraisal process.

I. EAST WEST RAIL

The diagram alongside shows the potential future rail network on completion of EWR (and HS2). The darker dotted lines are existing transit (guided bus) networks, and the lighter dotted lines are potential extensions to these or additional transit routes as identified in the **Chapter 2: Spatial Framework**.

The diagram is based on plans published by HS2 and the EWR Consortium, except in the case of EWR between Bletchley and Cambridge, where it is based on the detailed route that has been explored in the course of this study.

This potential route, which has not been subject to an engineering feasibility study, but appears broadly plausible and has been identified in response to the development potential of a number of locations along the route that became apparent through the relevant case studies.

The plan (below-right) therefore shows a route option (solid red line) additional to those previously considered - and we recommend that this be added to the on-going design and appraisal process. Its key features are:

1. Divergence from the existing Marston Vale line near Millbrook
2. Wixams Station - including MML/EWR interchange and parkway access and enlarged/intensified development adjacent - see Marston Vale case study
3. New Sandy station (replacing the existing station - marked x) - providing ECML/EWR access and a focus for new development north of Sandy - see Sandy case study
4. New station between Sandy and Cambridge as a focus for new development - with potential for access from the A1198 - see Bassingbourn case study
5. Junction with the existing London-Cambridge line west of Foxton
6. Proposed Cambridge South Station (Addenbrookes)
7. Potential for tram-train services via the residual, eastern portion of the Marston Vale line and new connections serving development areas in south/eastern Milton Keynes, Marston Vale and central Bedford (dotted red line) - see the Bedford and Marston Vale case studies.

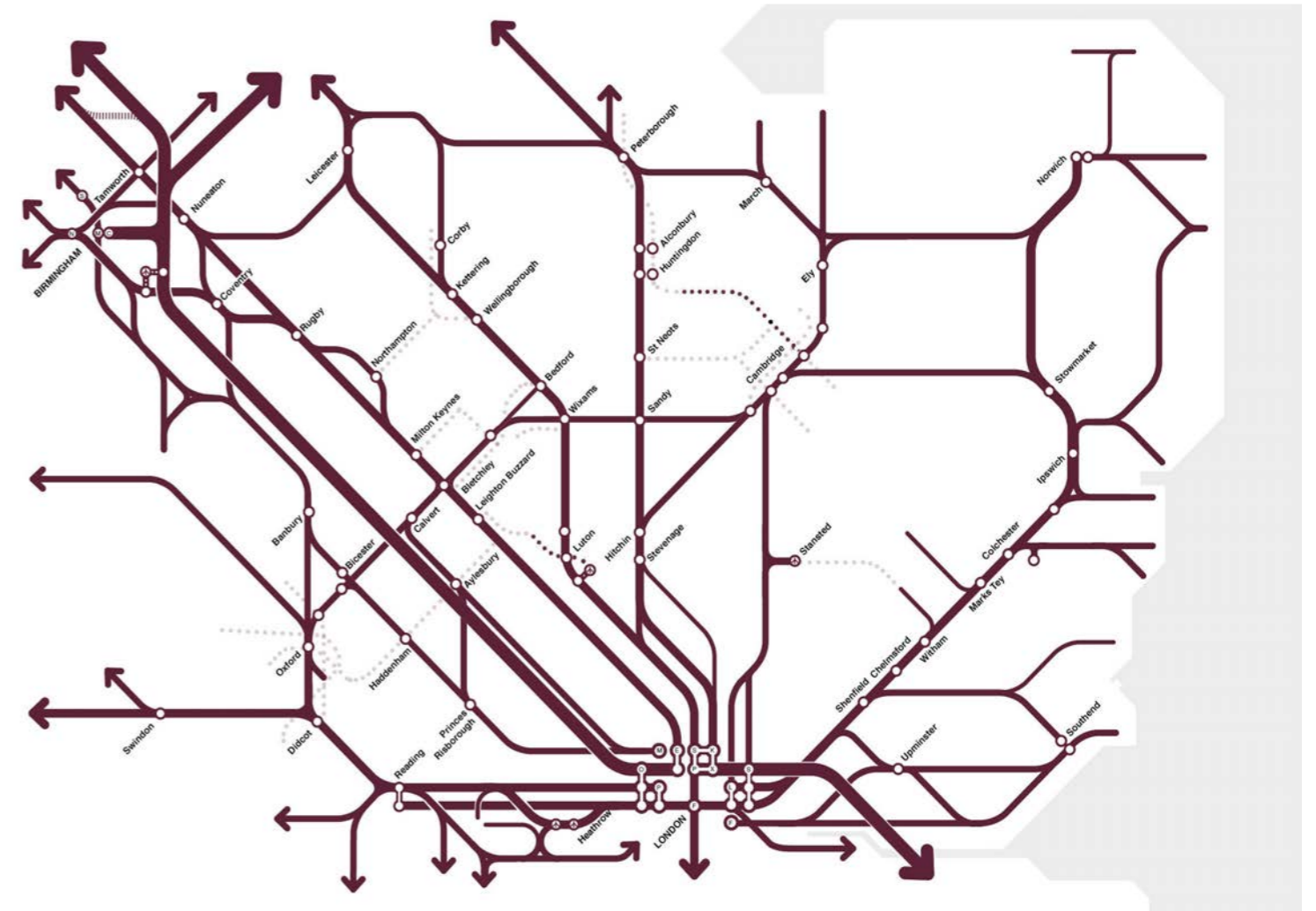


Diagram of the national rail network highlighting the role of East West Rail in connecting radial routes coming from London.



CONCLUSIONS AND RECOMMENDATIONS

II. OXFORD TO CAMBRIDGE EXPRESSWAY

At the time of this study no definite “line on the map” route alignment options have been published for the section of the Expressway between the M1 and A34/M4. This study is therefore based principally on an appreciation of the broad route options presented in the *Oxford to Cambridge Expressway Strategic Study: Stage 3 Report*.

Following our own review of these options we have, for the purpose of this study, assumed that option C is discounted as it provides the least direct route and, at a strategic scale, has the least potential to directly support the larger development opportunities that emerged from the spatial analysis in chapter 2.

On this basis we have consolidated our understanding of the potential routing of the Expressway west of the M1 to two strategic approaches and their corresponding geographic corridors, irrespective of specific route alignments:

Approach α Southern Option

- based on option A from the Stage 3 Report
- for a new “cross-country” alignment north of Aylesbury and south of Oxford.
- additional potential for link to A41

Approach β : Northern Option

- based on option B (or C) from the Stage 3 Report
- new road broadly parallel to EWR between Milton Keynes and Bicester + A34 upgrades around Oxford
- synergies with potential upgrade of A420 Swindon to Oxford.

For the purpose of illustration, these broad approaches have been synthesised with the indicative route options published by Highways England at various points, our own understanding of the topography and landscape, and our speculative case study proposals, to create simplified/indicative route alignments. These alignments feature on the **Illustrative Scenario** that follows, but are not recommendations and do not indicate a preferred or tested proposal.

The role for such a route as part of the national network seems logical, in that it addresses a perceived “gap” in that system and has the potential to provide relief and resilience to the orbital routes around London and Birmingham.

At a regional scale, the strategic case for the route is less clear-cut, given that all of the city region and sub-regional areas within the corridor (Oxford, Milton Keynes and Cambridge) are aiming to reduce the use of private cars as a means of access, particularly for commuters.

Similarly, in terms of local access, more targeted local measures, to tackle congestion or increase walking and cycling rates for instance, are likely to provide far better value for money.

Nonetheless, there could be a compelling strategic case for an additional link in the national network. In that instance, such a route might additionally support large-scale growth in locations that, despite being attractive for other reasons, currently lack access to the strategic highways network. For example, development in Aylesbury Vale, such as that identified in **Chapter 2**, could be supported by an appropriate routing within either Approach α or Approach β . Similarly, a new settlement or settlements outside of the green belt south of Oxford (e.g. Chalgrove or North/East of Didcot) might be supported by an appropriate routing for the Expressway within Approach α .

If the Expressway project is progressed, the selection of any final alignment would have a significant impact on, but should also be informed by, any potential development opportunities along the way. It is therefore recommended that a full appraisal of this be undertaken in due course.

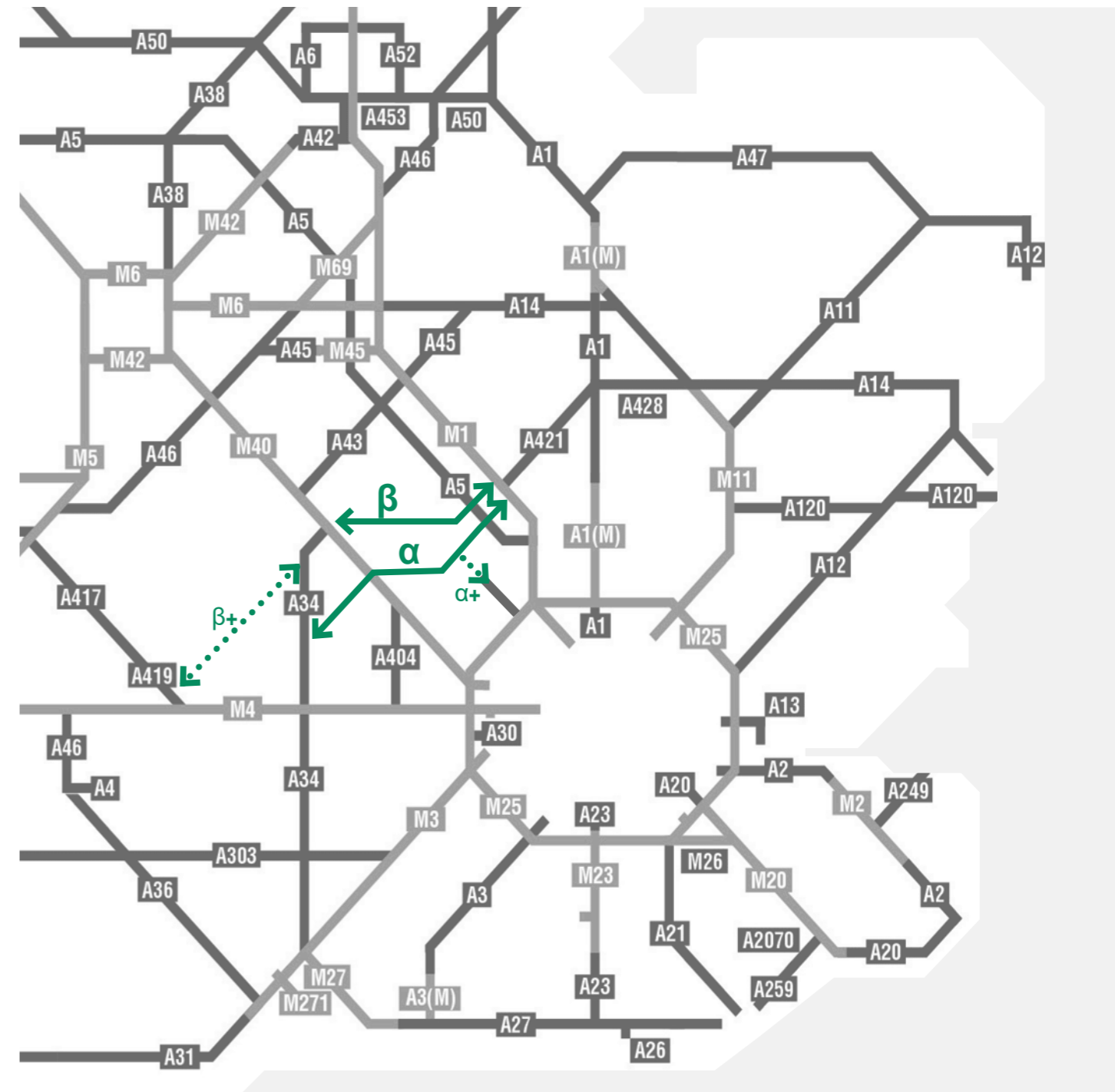


Diagram of the Highways England network highlighting two strategic approaches to delivering a connection.

CONCLUSIONS AND RECOMMENDATIONS

Governance

The initial spatial framework developed in this study deliberately disregards current Local Authority boundaries, and is instead formulated principally with regard to the transport, landscape, economic and built environment context.

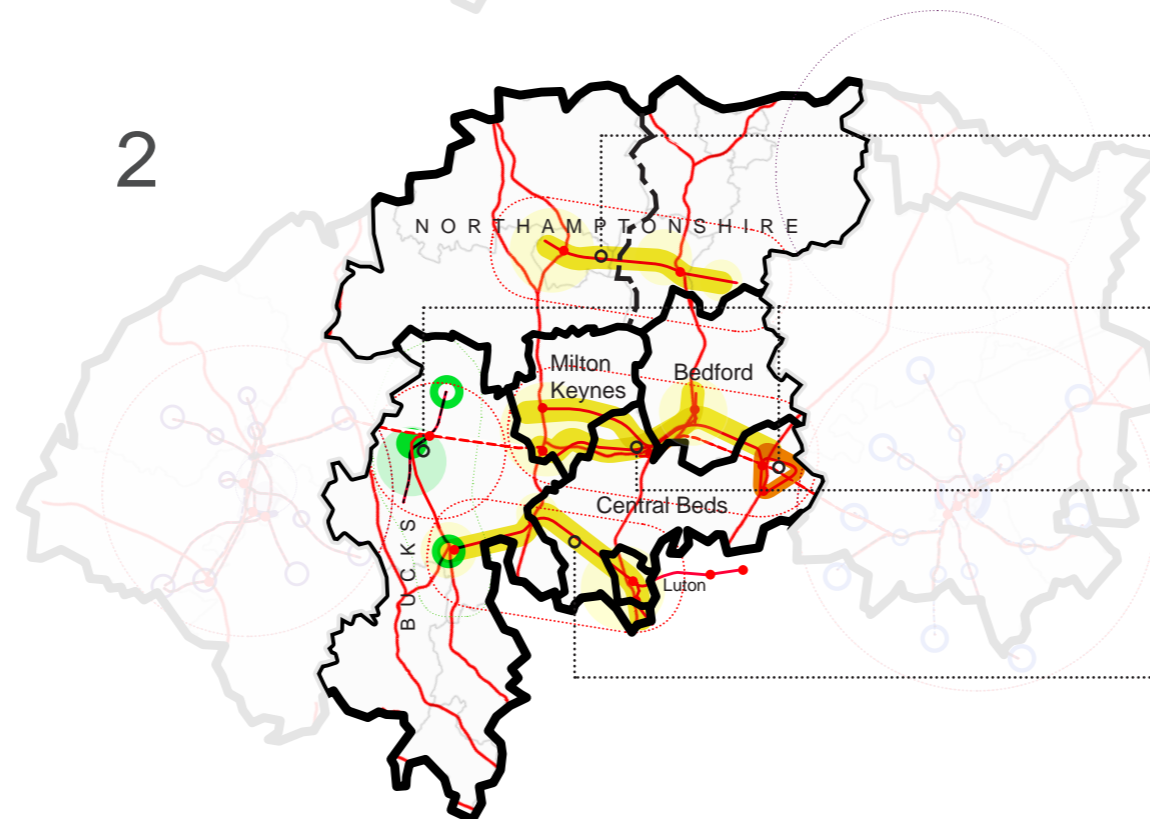
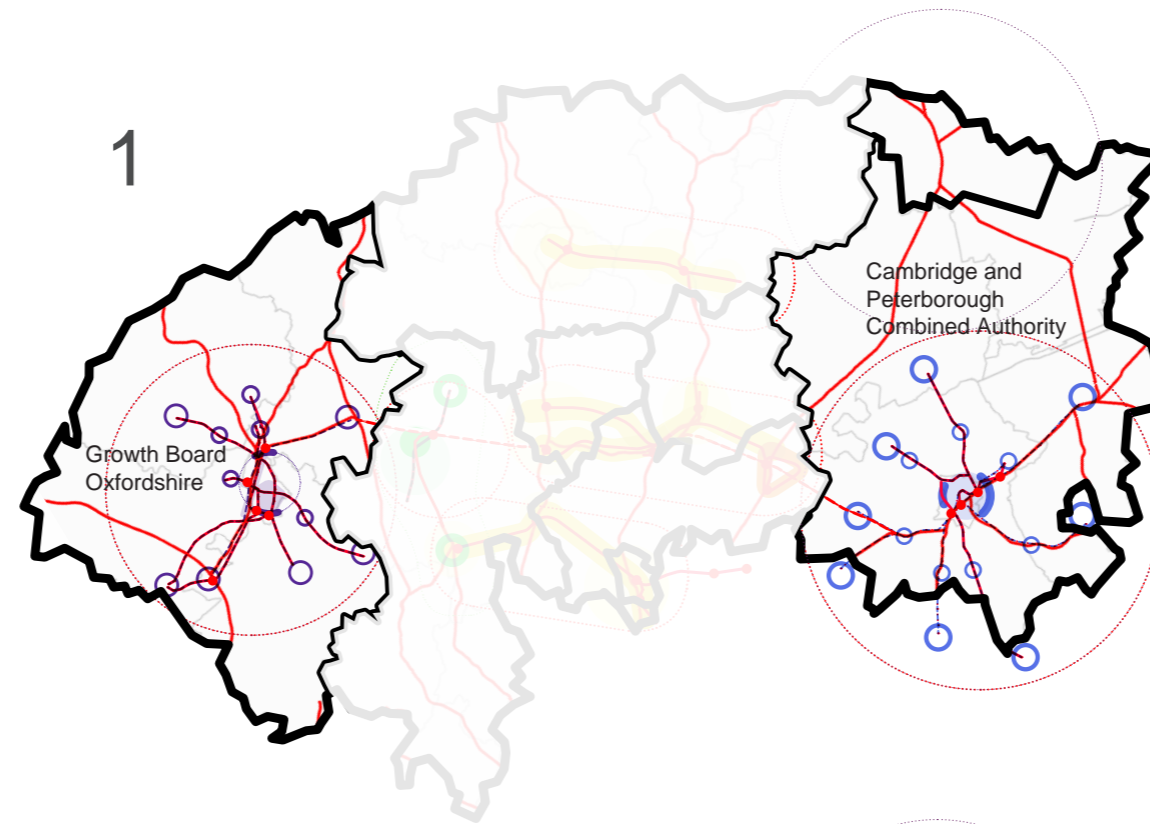
We have recommended that an over-arching spatial framework should be developed collaboratively by authorities across the corridor, and separately the NIC are consulting on options for how governance arrangements might be developed or reformed to support greater cross-corridor collaboration and joint-working, in particular with respect to infrastructure investment and associated spatial planning initiatives.

The pair of drawings alongside overlays existing Local Authority boundaries onto the proposed initial spatial framework, covered earlier in this report. The drawings highlight the difference between:

[1] the two ends of the corridor (Oxfordshire and Cambridgeshire) where there is already a strong alignment between existing or emerging governance structures and the spatial framework for growth proposed in this report, and;

[2] the centre of the corridor where the key opportunities for growth defined in the spatial framework bridge between different planning and governance areas. This would potentially hamper the realisation of these aspects, in the absence of reform of these structures, or the addition of mechanisms to support cross-boundary initiatives.

We recommend that the initial spatial framework, and future iterations of an over-arching framework developed and agreed by the relevant authorities, and in particular any discontinuities or conflicts between them and existing governance arrangements, be taken into account as proposals to reform governance arrangements across the corridor are progressed.



The Northampton - Wellingborough axis identified in the spatial framework crosses between the multi-district Joint Planning Unit areas of North Northamptonshire and West Northamptonshire

The two new city locations shown in the spatial framework may require bespoke and focussed governance arrangements to support their delivery and their eventual population would justify their own council.

The opportunity area stretching from Milton Keynes to Sandy via Marston Vale and Bedford criss-crosses between three different Unitary Authorities: Milton Keynes, Central Bedfordshire and Bedford.

Similarly the opportunity corridor from Aylesbury, via Cheddington/Leighton Buzzard to Luton (and indeed potentially on to Hitchin by extension eastwards) crosses between at least three Local Authority areas (Luton, Central Bedfordshire and Aylesbury Vale).

CONCLUSIONS AND RECOMMENDATIONS

Key Factor 2 EXEMPLARY URBAN DESIGN

While less obviously related to the NIC's infrastructure remit, the design and detail of new developments are vitally important in minimising the need for expensive additional infrastructure, maximising the benefits of existing and new infrastructure, and ensuring that the growth that new infrastructure allows is good.

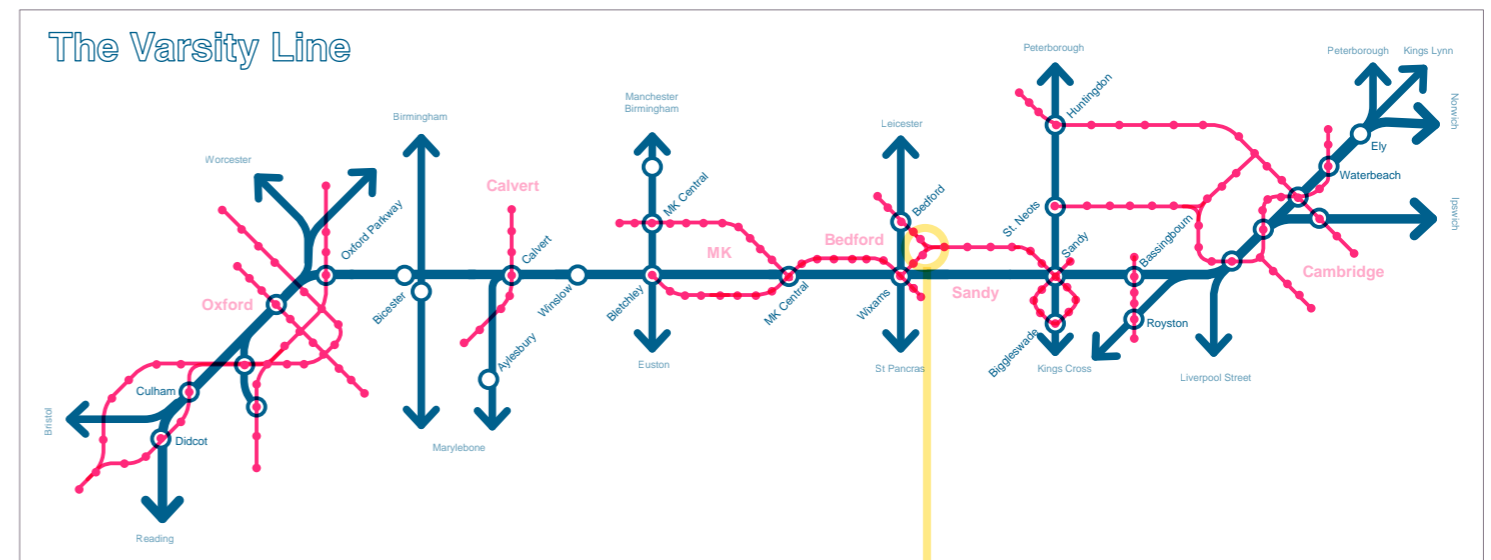
The success of new development across a wide range of metrics will be as much to do with the detail of how particular typologies – the central subject of this study – are realised, as to what the particular typology is. The various possible development typologies (intensification, new villages, urban extensions, new cities etc.) are not inherently good or bad, but there can be good and less good versions of them.

What this means will vary by typology – as outlined in the case studies – but with reference to these, and to the best practice examples, certain common features have been identified:

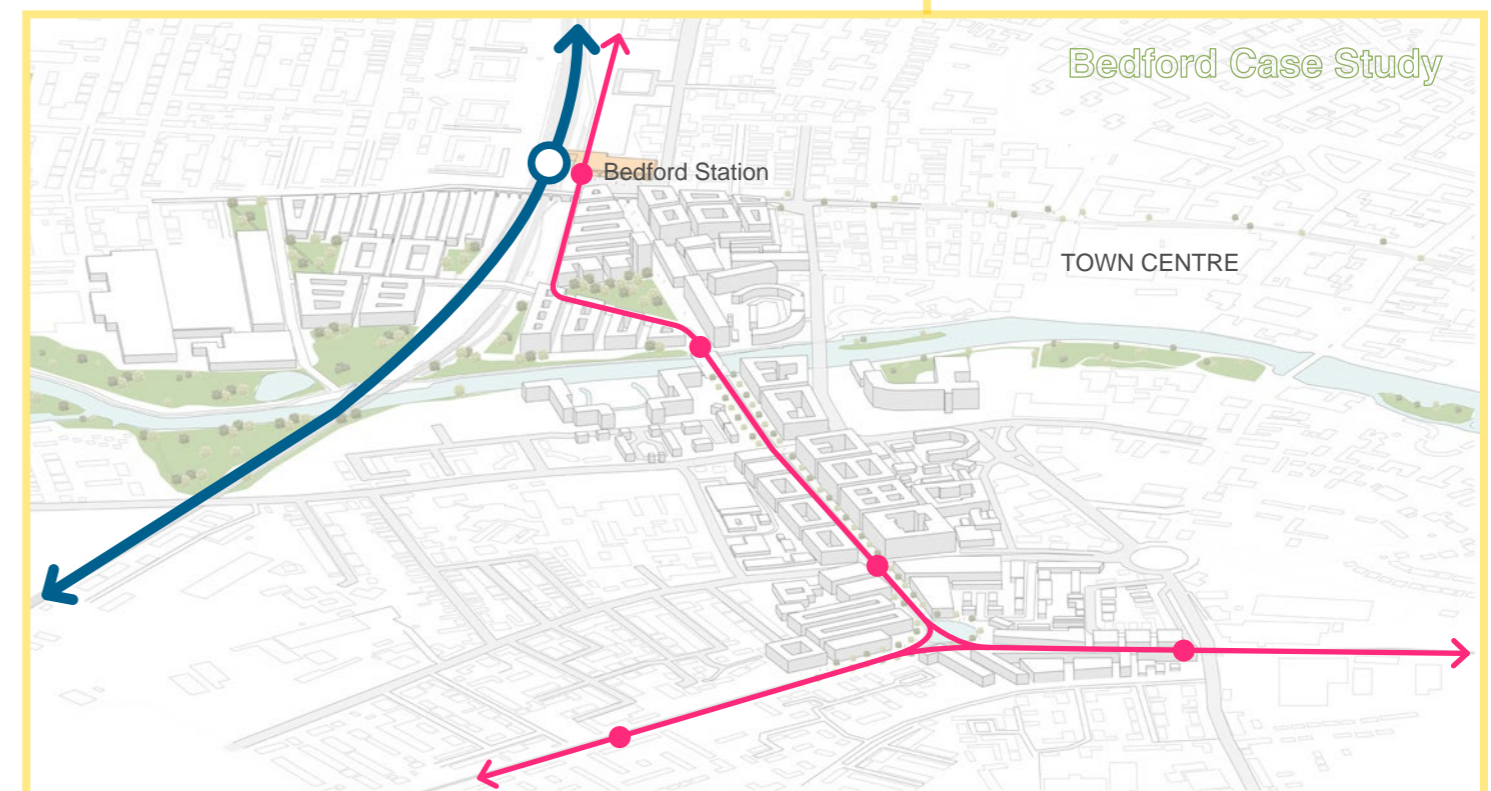
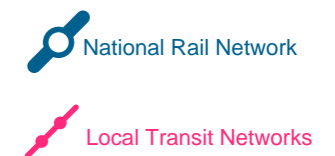
- In urban areas existing and new street networks should prioritise walking and cycling, and should be simple, legible and permeable in nature (i.e. avoiding complicated and confusing layouts of winding roads and cul-de-sacs that typify much suburban development);
- Neighbourhoods should be organised around local facilities and access to high quality public transport, with the latter being co-located, accessible to all, and central to the layout of the place;
- Medium to high levels of density should be achieved to support shorter travel distances to, and higher patronage of, local facilities and public transport services. With good design these densities can support, rather than detract from, the creation of pleasant environments providing for a good quality of life;
- The distribution of open space should be used to encourage a compact urban form, rather than to disperse development, to create a strong sense of differentiation between the built environment of villages, towns and cities, and adjoining open spaces of greens, commons, parks and the countryside;

Within urban areas pleasant streets and smaller-scale, carefully designed spaces should be provided so that exemplary social and play space is available on everyone's doorstep. In this respect the space between buildings is as important as the buildings themselves;

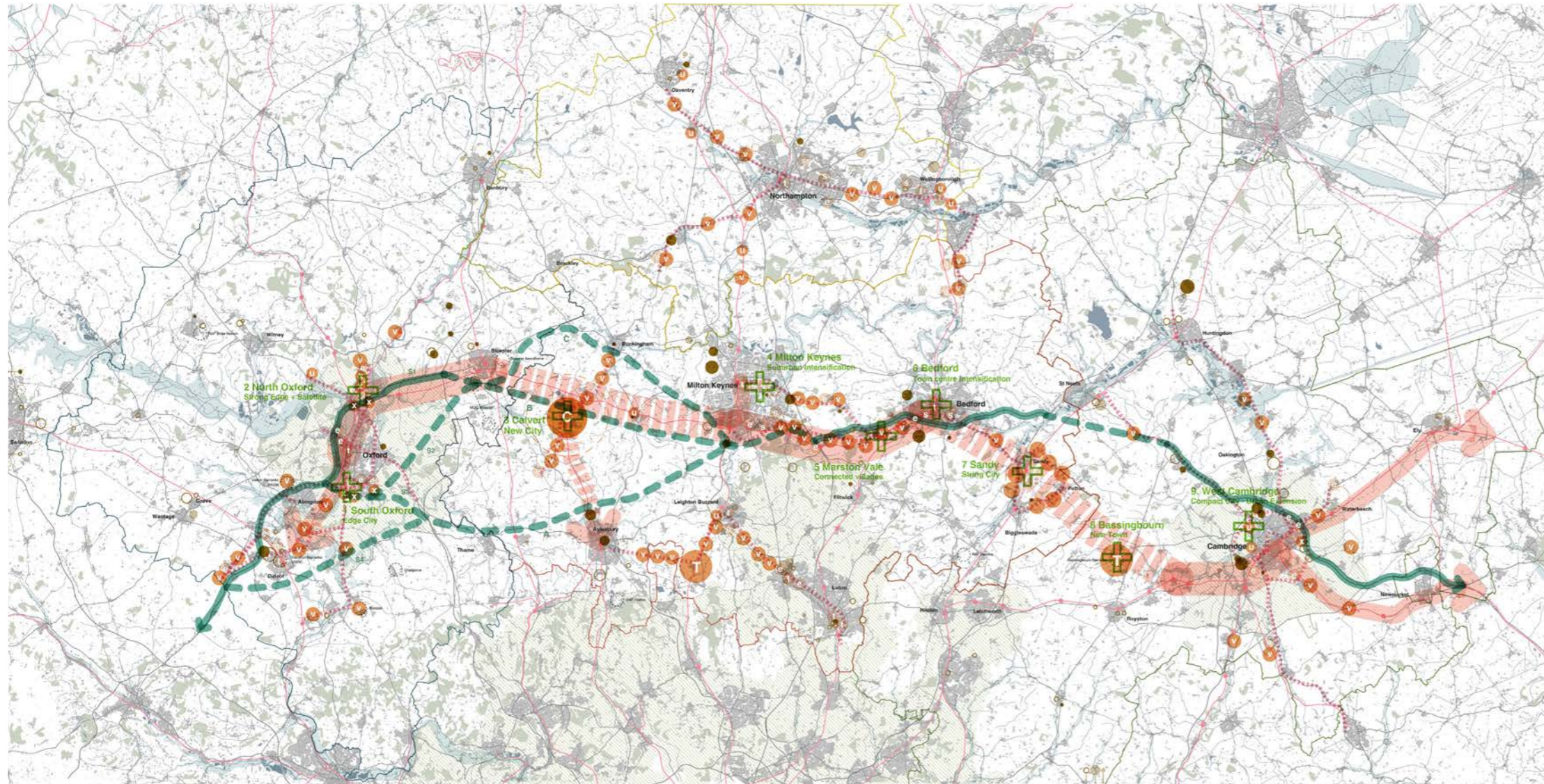
- Built development should go hand-in-hand with the creation of diverse and ecologically rich landscapes and waterscapes - for instance in Marston Vale where the Bedford and Milton Keynes Waterway Trust's canal project is struggling to find a vehicle for delivery;
- Places should accommodate a mix of uses with local services all within walking distance and places for work also integrated within neighbourhoods to a greater or lesser extent (depending on the circumstances/typology in question);
- Extensions to existing places should integrate well with adjacent areas with a permeable street layout;
- Generic responses with the application of standard building "products" and layouts, irrespective of local conditions, should be avoided. Within a strong organising urban framework there should be space for variation, individuality and delight in the design of buildings and spaces;
- Larger-scale settlements will require careful seeding and nurturing of their economic and institutional foundations. This could, for example, involve the creation of publicly funded research institutions tailored to the latent, but currently unfulfilled, linkages between existing economic/knowledge clusters across the corridor;
- Development of all types should minimise the load imposed on wider water, energy and waste networks, through localised provision and closed-loop processes;
- Settlements should not be designed around particular technologies or modes of transport to the exclusion of others – as was often the case in relation to the car in 20th century development. Instead they should provide the possibility of flex and adaptability over the long term, and prioritise the creation of human-centred urban environments.



The drawings here, drawn from earlier in the report, provide an example of the mutually supportive relationship between a co-ordinated and comprehensive transport system across the corridor and high-quality, intensively developed regeneration and development projects at the local level.



ILLUSTRATIVE SCENARIO - OVERVIEW



ILLUSTRATIVE SCENARIO

In addition to the requirements of the original brief 5th Studio were asked to develop an “Illustrative Scenario”. This is presented on the left and it relates particular approaches and the application of typologies to the distinct challenges and opportunities of locations within the corridor. It does this only in broad terms, and while we believe the scenario presented is broadly plausible, it is not fully tested and is only intended to provide an illustration of the overall scale of development necessary to achieve the 2050 “Transformational Scenario”, and one way in which that might be achieved.

This scale of development over the next 34 years would indeed be *transformational*. If framed and enabled by the right infrastructure, in particular new and extended transit routes to spread the benefit of East West Rail, a step-change in both the quality and sustainability of places to live, and the degree of economic connectedness across the corridor, seems a realistic proposition.

The illustrative scenario shows one way in which the full range of typologies outlined in **Chapter 3: Typologies and Case Studies** could potentially be deployed across the corridor. This is also in line with the spatial framework described in **Chapter 2: Spatial Framework**, and mindful of the high-level constraints identified from the corridor-wide mapping exercise that has been completed.

This illustration has been tailored to meet the overall target to 2050 of accommodating an additional population of 1.9 million, including around 450,000 from development accommodated due to pressures from land constrained markets.



Contains OS data © Crown copyright and database right (2016)
The drawing also selectively includes data transposed from the following Governmental Agencies: Historic England | Environment Agency | Natural England | DCLG | Highways England | Department for Transport | National Infrastructure Commission |

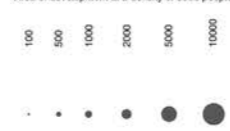
Legend

- Existing Roads
- Existing Rail Lines
- Existing Rail Stations
- EWR
- EWR Missing Section
- OZCEW
- OZCEW Options
- Proposed Transit Lines
- Selected MOD sites



- Case study location
- Application as per Savills Data
- Permission as per Savills Data
- Under Construction as per Savills Data
- Allocation as per Arup Report

Area of development at a density of 3500 people / sqkm



Typologies

- Town Centre Intensification at a density of 3500 people / sqkm
- Suburban Intensification at a density of 3500 people / sqkm
- Edge Intensification at a density of 3500 people / sqkm
- Compact city urban extension at a density of 7000 people / sqkm
- Strong Edge and Satellite at a density of 7000 people / sqkm



New connected village at a density of 3500 people / sqkm



New Town at a density of 7000 people / sqkm

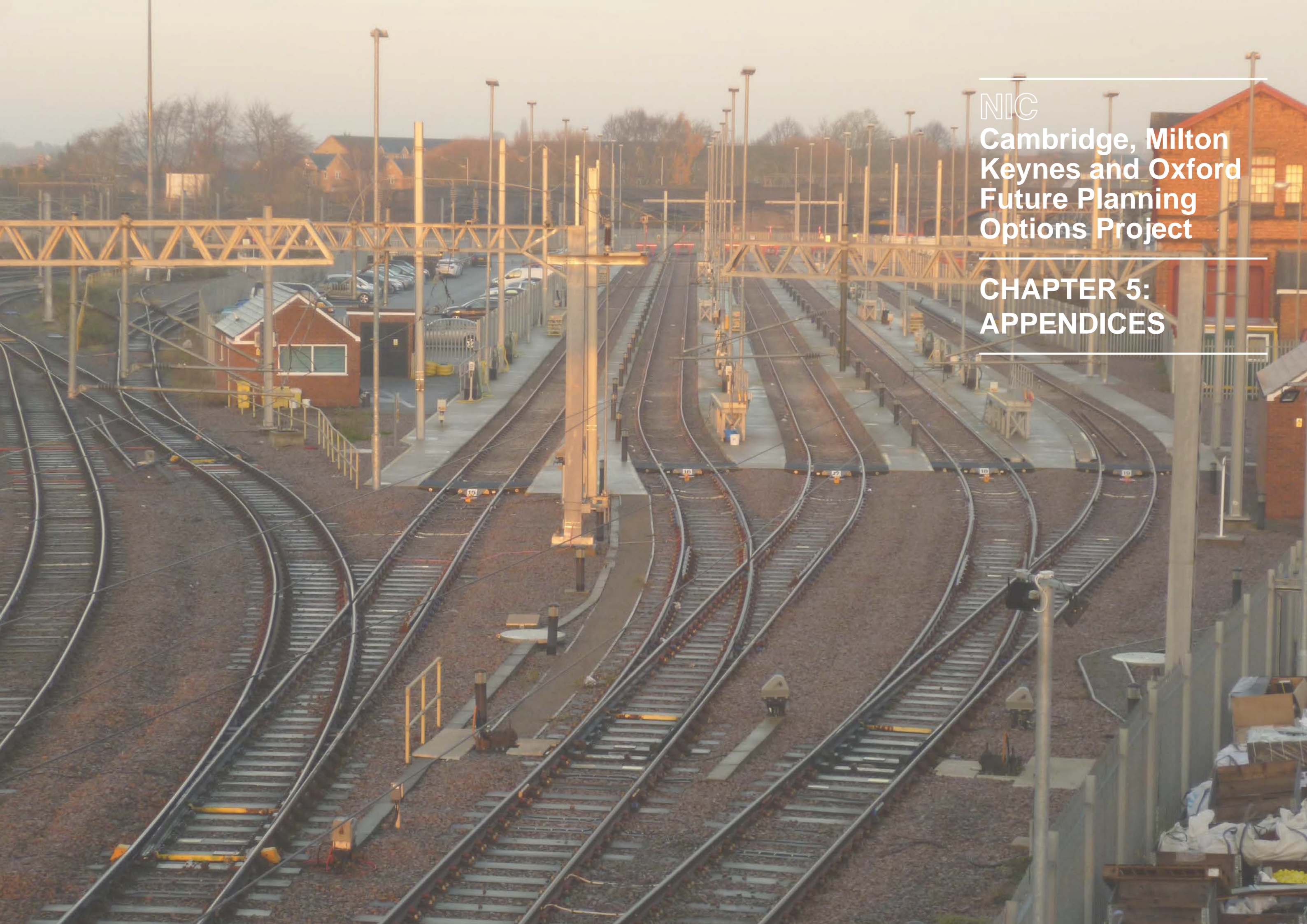


String City at a density of 7000 people / sqkm



New City at a density of 14000 people / sqkm

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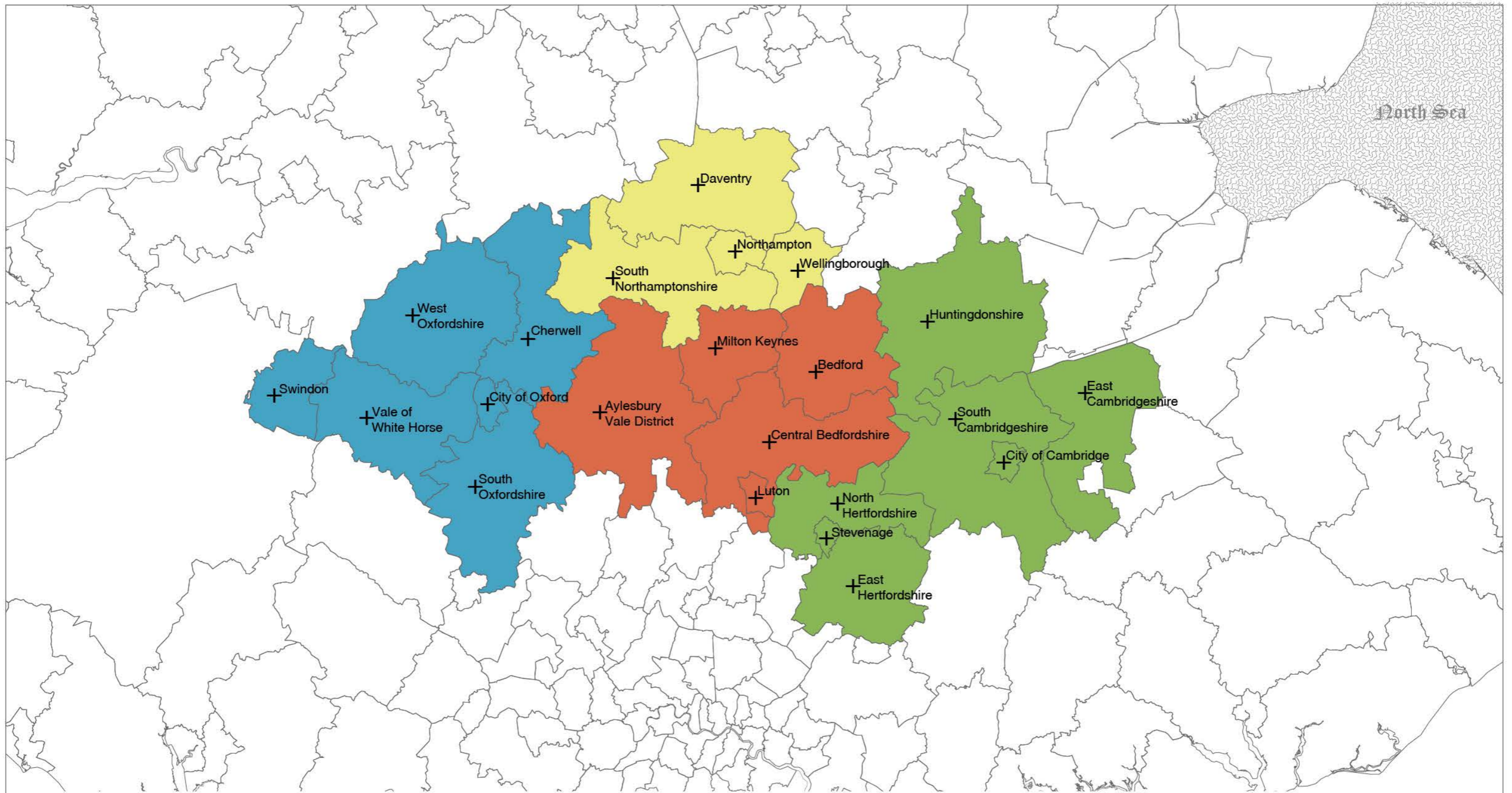
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CHAPTER 5:
APPENDICES

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APPENDIX A:
CORRIDOR
DEFINITION MAPS



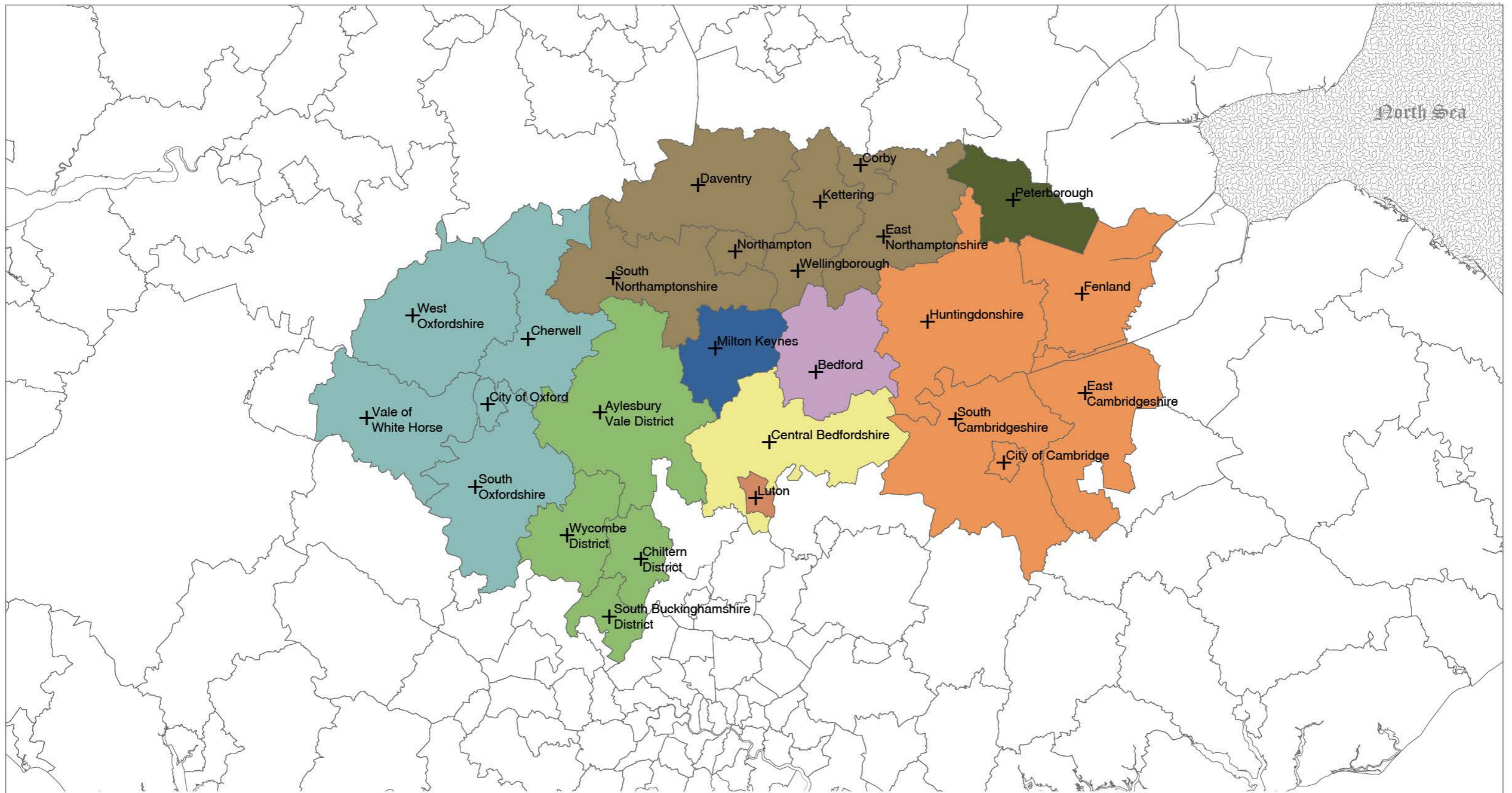
Savills Definition



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- | | |
|--|---|
|  Swindon and Oxfordshire |  Northampton and part Northamptonshire |
|  Aylesbury Vale- Milton Keynes - Bedfordshire - Luton |  Cambridgeshire and North and East Hertfordshire |










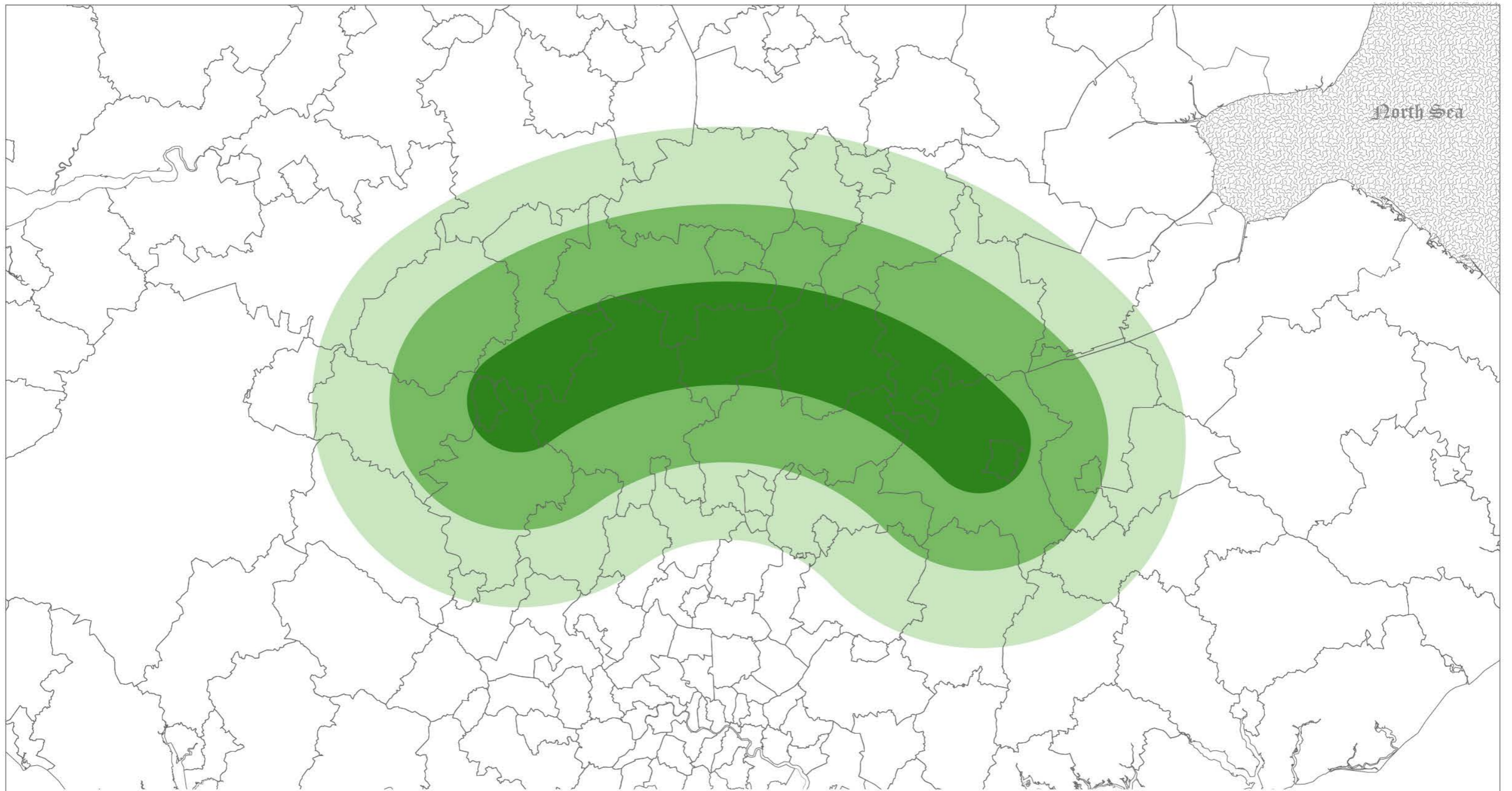
Governance Definition



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Future Planning Options Project

- | | | |
|---|--|--|
|  Oxfordshire |  Northamptonshire |  Bedford |
|  Buckinghamshire |  Central Bedfordshire |  Peterborough |
|  Milton Keynes |  Luton |  Cambridgeshire |





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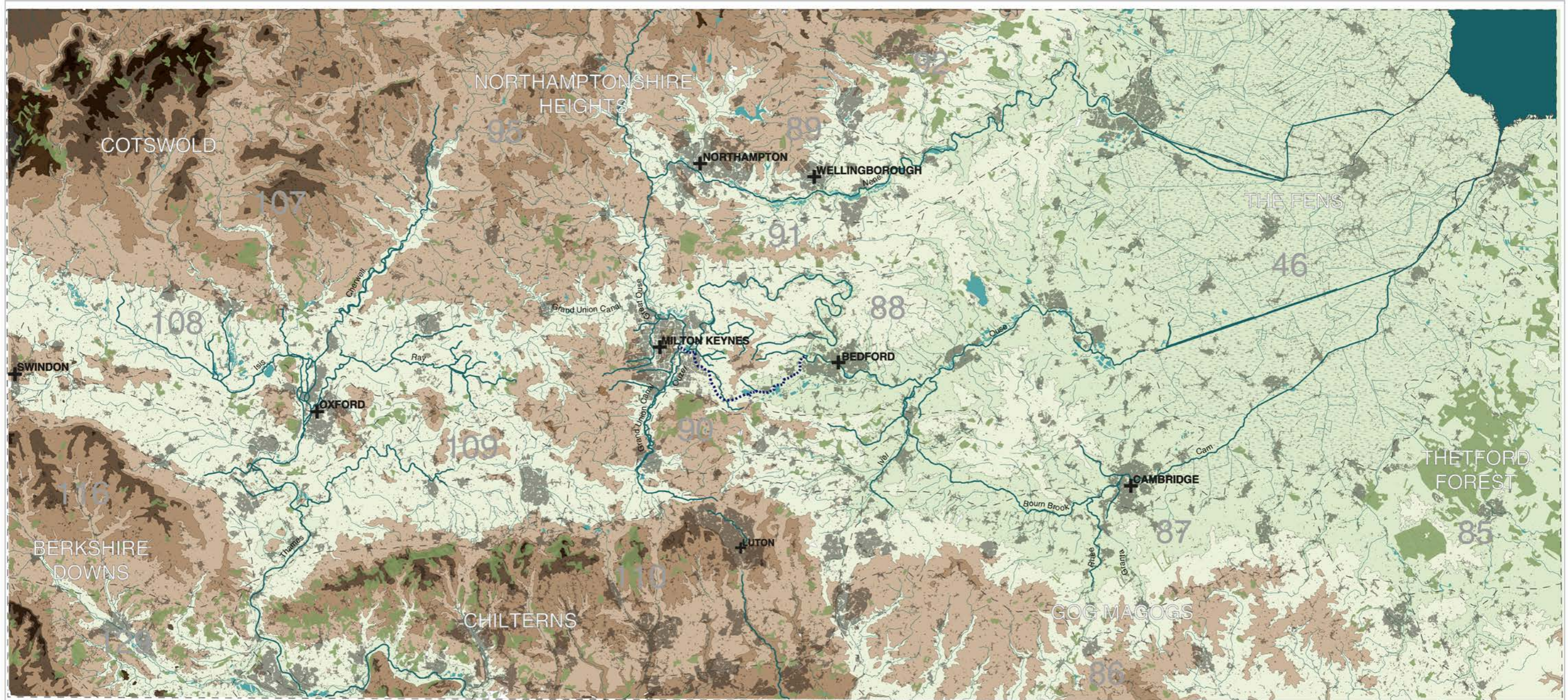


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APPENDIX B:
BACKGROUND
MAPPING



TOPOGRAPHY

Scale 1:250,000 on A1
Rotated view c.35° E



Legend

- Rivers
 - National Character Area Boundaries
 - Proposed Bedford to Milton Keynes Waterway Park (Bedford and Milton Keynes Waterway Trust)
 - Lakes
 - Woodland regions
- Height
-
- + 50m
+ 350m

National Character Area Profiles

- | | | | |
|----|---|-----|---------------------------------|
| 46 | The Fens | 95 | Northamptonshire Uplands |
| 85 | The Brecks | 107 | Cotswolds |
| 86 | South Suffolk and North Essex Clayland | 108 | Upper Thames Clay Vales |
| 87 | East Anglian Chalk | 109 | Midvale Ridge |
| 88 | Bedfordshire and Cambridgeshire Claylands | 110 | Chilterns |
| 89 | Northamptonshire Vales | 116 | Berkshire and Marlborough Downs |
| 90 | Bedfordshire Greensand Ridge | 129 | Thames Basin Heaths |
| 91 | Yardley Whittlewood Ridge | | |
| 92 | Rockingham Forest | | |

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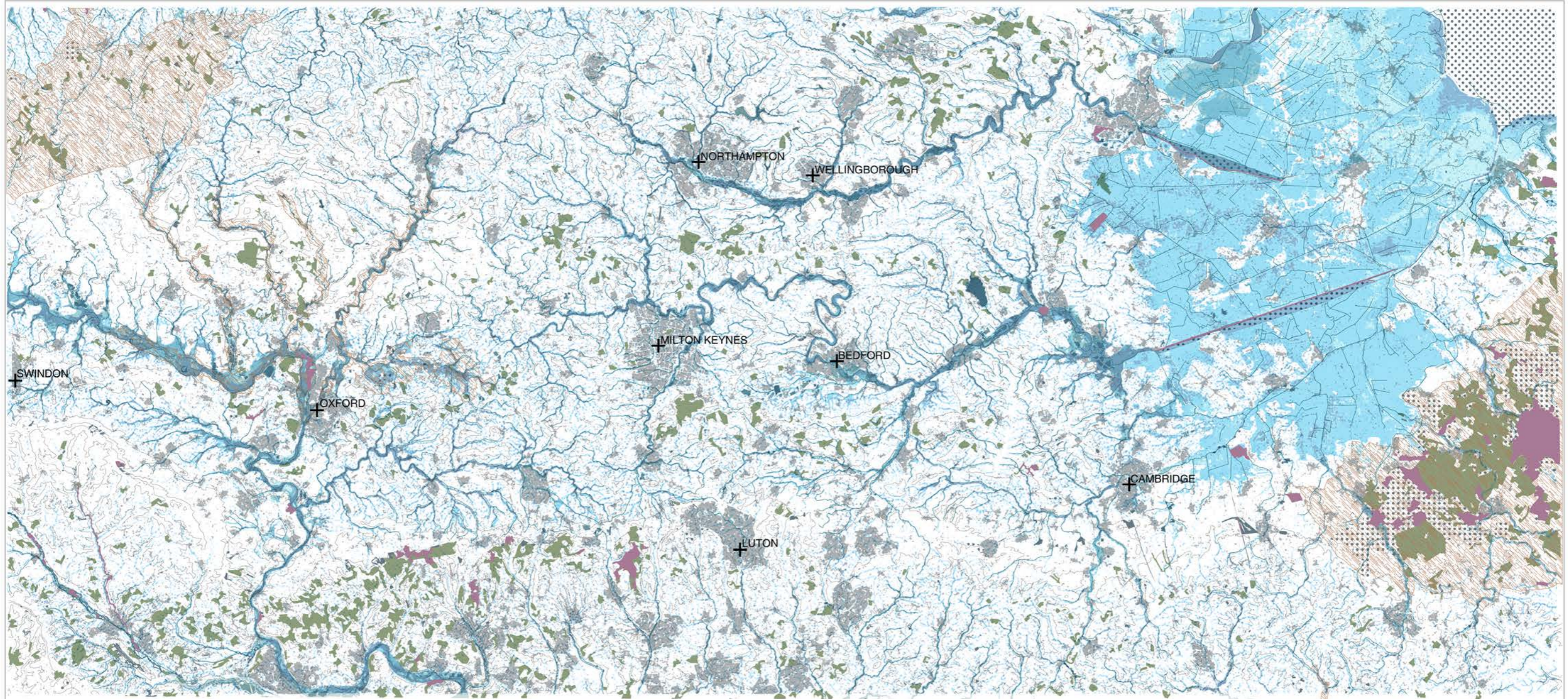
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SURFACE WATER, FLUVIAL AND PLUVIAL RISK OF FLOODING AND ENVIRONMENTAL CONSTRAINTS

Scale 1:250,000 on A1
Rotated view c.35° E



Legend

- Rivers
- Lakes
- Historic Flooding
- Woodland regions
- Special Areas of Conservation
- Environmentally sensitive areas
- Sites of Special Scientific Interest
- Risk of Flooding from Rivers, Seas and Surface Water

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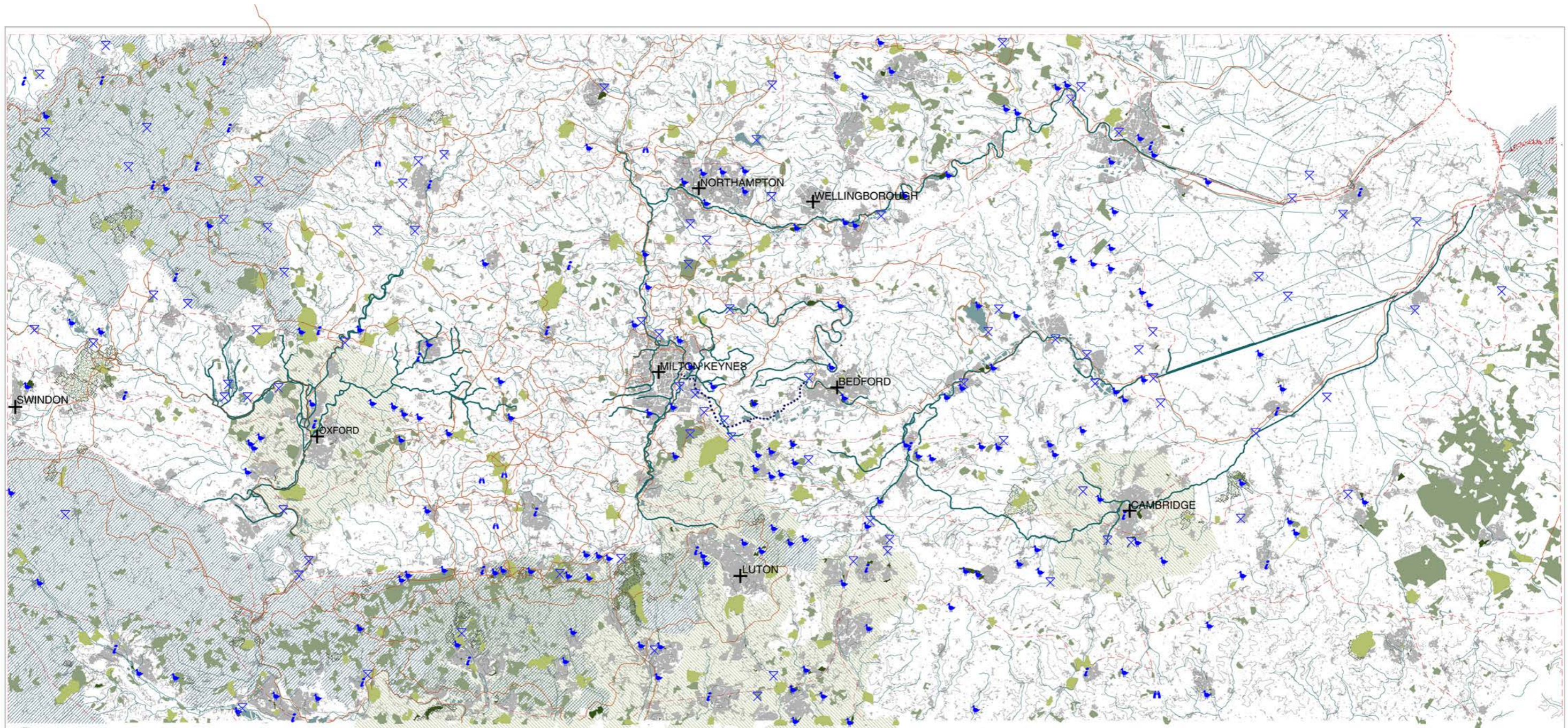
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LEISURE SPACE AND PRECIOUS LANDSCAPES

Scale 1:250,000 on A1
Rotated view c.35o E



Legend

- | | |
|--|---|
| Rivers | Local authority green belt boundaries 2014-2015 |
| Trails | Areas of outstanding natural beauty |
| Proposed Milton Keynes and Bedfordshire Waterway | Local nature reserves |
| Lakes | Nature Reserve |
| Woodland regions | Picnic and Camping site |
| Parks and Gardens | Information Point |
| National Character Areas | View point |
| National Trust Land | |

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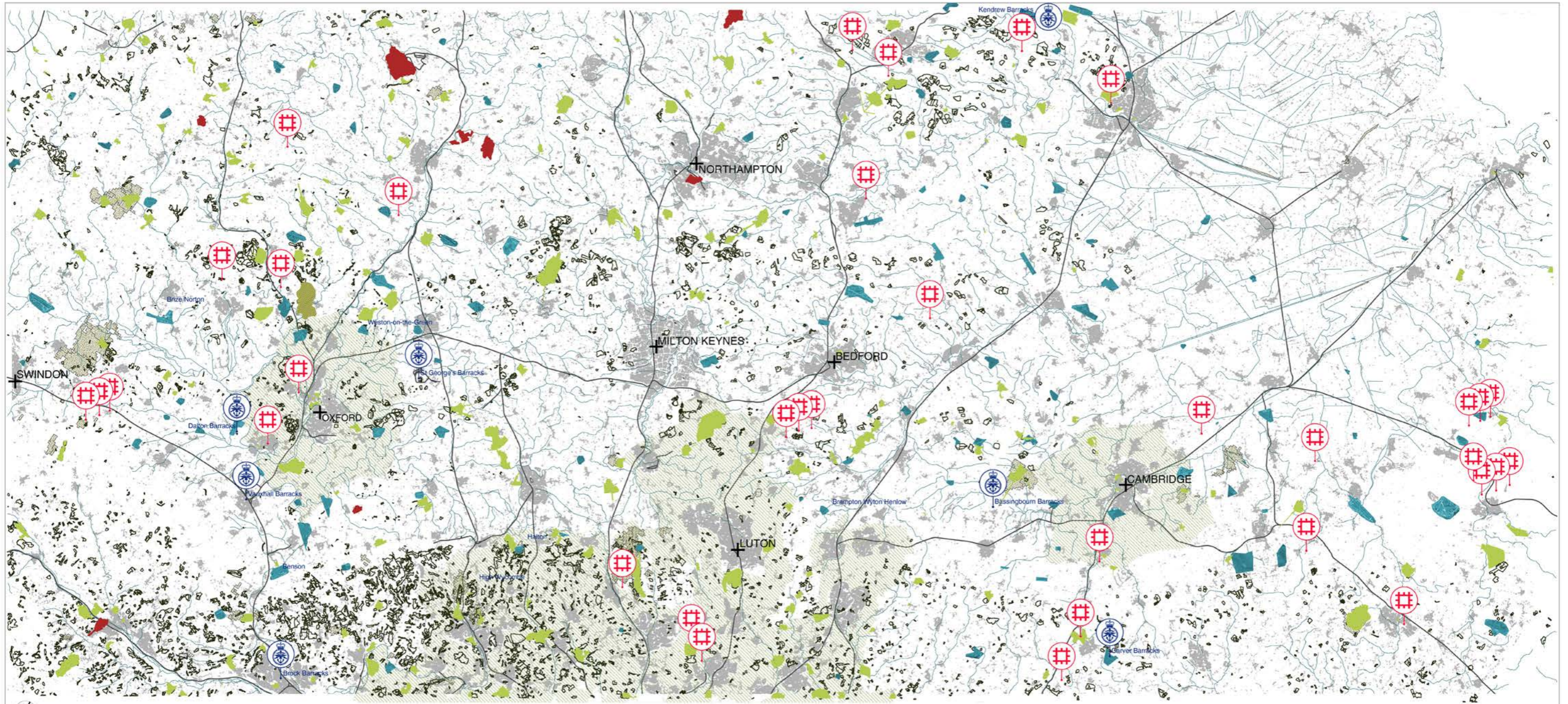
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HISTORIC FEATURES

Scale 1:250,000 on A1
Rotated view c.35° E



Legend

-  Rivers
-  Rail
-  Local authority green belt boundaries 2014-2015
-  Battlefields
-  Airbases
-  MoD sites
-  Airfields
-  Ancient Woodlands
-  World Heritage Site
-  English Heritage Sites
-  Parks and Gardens
-  National Trust Land

credits/ copyrights

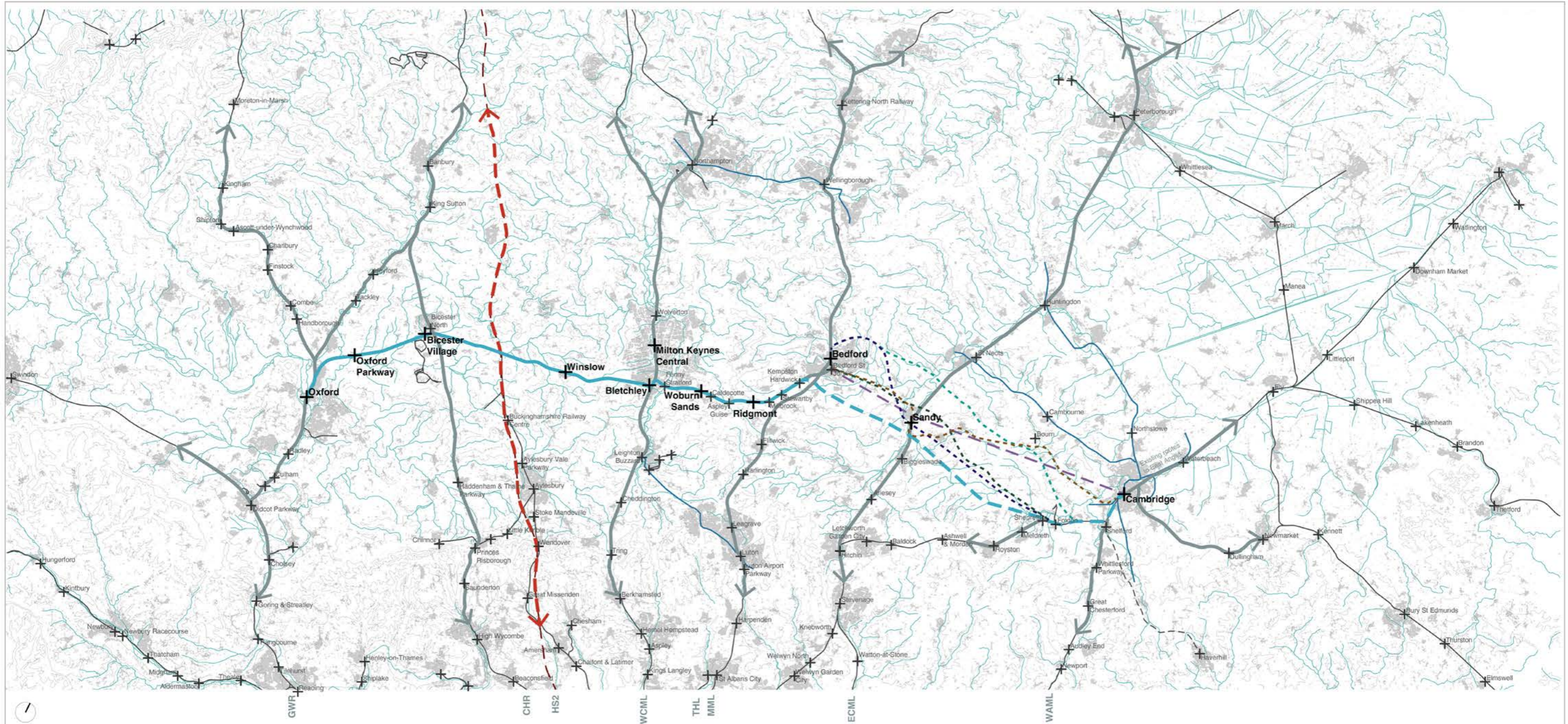
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EXISTING AND PROPOSED RAIL INFRASTRUCTURE

Scale 1:250,000 on A1
Rotated view c.35° E



Legend

- | | | |
|---|---|----------------------------|
| Rivers | Former Bedford to Cambridge railway line - dismantled | MML Midland Main Line |
| Existing rail lines | High Speed 2 (HS2) | ECML East Coast Main Line |
| Railines crossing with East West Rail | HS2 crossing East West Rail | WAML West Anglia Main Line |
| East West Rail Western Section | Dismantled Line | Guided bus routes |
| East West Rail Central Section C2-2 (most favourable) | GWR Great Western Railway | |
| East West Rail Central Section Alternative C1-1 | CHR Chiltern Railways | |
| East West Rail Central Section Alternative C1-8 | HS2 High Speed 2 | |
| East West Rail Central Section Alternative C1-9 | WCML West Coast Main Line | |
| East West Rail Central Section as per Arup's Report | THL Thameslink | |

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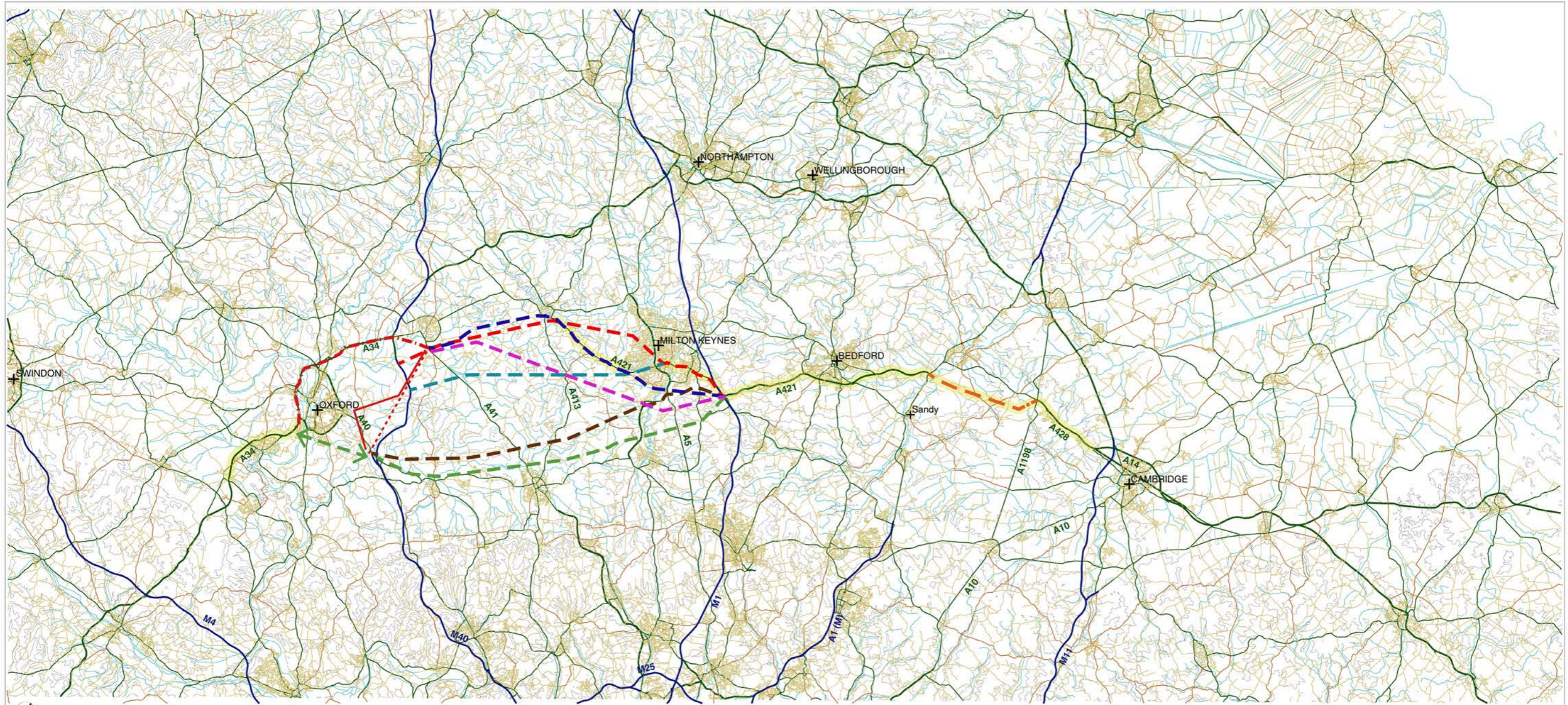
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EXISTING AND PROPOSED ROAD INFRASTRUCTURE

Scale 1:250,000 on A1
Rotated view c.35o E

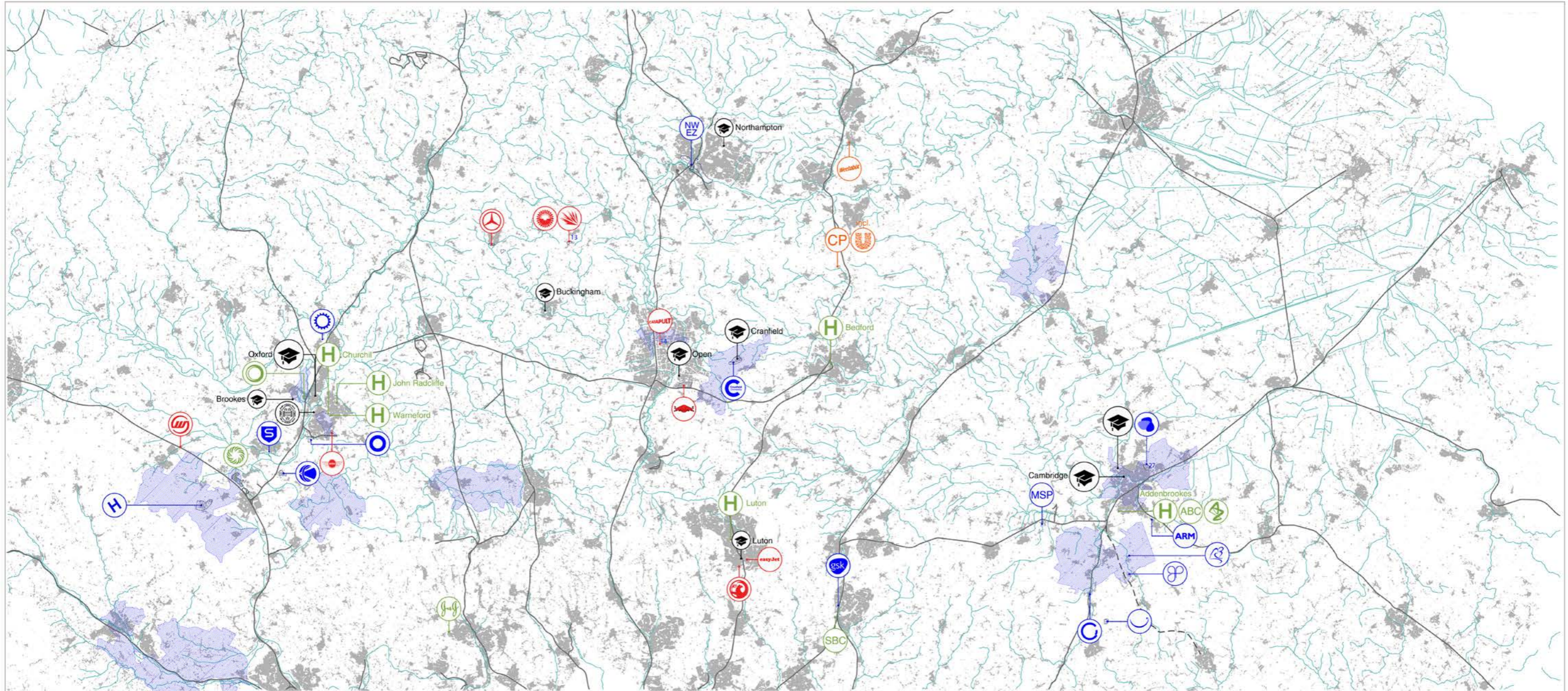


- Legend**
- Rivers
 - Motorways
 - A-roads
 - A-roads (Dual Carriageway)
 - B-roads
 - Minor roads
 - - - Oxford to Cambridge Expressway Option 1 as per Arup Report
 - - - Oxford to Cambridge Expressway Option 2 as per Arup Report
 - - - Oxford to Cambridge Expressway Option 3 as per Arup Report
 - Existing roads as part of O2CEW
 - - - Oxford to Cambridge Expressway Connecting existing A-roads
 - - - Oxford to Cambridge Expressway Option 4
 - - - Oxford to Cambridge Expressway Option 5
 - - - Oxford to Cambridge Expressway Option 6
 - - - Oxford to Cambridge Expressway- Oxford Section Option 1
 - Oxford to Cambridge Expressway- Oxford Section Option 2
 - - - Oxford to Cambridge Expressway- Oxford Section Option 3

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SITES OF ECONOMIC AND INDUSTRIAL IMPORTANCE

Scale 1:250,000 on A1
Rotated view c.350 E



Legend

- Existing rail lines
- University and Research
- Engineering, Technology and Nuclear
- Bioscience
- Moto Industry and Motosports
- Food and Food Technology
- MSOAs with over 1,500 Knowledge Jobs

- University
- Hospitals
- Harwell Campus
- Culham Science Centre
- Begbroke Science Park
- Oxford Science Park
- Silverstone Technology Park
- Transport Systems Catapult Centre

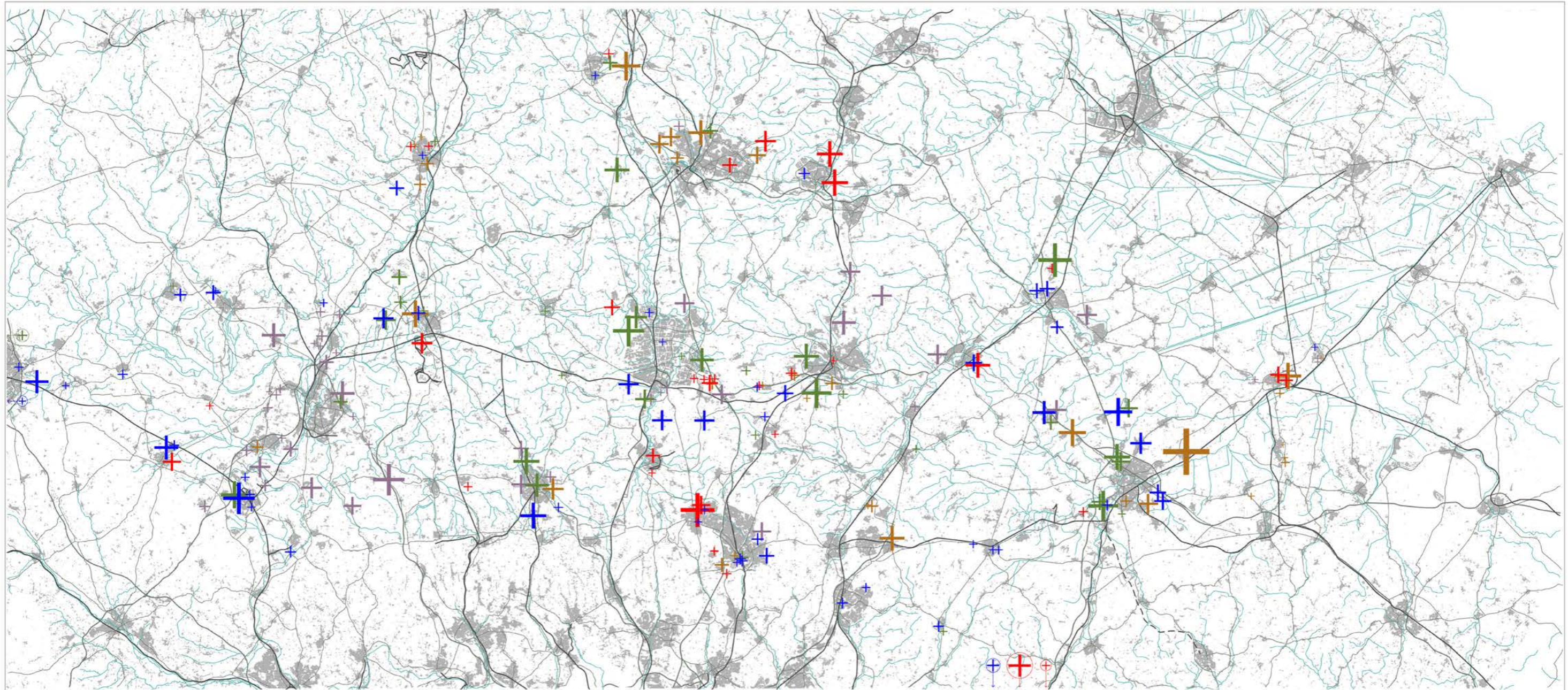
- Northampton Waterside Enterprise Zone
- Cranfield Technology Park
- Stevenage Bioscience Catalyst
- Colworth Science Park
- Melbourn Science Park
- Addenbrookes Biomedical Campus
- Babraham Research Campus
- Granta Park

- Chesterford Research Park
- Wellcome Genome Campus
- Williams F1
- Oxford Instruments
- BMW Mini
- Mercedes Benz
- Sahara Force India
- Red Bull Racing
- Vauxhall

- EasyJet
- GSK
- Johnson & Johnson
- Weetabix
- Unilever
- Astra Zeneca
- ARM
- Sophos
- Oxford University Press

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KNOWN HOUSING DEVELOPMENTS

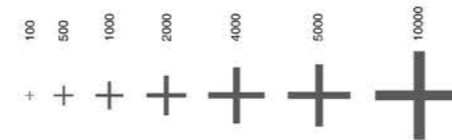
Scale 1:250,000 on A1
Rotated view c.35o E



Legend

-  Rivers
-  Existing rail lines
-  Application as per Savills Data
-  Permission as per Savills Data
-  Under Construction as per Savills Data
-  Built-up areas
-  Main roads
-  Promotion as per Arup Report
-  Allocation as per Arup Report

Capacity / No of homes



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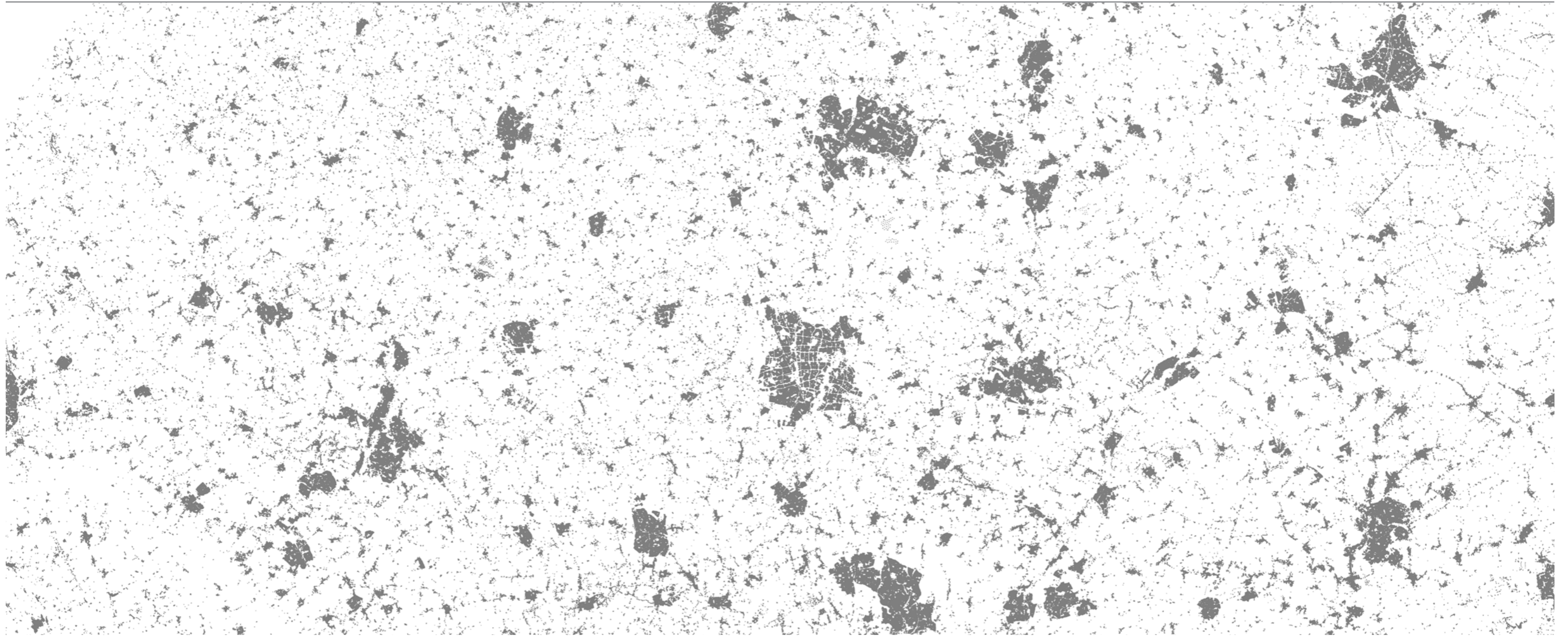
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APPENDIX C: SPATIAL
FRAMEWORK
DRAWING SEQUENCE

SPATIAL FRAMEWORK



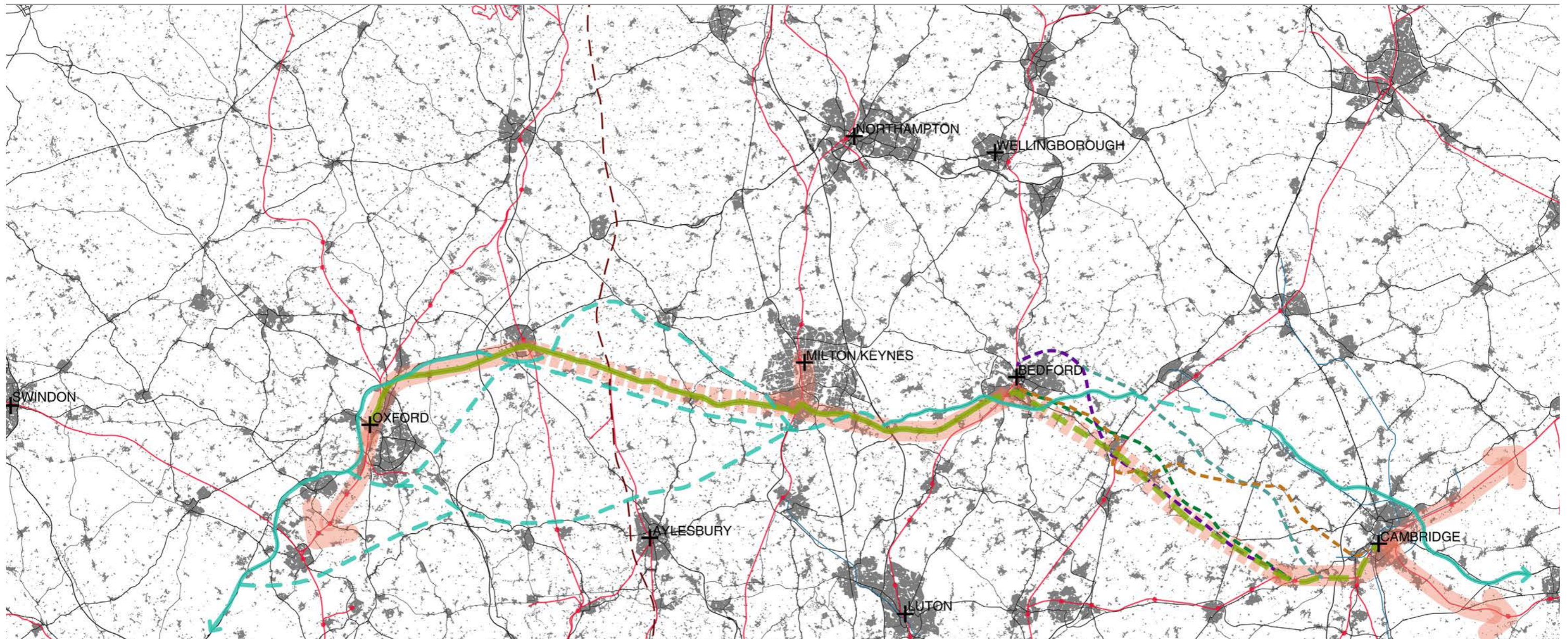
EXISTING BUIL-UP AREAS



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Highways England | Department for Transport | National Infrastructure Commission |

SPATIAL FRAMEWORK



EXISTING AND PROPOSED INFRASTRUCTURE

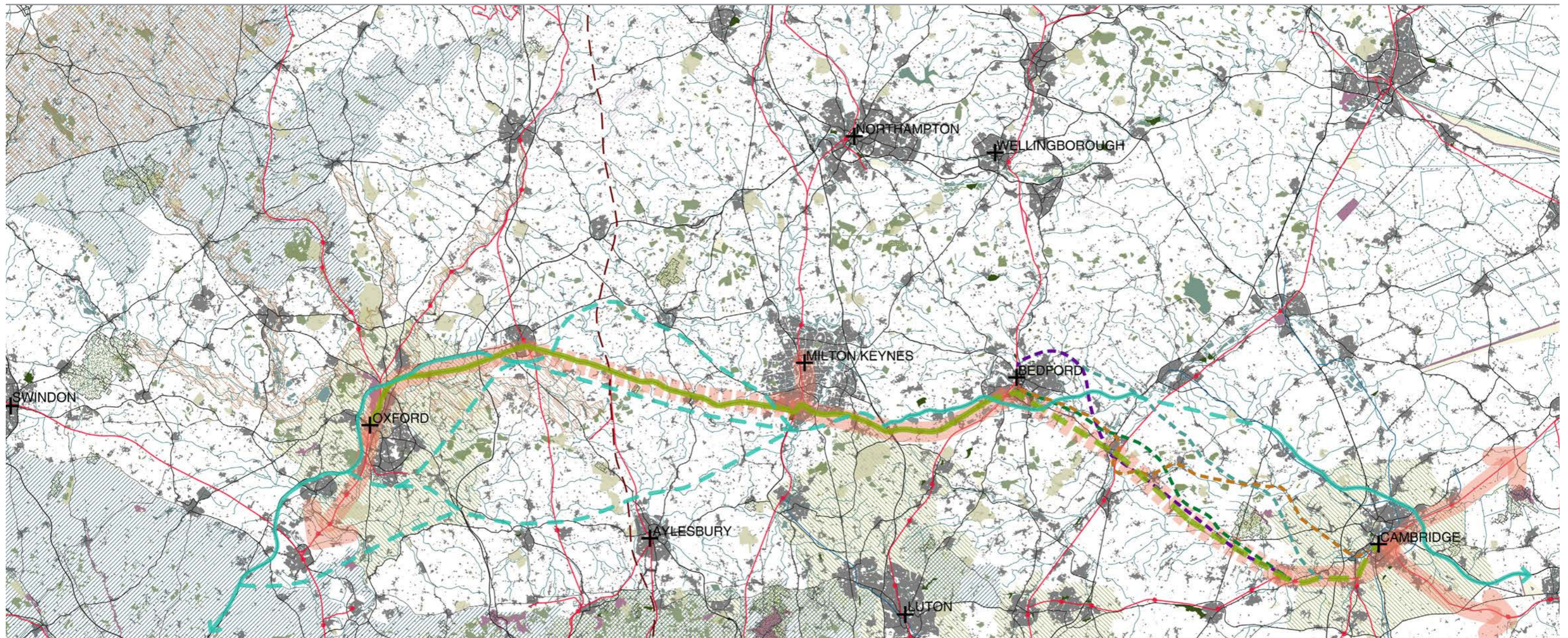
- Legend**
- Settlements
 - East West Rail Western Section
 - East West Rail Central Section C2-2 (most favourable)
 - East West Rail Central Section Alternative C1-1
 - East West Rail Central Section Alternative C1-8
 - East West Rail Central Section Alternative C1-9
 - Former Bedford to Cambridge Railway Line - dismantled
 - High Speed 2 (HS2)
 - Guided Bus Routes
 - O2CEW Options



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SPATIAL FRAMEWORK



EXISTING AND PROPOSED INFRASTRUCTURE & LAND CONSTRAINTS



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








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 Highways England | Department for Transport | National Infrastructure Commission |

SPATIAL FRAMEWORK



EXISTING AND PROPOSED INFRASTRUCTURE & LAND CONSTRAINTS & SURFACE WATER, FLUVIAL AND PLUVIAL RISK OF FLOODING

Legend

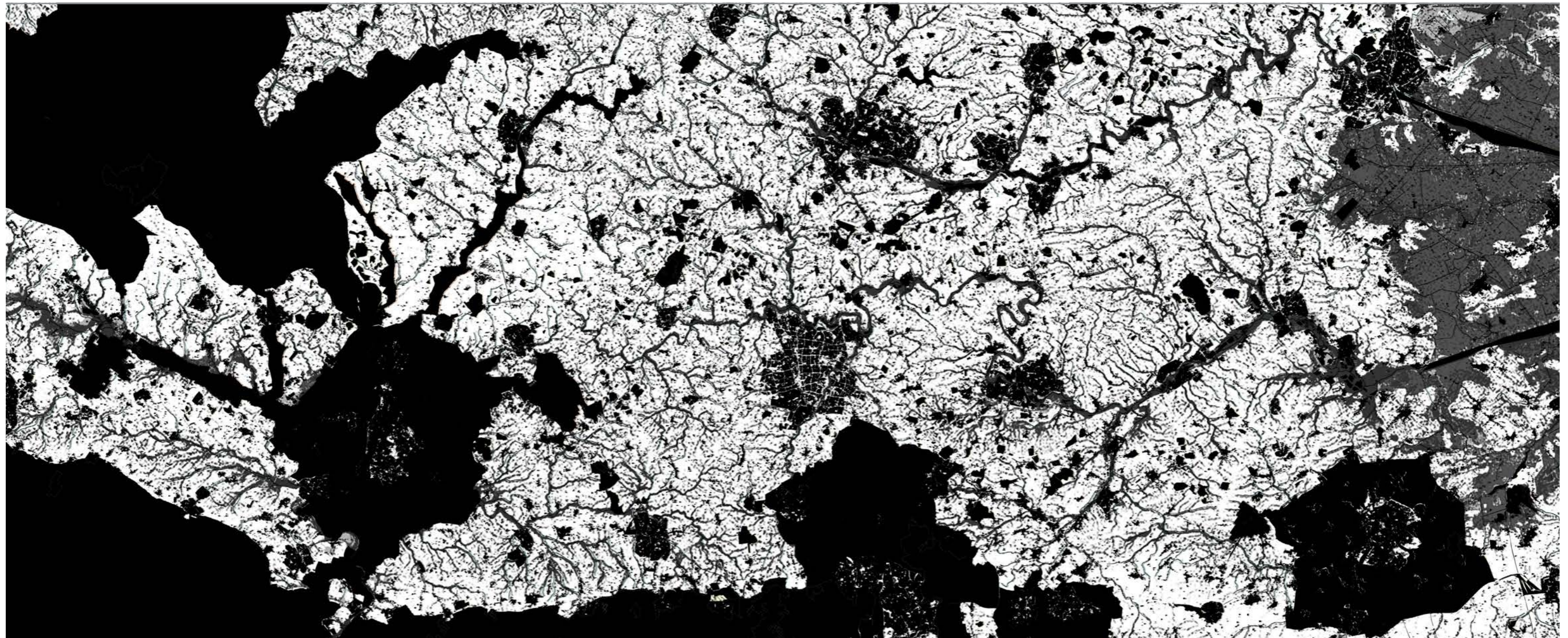
- | | | |
|---|---|--|
|  Settlements |  Rivers |  Areas of Outstanding Natural Beauty |
|  East West Rail Western Section |  Lakes |  Local Nature Reserves |
|  East West Rail Central Section C2-2 (most favourable) |  Ancient Woodland |  Local Authority Green Belt Boundaries 2014-2015 |
|  East West Rail Central Section Alternative C1-1 |  Special Areas of Conservation |  Sites of Special Scientific Interest |
|  East West Rail Central Section Alternative C1-8 |  National Trust Land |  Risk of Flooding from Rivers, Seas and Surface Water |
|  East West Rail Central Section Alternative C1-9 |  Parks and Gardens | |
|  Former Bedford to Cambridge Railway Line - dismantled |  Environmentally Sensitive Areas | |
|  High Speed 2 (HS2) | | |
|  Guided Bus Routes | | |
|  O2CEW Options | | |

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SPATIAL FRAMEWORK



LAND WHERE YOU CAN'T BUILD

Legend

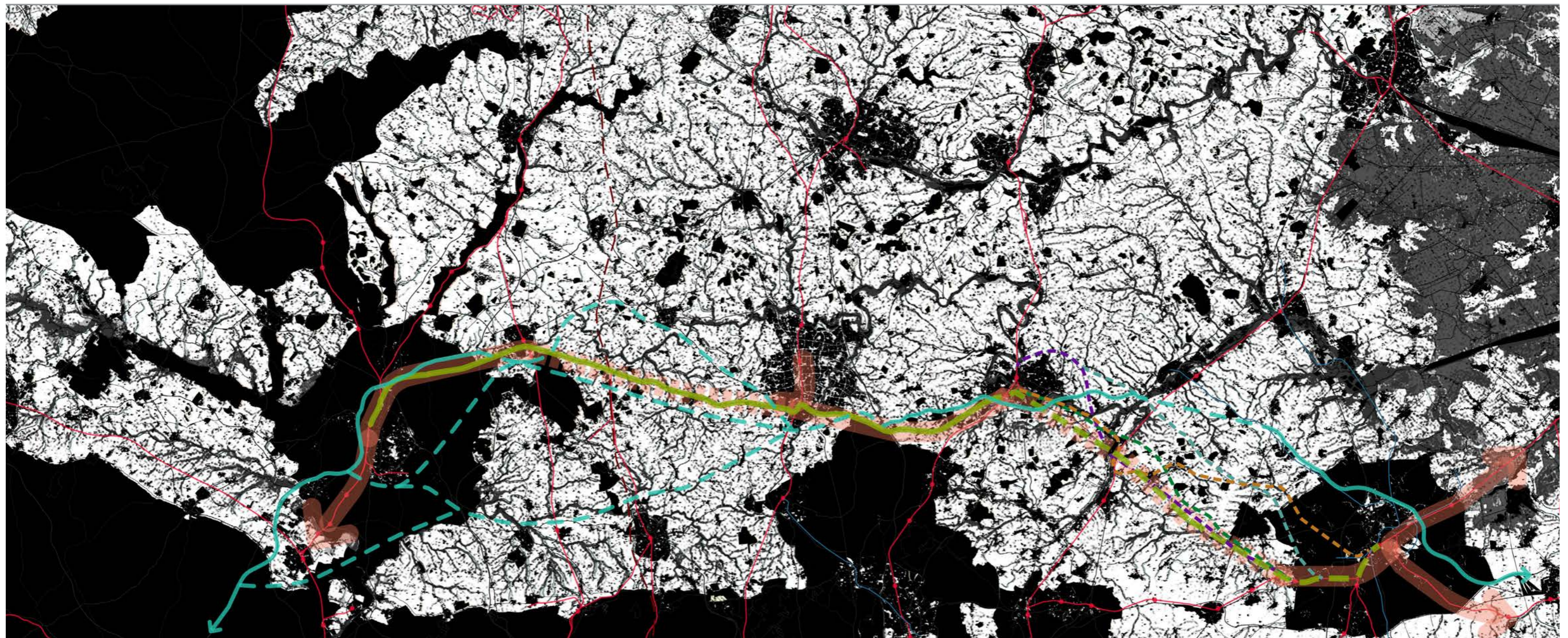
- | | | |
|---|---------------------------------|--|
| Settlements | Rivers | Areas of Outstanding Natural Beauty |
| East West Rail Western Section | Lakes | Local Nature Reserves |
| East West Rail Central Section C2-2 (most favourable) | Ancient Woodland | Local Authority Green Belt Boundaries 2014-2015 |
| East West Rail Central Section Alternative C1-1 | Special Areas of Conservation | Sites of Special Scientific Interest |
| East West Rail Central Section Alternative C1-8 | National Trust Land | Risk of Flooding from Rivers, Seas and Surface Water |
| East West Rail Central Section Alternative C1-9 | Parks and Gardens | No-build land |
| Former Bedford to Cambridge Railway Line - dismantled | Environmentally Sensitive Areas | |
| High Speed 2 (HS2) | | |
| Guided Bus Routes | | |
| O2CEW Options | | |

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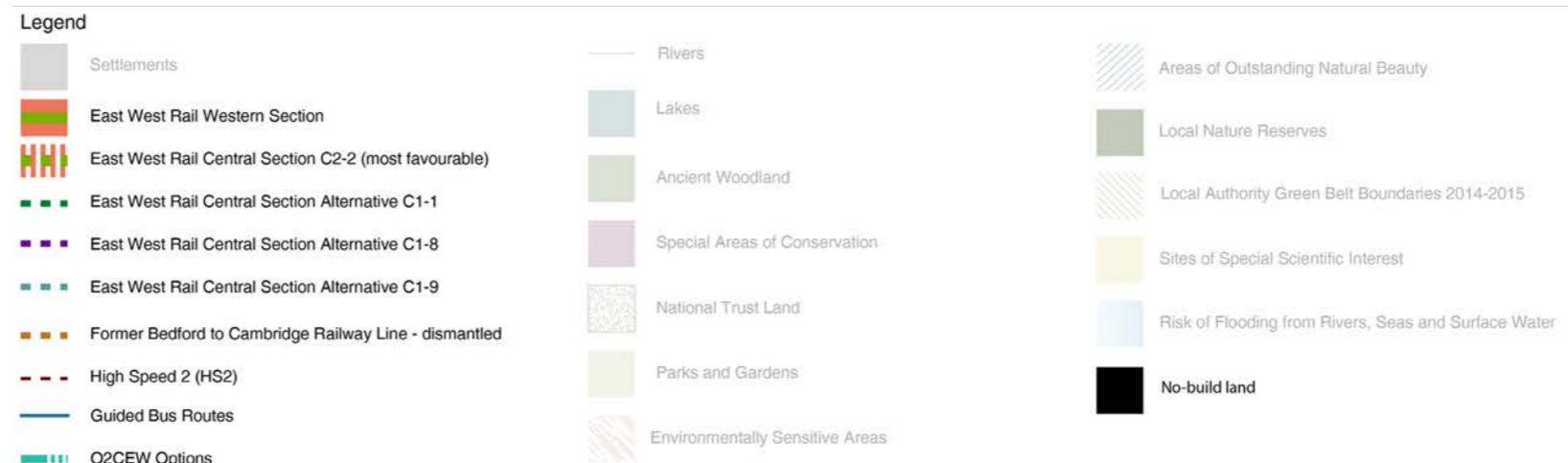
The drawing also selectively includes data transposed from the following Governmental Agencies:
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 Highways England | Department for Transport | National Infrastructure Commission |



SPATIAL FRAMEWORK



LAND WHERE YOU CAN'T BUILD & PROPOSED INFRASTRUCTURE



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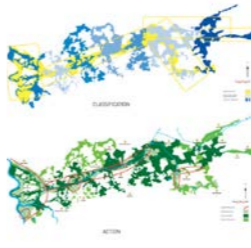












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APPENDIX D: BEST
PRACTICE EXAMPLES

BEST PRACTICE EXAMPLES: MATRIX

<p>X-LARGE</p> <p>></p>	 <p>1 Clara Plan Australia</p>	 <p>2 Stedenbaan Netherlands</p>	 <p>3 Helsinki Finland</p>	 <p>4 Stockholm Sweden</p>		
<p>LARGE</p> <p>></p>	 <p>5 Nieuwegein Netherlands</p>	 <p>6 Letchworth UK</p>	 <p>7 Sheffield City Region UK</p>	 <p>8 Emscher Park Germany</p>		
<p>MEDIUM</p> <p>></p>	 <p>9 Hafencity Germany</p>	 <p>10 Vastro Hamnen Sweden</p>	 <p>11 Linear City Spain</p>	 <p>12 Vathorst Netherlands</p>		
<p>SMALL</p> <p>></p>	 <p>13 Carlsberg District Denmark</p>	 <p>14 Zuidas Netherlands</p>	 <p>15 Euralille France</p>	 <p>16 King's Cross UK</p>	 <p>17 Rieselfeld Germany</p>	 <p>18 Southern Fringe UK</p>

BEST PRACTICE EXAMPLES

SYDNEY TO MELBOURNE HIGH SPEED RAIL

Location: Australia
 Scale: XL
 Infrastructure: 915 km long High Speed Rail
 Typologies: All but mainly 4.7 New Town, 4.8 String City, 4.9 New City

The CLARA Plan had developed a strong focus on livability and connectivity for smart city design. The High Speed Rail network between Sydney and Melbourne via Canberra and other smaller inland cities will be 915 km long.

The project will be completed in 5 phases; Land acquisition and political mandate; Land entitlements, subdivision works and concurrent High Speed Rail works; Infrastructure works; Post subdivision and Infrastructure works; housing and commercial Real Estate. Each city can be initially developed to a minimum core size of 2025 hectares, equating to a minimum of 16,200 Ha of development.

The proposed 8 new cities will improve the significant

benefits to the Australian economy through city development.

The proposal for the High Speed Rail emphasises decentralising of the largely coastal Australian population and moving them to sustainable second tier cities.

The developer, CLARA, plans to fund the development through a value capture model that will use proceeds from the uplift (taxes, charges, duties, levies, private contributions) in value of land to partially or fully fund the physical and social infrastructure.



Source 15: Consolidated Land and Rail Australia Pty Ltd, (2016)



Source 16: Law, J. (2014)

STEDENBAAN

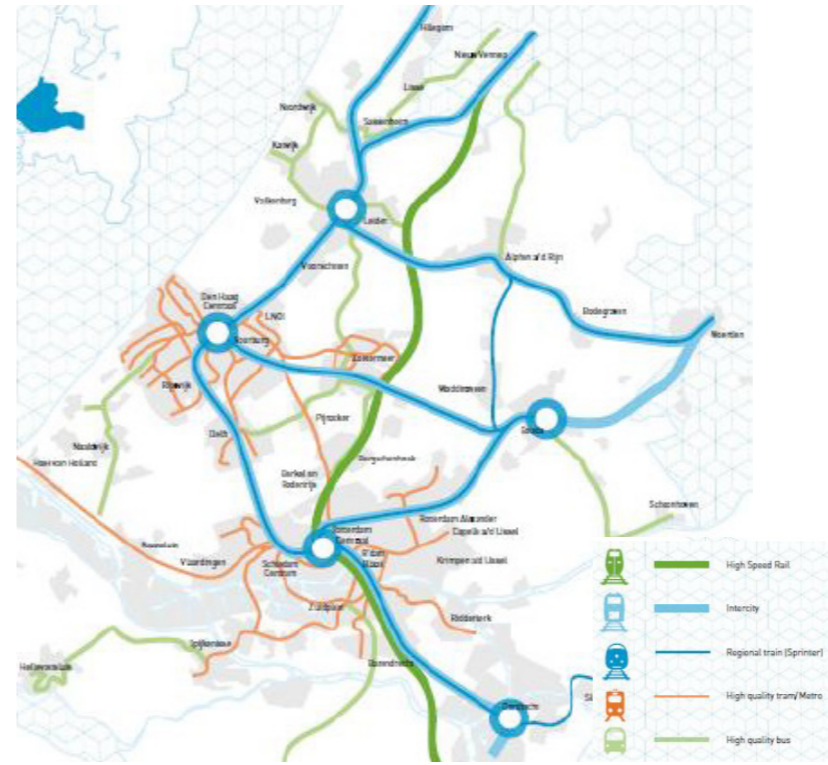
Location: Holland Randstad, The Netherlands
 Scale: XL
 Infrastructure: High Frequency Rail, 36 new stations and additional public transport services
 Typologies: 4.6 New Small Settlement, 4.8 String City

Stedenbaan (the City Line) is an attempt to integrate a high-quality transit system at the scale of the southern arc of the Randstad in Holland, together with diverse and high-density urban developments around the 36 railway stations it will be serving.

Complementary public transport services are being introduced in order to smooth door-to-door mobility, connecting into the rail stations.

Stedenbaan has resulted in a shift of focus from the city to the region, and from urban containment to networked urbanization. A project group specifically appointed by the city-regions, and independent from the South-Holland provincial government, is charged with the coordination of the Stedenbaan project, is proving successful in keeping regional ambitions intact.

Key aspects of the new settlement include 25,000 to 40,000 homes near the Stedenbaan stations, new offices centralized around the station, and sufficient and sustainable infrastructure for the High Frequency Rail Program, which will offer additional passengers train rides every 10 minutes to key areas in the development by 2020.



Source 17: Programmabureau StedenbaanPlus (undated)



Source 18: Spaans, M. and Stead, D. (2013)

BEST PRACTICE EXAMPLES

HELSINKI VISION

Location: Helsinki, Finland
 Scale: XL
 Infrastructure: Improvements on transport infrastructure, pedestrian and cycle routes, green network
 Typologies: 4.8 String City, 4.9 New City

The growing concept in Finland of a “new urbanity”, a desire for a more urban community structure, is the basis for Helsinki’s vision for 2050.

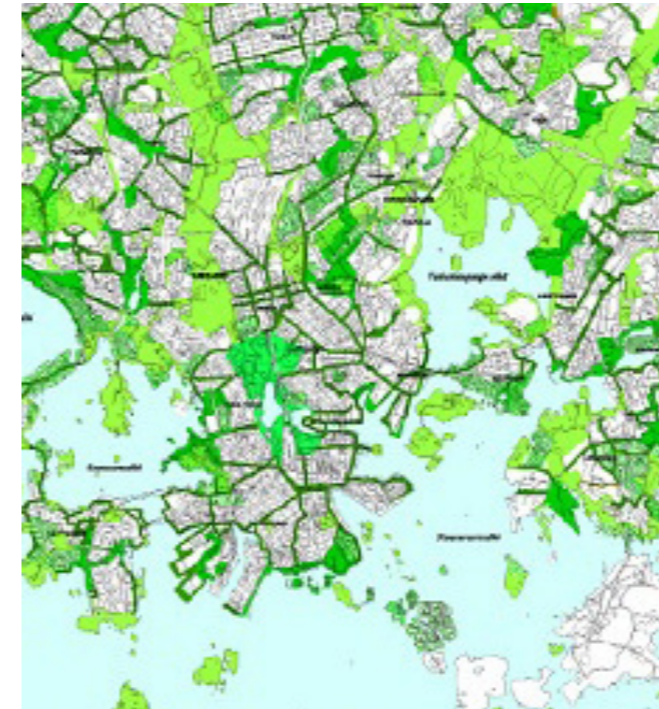
Dense urban structure support efficient and fast commuter trams and metro services that are inexpensive, offer easy access to amenities, and minimise traffic emissions.

Although there is a strong focus on improving the transport infrastructure, the 2050 masterplan stresses the value of safe and ample pedestrian and cycle routes.

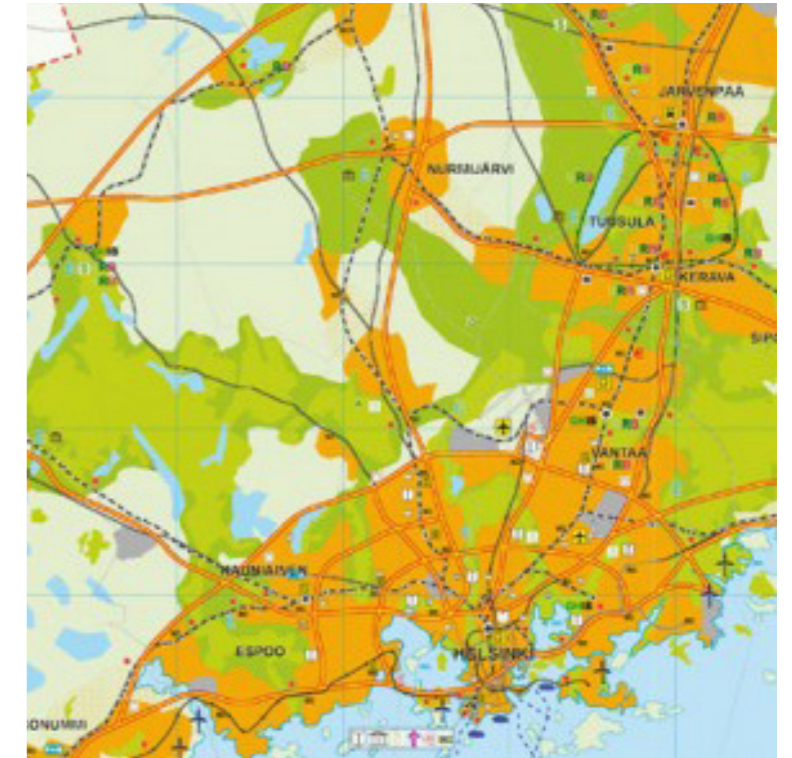
Establishing Helsinki as a green network city, with 40% of the city as woodland and public green space, and reinforcing its relationship to the sea provided

opportunities for the city to develop recreational areas and recreational services to take advantage of its location. Helsinki aims to enable urban life to be developed in suburban centres linked to central city areas through attractive public transport optimal for residents and services.

860,000 residents currently accommodated within the 11,000 hectare city area and 600,000 additional residents will be moving in and around the city by 2050.



Source 19: Green structure composed of natural areas (Green Fingers), recreational parks, community gardens, cemeteries, ecological corridors, golf area and others, (n.d.)



Source 20: STAR, (2007)

STOCKHOLM URBAN GREEN COMMONS

Location: Stockholm, Sweden
 Scale: XL (Planning approach and Governance)
 Infrastructure: investment on tramways, bike lanes and carbon emission neutralisation
 Typologies: All but mainly 4.8 String City, 4.9 New City

Grown out of archipelago landscape with several bodies of water and has maintained ancient natural landscape

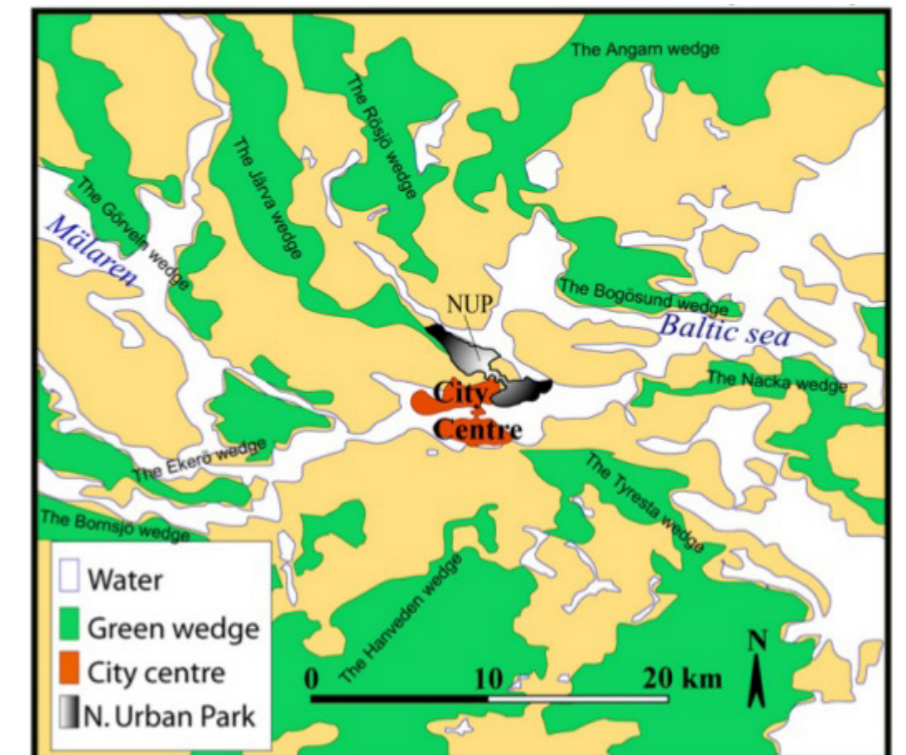
95% of the 900,000 inhabitants live within 300 m of green space, and 33% of the 18,800 hectare city is public green zones and parks.

Bike lanes cover a total of 760 km and public transport is abundant, efficient, and easily accessible within the city; more money being invested for tramways and to neutralize carbon emissions

Overall concepts that drive the Stockholm planning include:

- Nature conservation to improve the health of humans and maintain a habitat for wildlife;

- Using geographical constraints framework for designing urban developments and metro systems (settlements have occurred in the natural depression of land with radial rail systems running through suburban towns);
- Maintaining the green wedges system of parks and open spaces which result from the radial pattern;
- Ensuring that there is cooperation between municipalities, regional bodies, and national government to provide the density and walkability needed to make the urban developments livable.



Source 21: Barthel, S. et al. (2005)

BEST PRACTICE EXAMPLES

NIEUWEGEIN

Location: Nieuwegein, Netherlands
 Scale: L
 Infrastructure: High Frequency Rail, 36 new stations and additional public transport services
 Typologies: 4.6 New Small Settlement, 4.7 New Town

Overspill town: founded in 1971 as a planned city following the merging of two municipalities, to accommodate Utrecht's growth.

Key transport connections: connected to Utrecht via light rail, three motorways (A27 in the east, the A2 and A12 to the north and west of the area), and even a pedestrian ferry crossing the river.

Although it was born out of the need to house growing population of Utrecht, continuous effort to create its own identity and autonomous development, rendered it a complete medium-sized town within two decades.

The Lek River, the Amsterdam Rhine, the Merwede canal, and ample green space give opportunities for

residents and visitors to enjoy waterways and recreational activities.

A vital "lively" city; major development is still ongoing or it has been recently completed. The main focus was the alteration of the 70s city shopping centre, a series of squares and boulevard, into a "Blooming City".

Several national sports federations are based there, diversifying social and economic activities.

The current annual population growth rate is +0.55%.



Source 22: Janwillemvanaalst, 2014. Topographic map of Nieuwegein as of March 2014



Source 23: Gotravelaz, n.d.

LETCWORTH, FIRST GARDEN CITY

Location: Letchworth, UK
 Scale: L
 Infrastructure: n/a
 Typologies: 4.6 New Small Settlement, 4.7 New Town

The poverty of urban life during the late 1800s in England birthed the world's first Garden City, Letchworth in 1903, which was inspired by the ideas of community management and economic stability detailed within "Toward: A Peaceful Path to Reform" by Ebenezer Howard.

Howard founded a company, First Garden City Ltd (FGC) to ensure that 7 years after the town's completion, residents would be able to buy the estate, although it eventually became owned by the Letchworth Garden City Heritage Foundation.

Recently the town has reached its population target of 30,000 and has also paid off all its debts.

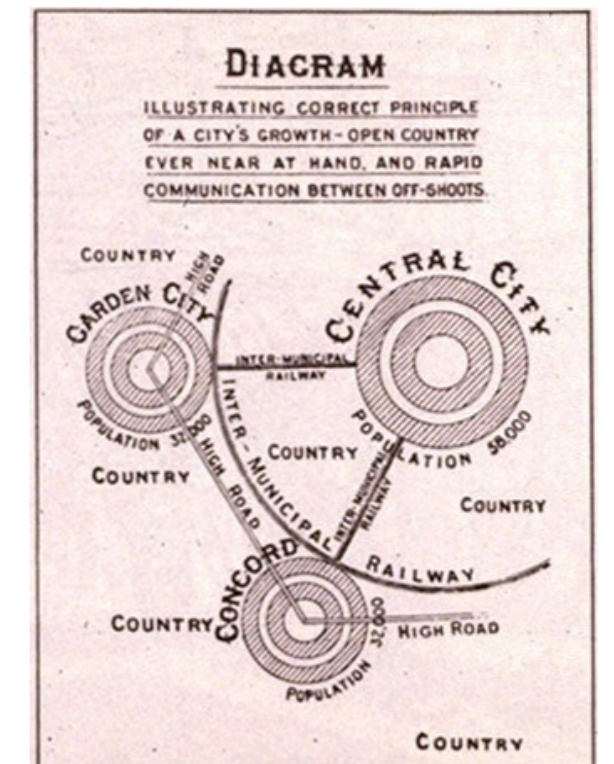
The settlement became a phenomenon around the UK

and the world for its:

- Emphasis on community engagement and community ownership
- Easy commuting distances with wide range of jobs within the Garden City
- Combining the best of the country and city with each person owning gardens and the ability to grow their own food also addressing environmental concerns by establishing a robust green infrastructure network that reduces carbon production and uses energy positive technology



Source 24: Heritage Foundation Letchworth Garden City, (2014)



Source 25: Spatial Agency, (n.d.)

BEST PRACTICE EXAMPLES

SHEFFIELD CITY REGION

Location: Sheffield, UK
 Scale: L
 Infrastructure: general investment in transport
 Typologies: 4.1 Town Centre Intensification, 4.8 String City

Domestic and international stakeholders have been investing in the widely celebrated transformation and improvement to the city over the past 15 years.

Sheffield City Region decided to invest 1.3 billion into the local economy for the next few decades to improve infrastructure, transport, skills, housing, drivers of business growth.

The masterplan includes an enterprise zone along the M1, meant to take advantage of connections to transport, a multimillion pound HSBC development, a manufacturing district, innovation district for research institutions and entrepreneurs, and a retail quarter with 1.5 hectares and 0.53 hectares retail space.

The Sheffield masterplan proposes a target of 14

hectares of office space and over 7,000 jobs over the next 10 years within the three business districts, Central, Riverside, and Sheaf Valley.

The City of Sheffield plans to rebalance growth between the public and private economic sector, increase the number of new businesses, as well as improve competitiveness in existing key growth sectors of: knowledge, creative and digital industries, high education, cultures, business services, retail, leisure.



Source 26: CABE, (2011)

EMSCHER PARK

Location: Ruhr Region, Germany
 Scale: L
 Infrastructure: n/a
 Typologies: 4.3 Edge Intensification, 4.6 New Small Settlement, 4.8 String City, 4.9 New City

Originally planned as part of a 10 year regeneration programme to address the decline of the industrial heartland from heavy industrial pollution causing mass emigration and economic challenges

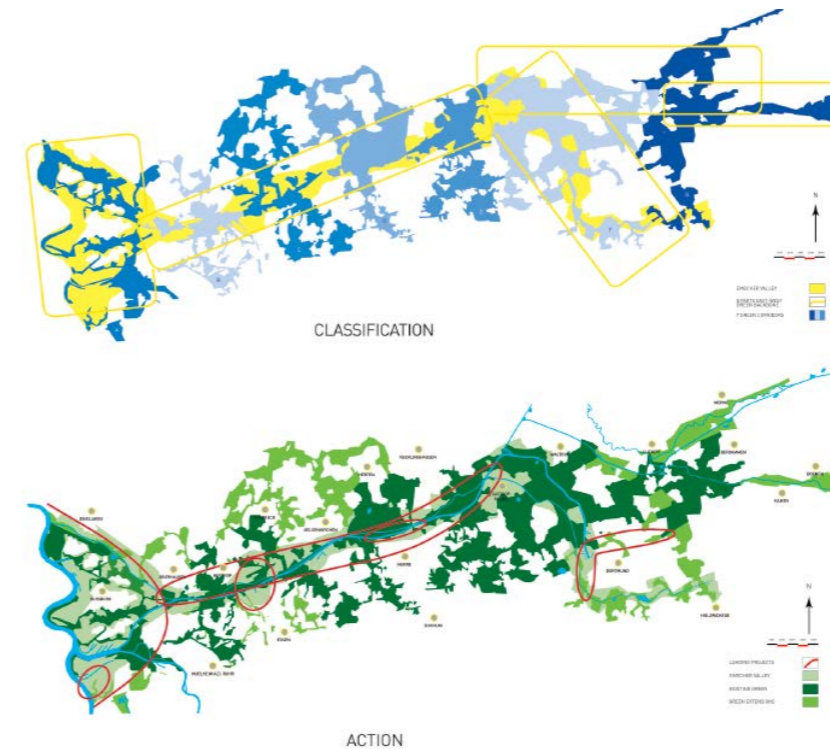
Landscape framework: Emscher Park acts as the landscape connector of 17 settlements in the Ruhr Valley

The scheme re-uses / re-purposes heritage structures with various locations for development within the overall masterplan facilitated by new governance structures.

Strategic themes were established to reuse industrial heritage, regenerate river systems, develop new types of employment systems and new types of housing.

All new ideas were linked by a regional park; there was a great effort put into integrating former contaminated industrial sites into the 45,700 hectare landscape network.

7,500 dwelling units were created in the area that were very cheap compared to the surrounding areas.



Source 27: Beyond Plan B, (n.d.)



Source 28: Beyond Plan B, (n.d.)



Source 29: Source: Sustainable Cities, (n.d.)

BEST PRACTICE EXAMPLES: LARGE

HAFENCITY

Location: Hamburg, Germany
 Scale: M
 Infrastructure: New subway connections and green infrastructure
 Typologies: 4.2 Suburban Intensification, 4.3 Edge Intensification, 4.5 Urban Extension

This project, positioned between a UNESCO World Heritage site to the north and the Elbe River to the south, is scheduled to be finished by 2050 and will extend Hamburg's inner city by 40%.

The land was originally old port sites south of the city centre. The development brings Hamburg to the waterfront.

New subway connections transformed the once suburban area into being seen as a crucial part of the urban core.

The masterplan breaks down the larger area by developing three neighbourhoods with their own identities: Brokenhafen (living and leisure), Oberhafen (creative and cultural), and Elbbrücken (business and

housing).

Reworking the business district in the masterplan meant that the total realisable area increased from 150 to 232 hectares and a total of 0.6 hectares of new homes; There are also 5,000 potential jobs in leisure, retail, catering and hotels.

Green areas will also be increased through "Lohsepark", which will extend down to the River Elbe, a green play and leisure area in Bookenhafen; Public green space will cover an area of 28 hectares.



Source 30: IFC, (2014)



Source 31: Hafencity Hamburg, (n.d.)

VASTRO HAMNEN

Location: Malmo, Sweden
 Scale: M
 Infrastructure: n/a
 Typologies: 4.3 Edge Intensification, 4.5 Compact City Urban Extension

The increasing cultural and environmental issues that followed the decline of Malmo's industrial economy sparked interest in regenerating an old shipyard situated near Gamla Stad (Old Town) to the east and Oresund to the north.

Unemployment rate jumped to 22% in mid 1990s when 25,000 jobs were lost.

Vastro Hamnen was designed as an extension of Malmo's inner city with high density housing, schools, service facilities, parks, wharves, squares, bathing areas and urban parks spread across 175 hectares targeted to accommodate 10,000 people.

25,000 homes and 4,300 people moved to the area by 2012 and the city is determined to reach the target of

10,000 people over the next few years.

The scheme is praised by many for the high quality public space and attention to making intimate space between buildings appealing, but more importantly its cohesive organisation and design across the development.

The development was strategically designed around existing smaller districts in order to create a strong sense of place.



Source 32: Csader, S. (2015)

BEST PRACTICE EXAMPLES: MEDIUM

CIUDAD LINEAL

Location: Madrid, Spain
 Scale: M
 Infrastructure: Subway line - backbone of urban layout
 Typologies: 4.1 Town Centre Intensification, 4.2 Suburban Intensification, 4.4 Strong Edge Satellite

Ciudad Lineal (Linear City) is based on the idea of Arturo Soria y Mata which, in its most basic form, consists of two urban nuclei separated by a wide "line" (main road and light rail line). Soria's idea was that "surface transportation is such a basic organisational factor in modern living that we must arrange ourselves and our activities along its routes."

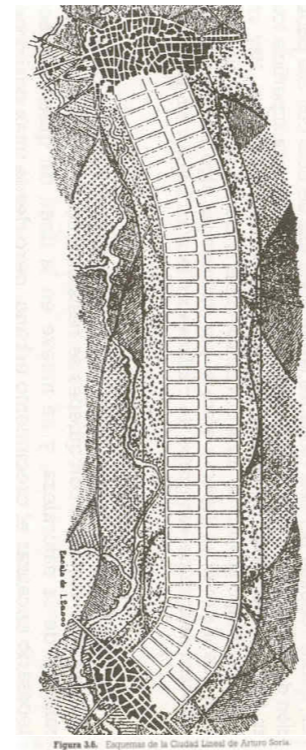
The main aim was to organise limited space in such a way as to bring the feel of the countryside to the city. Objectives were to make the city more natural, and closer to the natural world.

The main transportation route was the backbone of the urban layout. All other functions were arranged along the main transportation axis, intersected at certain intervals

by secondary perpendicular streets. The layout consisted of large blocks with residential buildings surrounded by vegetation with commercial and public structures situated at intersections.

Although Soria's linear city was conceived before Howard's Garden City, both share many similarities such as intermingling of rural and urban life, confronting city congestion, connection to the natural environment and pedestrian connectivity.

Source 33: Collins, G.R., (1959)



Source 34: Diego, J. (2009:32)



Source 35: Fernandez, J. (2006)

VATHORST

Location: Amersfoort, Netherlands
 Scale: M
 Infrastructure: n/a
 Typologies: 4.2 Suburban Intensification, 4.4 Strong Edge + Satellite, 4.5 Compact City Urban Extension

Vathorst is effectively an urban extension to Amersfoort, District of Utrecht, but it has been built a free-standing settlement of 11,000 new homes, a large business park and shopping centre and with community facilities from the outset. The public private development partnership financed the Dutch railway system to build and open a new train station in advance of demand, and also built bus rapid transit system along the main spine of the development. In planning the development of Vathorst, four main challenges had to be overcome:

- Extending beyond the motorway that had formed a clear boundary
- Incorporating an existing rural village.
- Building on land occupied by farming and industry
- Dealing with polluted and low-lying land that was liable to flooding.

The overall density is 44 dwellings per hectare, but varies between 35/hectare at the periphery and 100/hectare in apartments near Vathorst's railway station. There is an average 400m walk to a bus stop from every house, with a max of 600m.



Source 36: Citymarketing Amersfoort, (2015)



Source 37: West8, (n.d.)

BEST PRACTICE EXAMPLES: SMALL

CARLSBERG DISTRICT

Location: Copenhagen, Denmark
 Scale: S
 Infrastructure: New railway station
 Typologies: 4.2 Suburban Intensification, 4.3 Edge Intensification, 4.6 New Small Settlement

The small district between Frederiksberg and Valby districts in Copenhagen received its name from the brewery company, located on the site between 1847 and 2008.

The 20-hectare site (existing buildings around 100,000m², newly built approximately 500,000m²) was designed to improve the quantity and quality of access to public green space network (garden and squares) within the dense area filled with privately owned buildings.

High density and high rise development is centred around railway lines with a new station and an abundance of public transport to minimise use of car and provide access to transport for all.
 Carlsberg Visitors' Centre, Jacobsen Brewery and other

cultural revenue opportunities contribute in the financial success of the district.

"A city within a city": containing campus for 10,000 students (UCC), mixed residential, retail, offices; an environment that helps generate the district's income.

Source 38: Entasis, (2007); WAN, 2009; UCC, (2017); VisitCopenhagen, (2017)



Source 39: Entasis, (2007)



Source 40: WAN, (2009)

ZUIDAS

Location: Amsterdam, Netherlands
 Scale: S
 Infrastructure: Main train station, expansion of underground network, hybrid light rail system
 Typologies: 4.2 Suburban Intensification, 4.3 Edge Intensification 4.4 Strong Edge + Satellite

Zuidas (Southern Axis) is the business district of Amsterdam situated between the Amsterdam city centre and the Schipol Airport. It is also called the "Financial Mile" and it has drawn inspiration from London's Canary Wharf and Paris' La Defence. Large corporations have their HQ in the area.

It is positioned at a strategic location. Its rail station is a key feature and development is centred around it. It is expected to be the 5th busiest station in the Netherlands and it already accommodates fast connections to major Dutch cities, Brussels and Paris. In the future, the station will connect to the German High Speed Rail Network as well.

Expansion of current underground network and

enhancement of hybrid light rail system will enhance the quantity of transportation within the already well connected district.

There is a high concentration of business, financial, and legal services across the over 700 companies established in Zuidas.

Nearly 2,000 housing units have been built and by 2030, there is an expected total of 7,000 housing opportunities spread over 270 hectares.



Source 41: Cie.,(n.d.)



Source 42: City of Amsterdam, (n.d)



Source 43: Cie., (n.d.)

BEST PRACTICE EXAMPLES: SMALL

EURALILLE

Location: Lille, France
Scale: S
Infrastructure: New railway station
Typologies: 4.1 Town Centre Intensification

New centre within Lille: 800,000 m² of urban activities - a new TGV station, shopping, offices, parking, hotels, housing, a concert hall, congress - built on 120 hectares on the site of the former city fortifications by Vauban.

The arrival of the TGV and Eurostar placed Lille in the centre of the London-Brussels-Paris business triangle: highest number and quality of connections.

The masterplan works as a whole, instead of “one building solves everything”. High density, high rise; diverse scale combination that offered a balanced relationship of built component with adjacent park. “Flow” and traffic reorganization were in the core of the project.

“G-local” Urban Condition: Alternative way of thinking a

contemporary city, especially in the context of the EU.

Lille's Deputy Mayor, Pierre Mauroy, played an essential role in enabling the project. He pushed for the use of the site and changing legislation to allow for its development.

“It has been an extraordinary expensive endeavour that demonstrates the interconnections amongst politics, ambitions for one's own city, urban design and architectural ideologies” (Lang, J. 2005:232)



Source 44: OMA, (n.d.)

KING'S CROSS DEVELOPMENT

Location: London, UK
Scale: S
Infrastructure: Largest rail interchange in the UK
Typologies: 4.1 Town Centre Intensification

The King's Cross development has been an area in constant flux beginning in the mid 19th century when the railway arrived.

The Victorian era industrial hub turned into a series of disused buildings, railway sidings, and warehouses within a 28 hectares zone.

This redevelopment aims to reactivate the area with 1,900 new homes, 50 new buildings, 20 new streets, 10 new public parks and squares, 26 acres of open space, 400 new trees, and the refurbishment of 20 historic buildings.

Because of the development's location next to the largest interchange in the UK, sustainable travel is critical with accessible convenient cycling and walking routes.

The strong urban fabric of the site provided a base for the design of the new streets, squares, parks and gardens, which comprise 40% of the development.

Along with a strong focus on connection routes and open space, the development also will ensure that young people have access to new jobs and training to develop skills to compete in the job market.



Source 45: King's Cross Business Partnership Limited, (2015)

BEST PRACTICE EXAMPLES: SMALL

RIESERFELD

Location: Freiburg, Germany
Scale: S
Infrastructure: New tram line extension
Typologies: 4.4 Strong Edge + Satellite, 4.5 Compact City Urban Extension

In Freiburg, development of the urban area has been in the form of compact development along light rail routes, strengthening local neighbourhood commercial and service centres, and mixing housing with stores, restaurants, offices, schools, and other non-residential land uses.

For example, the urban district of Rieselfeld was built on 70 hectares on the site of a former sewage farm, and is located adjacent to a 250-hectare nature reserve. It provides about 4,200 residential units for 10,000 to 11,000 inhabitants.

It has been developed at high population density, with more than 90% of the buildings comprising apartments of up to five stories.

Priority is given to public transport and to foot and bicycle traffic. The buildings have low-energy construction, with district heating networks fed by a combined heat and power plant, integration of solar energy and re-use of rain water.

This lively and attractive Freiburg village begets the positive aspects of a comfortable city quarter that has evolved over the years.



Source 46: Luftfahrer, N. B., (2007)

SOUTHERN FRINGE

Location: Cambridge, UK
Scale: S
Infrastructure: Guided busway, bus terminus
Typologies: 4.4 Strong Edge + Satellite, 4.5 Compact City Urban Extension

Southern Cambridgeshire is a rural district covering 100 villages (all smaller than 8,000 people) located at the intersection of the M11 and A14 in the Eastern region of England.

The existing land can be described as having three main aspects and uses: fairly flat agricultural land, Trumpington Meadows village, and Addenbrooke's Hospital.

Overall 263 hectares of built and green infrastructure development that contains a riverside country park of 140 hectares and another 50 hectares of country park developments to compensate for built development on green belt

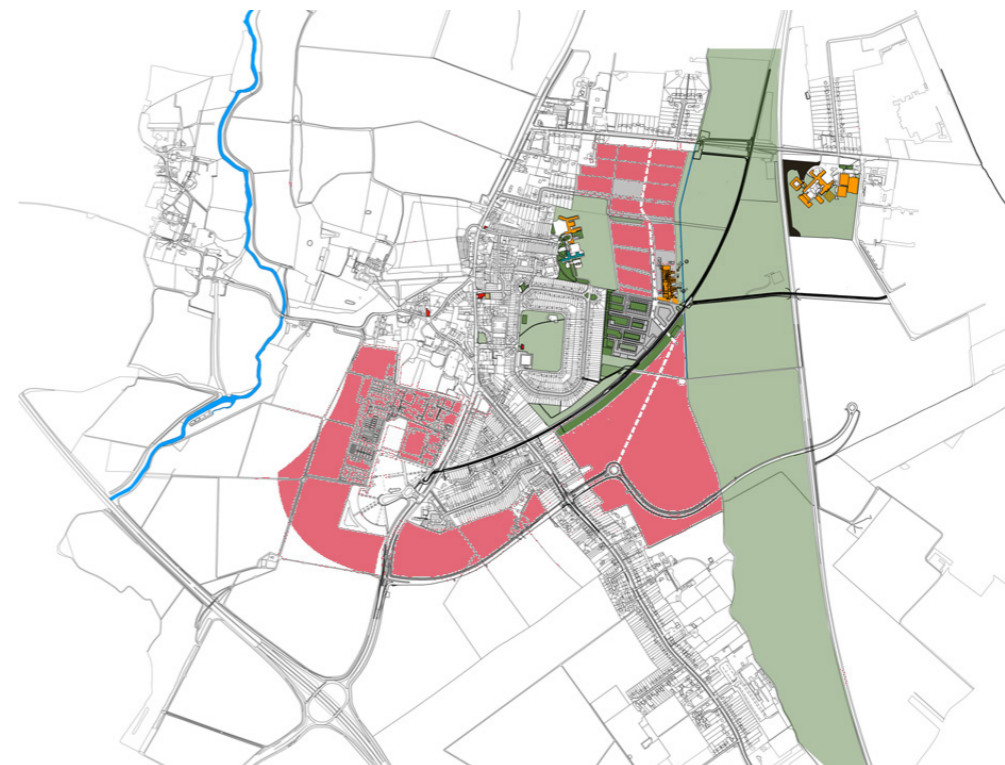
3,302 total number of new dwellings in 95 hectares -

excluding countryside parks development- equating to 7,924 people

Average density between developments: 8,350 p/km²

The movement strategy considers principle road junctions, the Addenbrooke's access roads, public transport, cycle and pedestrian routes, and countryside access as important components to improving transportation.

The majority of residents is located within 5 minute walk to bus terminus.



Source 47: 5th Studio

BLANK

NIC
Cambridge, Milton
Keynes and Oxford
Future Planning
Options Project

APPENDIX E: LIST OF
REFERENCES AND
SOURCES

LIST OF REFERENCES AND SOURCES

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