Greater Norwich

NEW SETTLEMENT STUDY

Final Report by
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in collaboration with
Mott MacDonald
Integrated Transport Planning
DTZ

on behalf of
Greater Norwich Development Partnership

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a) The provision of new settlements is inexorably linked to the need to provide new housing and to improve or maintain the social, economic and environmental conditions within our major towns and cities. In acting as an alternative location for development pressures, new settlements can provide flexibility for existing towns and cities, allowing them to repair the urban fabric and to protect their special character.

b) New settlements can establish their own identities and act as development 'magnets' in their own right, thereby reinforcing the position of their 'central' town or city and supporting regional growth and development. Comprehensive master planning with 'place-making' at its heart will assist this process.

c) Self-containment has never really been achieved and, increasingly, is seen as an unrealistic objective. Recent research and the eco-town initiative advocate the concept of 'linked communities' and the importance of new settlements establishing their role within the hierarchy, a role that complements the higher order centre and is capable of change over time.

d) Significant development, planned and implemented on a large scale, allows higher overall standards of development to become attainable. It also allows for a greater degree of experimentation in building techniques and infrastructure provision than would otherwise be possible. This experimentation is a desirable and necessary requirement if the sustainability agenda is to be pushed ahead in a timely manner.

e) The potential for cross-subsidy, proper provision of social, community and green space facilities and alternative forms of management and governance is much greater in a new settlement where increases in land values can be captured for the benefit of the community as a whole.

f) The experience of the recent eco-towns initiative suggests that experimentation in terms of new building and infrastructure provision require the explicit support of central government, both political and financial. In a localism agenda, this requirement would apply equally at the local level although the availability of financial resources would be different.

g) There would appear to be a scale beyond which the private sector cannot extend itself. Current indications are that this is somewhere in the region of 5-10,000 dwellings but this is clearly dependent upon the location and mix of land uses and the amount of essential infrastructure that is required. It is likely, however, that anything more than this will require significant public sector involvement, either as promoters of the scheme or partners in a joint venture arrangement with private sector partners.

h) New settlements relieve the development industry of strategic land promotion, focus on house-building rather than land trading and give certainty and continuity of supply

E02 A review of best practice in setting criteria and thresholds suggests that:

a) locational criteria can be helpful in identifying broad areas of search for potential new settlement locations;

b) additional criteria should be defined to assess the nature and form of the settlement and its response to social, economic and environmental considerations; and

c) thresholds are likely to be highly variable, depending upon location and economic factors but nevertheless the provision of appropriate education facilities is an essential pre-requisite.

E03 In most cases, the essential building block for a new community will be the primary school (suggesting some 1,500-2,500 dwellings depending on the particular requirements of the local education authority) but there are current trends which suggest that a larger settlement, which allows for the provision of a secondary school (around 7,500 dwellings) is preferable. This will facilitate a greater degree of self-containment and a stronger sense of community within the settlement.

E04 Sieve mapping analysis has suggested that there are virtually no 'primary constraints' affecting the Mangreen area, just very localised areas of flood risk to the west of Swardeston.

E05 Rather more of the Mangreen area is affected by 'secondary constraints' with only the immediate environs of the villages of Swardeston and Mulbarton being unaffected by statutory or policy designations. It should be said, however, that the two most expansive designations around Mangreen are the policy designations of Areas of Historic Landscape Character and the designation of the A47 Southern Bypass Landscape Protection Zone, both of which are defined as being 'flexible' in terms of their constraint on development. More detailed analysis would need to be undertaken in order to understand the implications of specific development proposals in these areas.

E06 More significant constraints, however, are the pylons and overhead cables (with their attendant 'buffer zones'), the existing minerals site and several County Wildlife Sites. The pylons, cables and minerals sites have a significant impact in the northern and

eastern part of the study area. There are no formal regulations that restrict development within a defined distance of pylons and cables but given the level of public interest in health and safety matters various sources suggest that there should be a no build zone of anything from 30m to 200m in residential areas. Proximity to pylons and cables has a negative impact on land values but the land can often be used for employment and open space.

E07 A further feature, not specifically highlighted on the constraints maps, but of great significance, is the Norwich-London railway which extends along the eastern part of the study area and has the effect of restricting access to the A140 in all areas other than the most northerly part of the study area. Elsewhere, there are limited opportunities for crossing the railway line, and with the exception a short stretch of the A140 nearest to Mangreen Hall and the A47 intersection, most use level crossings in existing villages.

E08 Having determined through the sieve mapping exercise that the Mangreen area, in principle, has the potential to accommodate a new settlement, we turned to consider whether there might be any development thresholds in terms of settlement size. From this we can determine the amount of development land required, making appropriate provision for associated land uses and input this to the master planning process.

E09 We concluded that education provision is one of the essential pre-requisites of a new community, all other factors being more significantly affected by external and/or commercial pressures. Conventionally, the primary school is seen as the building block of a new community but increasingly the view is being taken that a successful new community should educate its children through secondary school level.

E10 Based on information received from Norfolk County Council, the education authority, we have devised two development scenarios for Mangreen:

a) a scale of development that would support one primary school (approximately 1,800-2,000 dwellings); and

b) a scale of development that would support one secondary school together with the requisite number of primary schools (7,000+ dwellings).

E11 Our detailed analysis of site constraints and potential suggested that we should locate the potential development areas some distance from:

a) the A47 bypass with its potential for noise and air pollution and visual impact; and

b) the overhead cables, pylons and transformer station.

E12 This had the effect of pushing the potential development area away from Mangreen Hall, and further to the south and west, towards Swardeston and Mulbarton. We are aware of the sensitivity of the historical landscape in this general area and the general difficulties of crossing the Norwich-London railway line. We concluded that there was very limited prospect of:

a) securing a train station on the railway line – on grounds of cost and practicality;

b) constructing a bridge over or an underpass through the A47 embankment – again on grounds of cost and practicality, but also in terms of visual impact in the case of a bridge; and

c) undergrounding the pylons – these are 400Kv and 132 Kv lines and a major component of Norwich's electricity supply. Costs for undergrounding 400Kv lines are generally considered to be prohibitive.

E13 It was, therefore, concluded that development in the northern part of the study area was not likely to deliver a practicable development solution so we sought to test what alternative development scenarios might be possible. The options that we prepared as part of the master planning process were designed to test:

a) modest expansion of existing villages, akin to organic growth, which would provide a minimum level of development (1,800 dwellings and a primary school) and fit more neatly with the historic settlement pattern;

b) development on a scale to support a secondary school (7,000+ dwellings) focused in one location; and

c) a similar scale of development, with a more dispersed settlement pattern (to try to over come the limitations of access and to respond better to the historic landscape).

E14 Option 1 provides for a modest development of around 1,800 dwellings in total, some 1,100 in Swardeston and the remaining 700 in Mulbarton. In practice, however, this option does not provide for a 'new settlement' as such: the proposed 700 dwellings at Mulbarton would function as an expansion of the existing village and although it would provide for a new local centre it would utilise existing social, community and education facilities within the local area. In the case of Swardeston, the proposed 1,100 dwellings would considerably exceed the size of the existing village (by a factor of 3-4) but it would provide a local centre and a new primary school. For the purposes of this option, it has been assumed that secondary school facilities would be dealt with by way of contributions to existing facilities elsewhere within the local area.

E15 Option 2 assumes that the new settlement needs to be sufficiently large to accommodate a new secondary school and therefore takes as its minimum size some 7,000 dwellings. Option 2 presents a genuinely 'new' settlement, occupying the space between Swardeston and Mulbarton, to the west of the existing and proposed mineral sites and the Norwich-London railway line. The development would extend from the eastern side of Swardeston southwards and eastwards, leaving a buffer between the new development and Mulbarton. The new settlement would be of such a scale that a significant new centre would be established and a genuinely new, small market town would be created.

E16 Access to the A140 would be a highly problematical issue given the constraint of the Norwich-London railway line. Neither is there an easy option via the B1113 or via feeder roads to the A11. There are also particularly severe problems further to the north.

E17 It is also recognised that the scale of development required to deliver a new settlement of some 7,000 dwellings is such that it would occupy a significant amount of land to the west of the A140, significantly urbanising this area and creating a new market town, as an additional and substantial element in the settlement hierarchy.

E18 Option 3 similarly proposes a new settlement of some 7,000 dwellings but seeks to accommodate the development in a manner that is more respectful of the existing settlement hierarchy. It therefore proposes a series of connected villages, either new or expanded, on both sides of the A140. This also helps to reduce the problem of accessibility to the A140 but does not eradicate it. Problems remain further north.

E19 Detailed information is presented on physical infrastructure and transportation to assist the assessment process. The conclusions are that there would be no problems in connecting to water supply, wastewater treatment and foul drainage, flood risk and surface water drainage, energy or waste collection/disposal although there may be a need for upgrades particularly in the case of the larger development proposal.

E20 Transportation matters proved to be considerably more problematical. Key constraints on the highway network include:

a) the route into Norwich along the A140 - traffic from the proposed study area heading to Norwich would have little choice other than to use either the A140 or the B1113, which converge on a relatively small signalised T-junction to the north of the A47;

b) to the north of the B1113/A140 junction, the A140 is a relatively constrained single carriageway two-way road with road side access and numerous side roads. Significant widening may require land acquisition and the removal of a large number of mature trees along the road side, which would be likely to be met with strong opposition. The road also passes over the Norwich to Thetford railway line, and therefore this bridge structure would need widening at significant cost.

c) The capacity of the A140 to the north of the B1113 would be a key constraint on the size of any new development within the proposed study area, both in its role as a primary traffic route and a public transport corridor. The calculations contained within this report are crude and are based on very limited data, but they indicate that the road network could be significantly overloaded with a development of 1,800 dwellings at

Mangreen, and could be completely overwhelmed with a development of 7,000 dwellings in a similar location. (This calculation assumes that the proposals for Mangreen would be in addition to the current allocations in the JCS).

E21 The final stage of the study was to identify locational criteria that could be used to assess new settlement proposals and to apply these to the three illustrative master plans prepared to articulate the three development scenarios. It was decided not to apply a crude weighting system to these criteria as the criteria were not of equal weight. Instead, a simple 'traffic signal' colouring system was used to highlight where particular impacts would be created. Further work would then be necessary to consider how any adverse impacts might be mitigated in the detailed design.

E22 Given that the master planning process was designed to test three very different scenarios it is not possible to recommend one over the other; each raises very different issues and poses different questions which require local input. It is reasonable to say, however, that each would merit further assessment but only on the basis that significant transportation impacts could be overcome. In order to mitigate such impacts, substantial investment in transportation infrastructure would be required and this would have a significant influence on the financial viability of the project which would need to be tested further. It is also desirable that a final decision on whether to pursue a new settlement in this general location would not be made until a wider assessment of alternative locations around Norwich had been undertaken.

1.0 INTRODUCTION

1.01 In March 2010, David Lock Associates (DLA) in collaboration with Mott MacDonald, Integrated Transport Planning and DTZ were commissioned by the Greater Norwich Development Partnership (GNDP) to undertake Phase 1 of the Greater Norwich New Settlement Study. The aim of Phase 1 of the Study was two-fold:

a) to produce a set of criteria that could be used to identify and assess potential locations for new settlements in the Norwich Policy Area (NPA) in the period following the now adopted Core Strategy (i.e. post-2026); and
b) to investigate specifically the feasibility of Mangreen as a potential location for a new settlement by comparing it to the criteria, and undertaking some preliminary analysis of its potential capacity and likely performance relative to defined thresholds for infrastructure provision.

1.02 The intention was that Phases 2 and 3 of the Study would be commissioned separately, the need for the work being determined not only by the findings of Phase 1 but also by the overall planning policy context. It was recognised that the latter was likely to change in the light of the new government's early announcements on changes to the planning system. For the record, the intention was that Phase 2 would identify other potential locations using the agreed criteria in Phase 1, and prepare a detailed assessment framework for considering other locations. Phase 3 would apply the agreed assessment framework to these potential locations and obtain critical information where data was not available to complete the assessment process. The final output of all phases would be a series of recommendations for potential new settlement locations based on objective assessment of the available evidence.

1.03 Interim findings of the study, including recommended criteria and an assessment of Mangreen as a specific location, were presented to the Officers' Steering Group in August 2010. In essence, the findings indicated that Mangreen did not appear to offer as much potential as had been anticipated and it was decided that further work should be suspended until there was greater clarity on the Joint Core Strategy and in overall planning policy. Two matters were critical in this respect: preparation for the Examination in Public (EiP) into the Joint Core Strategy was already under way (the EiP was due to start in November 2010) and the new government had already announced its intention to change the planning system, including the abolition of regional spatial strategies.

1.04 Our work resumed in April 2010 at which point it was agreed that, as Mangreen did not appear to be a front-runner in terms of potential locations, no further detailed

work should be undertaken. Also, as changes to the planning system remain the subject of debate in the Decentralisation and Localism Bill 2010, and this might affect strategic planning processes in the NPA, Phases 2 and 3 would not be commissioned as this stage. The purpose of this report, therefore, is to pull together the various strands of work that have been undertaken to date so that they can be used to inform the forward planning process and as a springboard for further work when needed.

1.05 The report is structured as follows:

a) the evolution of new settlement planning in the UK (section 2)
b) strategic planning for the Norwich Policy Area (Section 3);
c) best practice: criteria and thresholds (Section 4);
d) sieve map analysis (Section 5);
e) development scenarios (Section 6);
f) technical information to support assessments (Section 7);
g) assessment criteria (Section 8);
h) assessment of development scenarios (Section 9); and
i) conclusions (section 10).

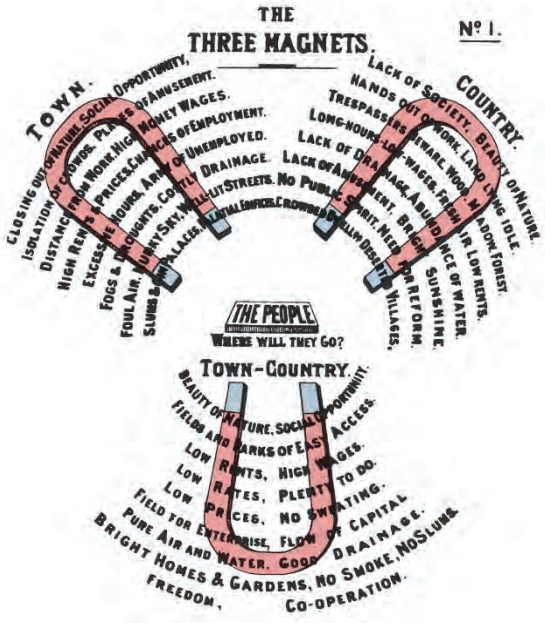
1.06 We would like to thank officers of the GNDP who have contributed to this study.

2.0 THE EVOLUTION OF NEW SETTLEMENT PLANNING IN THE UK

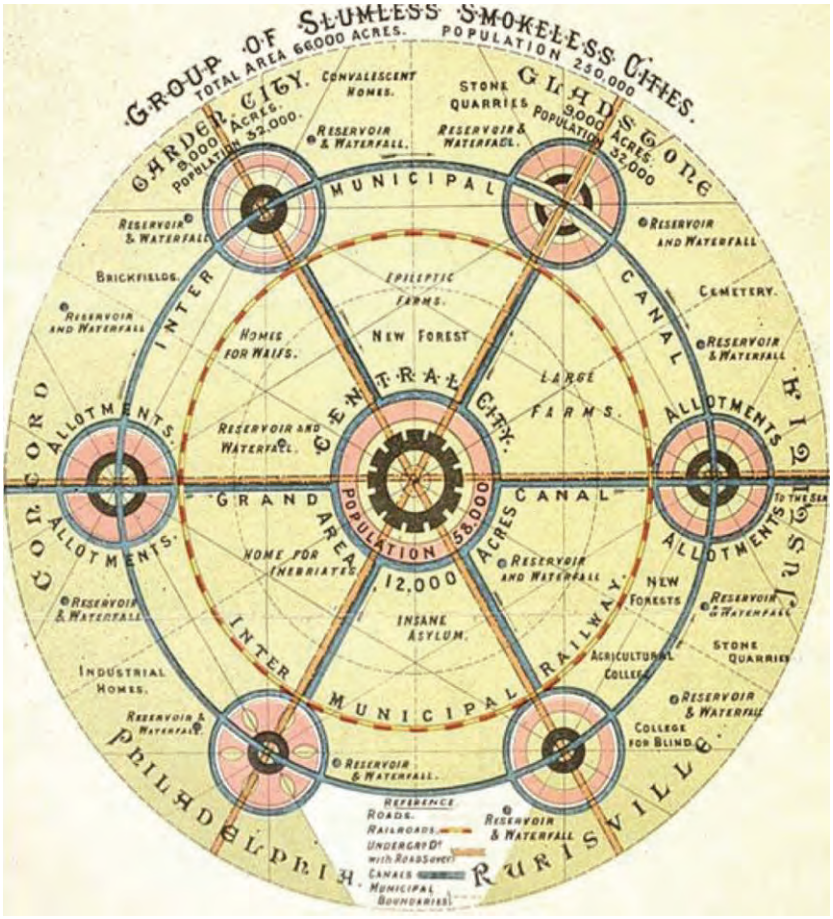
The 'Social City'

2.01 The growing industrialisation of the late nineteenth century heralded the start of a wave of consciously planned new settlements in the UK. Migration of population from rural to urban areas was occurring on an unprecedented scale, and it was clear that this was exacerbating a rising housing crisis with many people living in overcrowded, unsanitary, slum conditions. Social reformers recognised the need to find solutions to these increasingly undesirable living conditions and the 'Garden City' movement was born.

2.02 The Garden City movement was founded by Ebenezer Howard at the turn of the twentieth century with the aim of achieving a *'marriage of town and country'* in a new form of development. His book, *'To-morrow: a Peaceful Path to Real Reform'* (published in 1898 and re-issued in 1902 as *'Garden Cities of Tomorrow'*) described his idea of planned, self-contained, communities surrounded by parkland (a 'green belt') containing proportionate areas of housing, industry and agriculture. The objective was for people to live close to their place of work, in a green environment, with trees and open spaces from the countryside coming into the urban area. Howard illustrated his idea with the famous *'Three Magnets'* diagram which addressed the questions '*Where will the people go?*, the choices being *'Town'*, *'Country'* or '*Town-Country'.*



2.03 Howard proposed that the garden city should have a population of some 32,000 on a site of 2,400 hectares; it should be planned on the basis of a concentric pattern with open spaces, public parks and six radial boulevards, 37m wide extending from the centre. The garden city would be self-sufficient and, when it had achieved its full population, another garden city would be developed nearby. Howard envisaged a cluster of several garden cities functioning as satellites around a central city of 50,000 people linked by road and rail, each encompassed by a green belt to help prevent urban sprawl.



2.04 Underlying Howard's recommendations for the physical structure of the new garden city were his plans for its management and ownership structure which were to be quite unlike those of a normal town or city. Importantly, the intention was that the towns would be largely independent and managed by their own citizens each of whom would have an economic interest in the town. Development and management would be financed by ground rents and the land on which the buildings were constructed was to be owned by the group. The first garden cities were built at Letchworth and Welwyn, both in Hertfordshire and, whilst their delivery mechanisms differed from those originally intended, they remain two of the most successfully planned new communities in the UK.

DIAGRAM OF GENERAL TOWN-PLAN

Post-War New-Towns

2.05 The Barlow Report published in 1940 sought to tackle the problem of apparently ever-increasing size of towns and cities, a reaction against the suburban sprawl that had occurred in the inter-war years as a result of further rural-urban migration and the growth in rail transport; in doing so it raised the profile of this subject as a public issue for the first time. The report concluded that '*planned decentralisation'* was preferable to the ever-increasing expansion of town and cities through suburban development. In 1942, therefore, following Barlow's recommendation, the government created a central planning authority and announced that the Barlow report's recommendations on the decentralisation and relocation of population and industrial initiatives would be followed.

2.06 Post-war re-building initiatives saw plans prepared for London which, for the first time, addressed the issue of decentralisation, notably the *Greater London Plan* of 1944 which proposed that 1 million people should be re-located into a mixture of satellite suburbs, existing rural towns and new towns. The 10 new towns to be built outside London were, therefore, designed to tackle overcrowding in London and provide new businesses and homes for the growing London metropolis.

2.07 The *New Towns Act* of 1946 started the post-war new towns movement, which saw the public sector heavily involved in developing new settlements in strategic locations across the UK. In some cases new towns were almost entirely self-contained stand-alone settlements, such as Cwmbran, Harlow and Stevenage. In other locations, they were an expansion to an already existing town, such as Northampton, Warrington and Peterborough. In most cases they were a new larger development focused on an existing minor settlement. Typically, agencies of central government (development corporations) were responsible for developing these new towns in cooperation with local government.

2.08 The first wave new towns (late 1940s) were intended to help alleviate the housing shortage following World War II and most (with a few notable exceptions) were located beyond what has now become the Metropolitan Green Belt around London. These first wave new towns were Basildon, Bracknell, Corby, Crawley, Harlow, Hemel Hempstead, Newton Aycliff, Peterlee, Stevenage, Welwyn Garden City and Hatfield.

2.09 The second wave new towns (1961-64) were similarly initiated to help alleviate housing shortfalls but mostly were located in the Midlands and north of England i.e. Telford, Redditch, Runcorn, Skelmersdale and Washington.

2.10 The third and last wave of new towns (1967-70) allowed for additional growth and included Central Lancashire, Milton Keynes, Northampton, Peterborough, Telford and Warrington.

Private Sector New Towns and Villages

2.11 No new towns have been formally designated since 1970 but, more recently, the private sector has taken over from the public sector in developing new settlements and urban extensions to existing settlements across the country. Continuing growth in urban populations, rising housing densities, decreasing access to open space, and a fall in the availability of family housing have all contributed significantly to the need for this type of development.

2.12 New settlements built by the private sector have retained many of the key principles from the Garden Cities and new towns, and have evolved to reflect increasing awareness of environmental issues. The underlying aim has been to reduce the need for private car use through ensuring new development has efficient public transport links and high quality cycling and walking routes to employment, retail, education, and other key services and facilities that people need to access every day. A growing shortage of homes, decreasing affordability, and changing demographics have all contributed to increasing demand for these new developments. Most have been designed on the principle that there should be self-containment but few have managed to achieve this objective, most being dependent upon higher order settlements for employment and comparison good retailing. Examples of new settlements and major urban expansions include Poundbury, Dorset; Cambourne, Cambridgeshire; Ebbsfleet, Kent; Wixams, Bedfordshire; Sherford, Devon; Northstowe, Cambridgeshire; and Cranbrook, Devon.

2.13 Northstowe is a planned new community situated about 5 miles north-west of Cambridge in South Cambridgeshire District. Approximately 9,000 dwellings are to be provided for up to about 24,000 people, promoted by the developers as a 'model' for sustainable living. The new community will provide schools, employment areas (around 9,000 job opportunities are expected), open space and a town centre. The core development area of 279 hectares is situated within a development area of 427 hectares on the former Oakington Barracks airfield, which is adjacent to the existing towns of Longstanton and Oakington. The core development area is bounded to the north and east by the Cambridgeshire Guided Busway built by Cambridgeshire

County council on a disused railway line between Cambridge and St Ives, ultimately extending to Huntingdon. The A14 runs to the south-west of Northstowe and will be linked to the development by two new roads.

2.14 Northstowe seeks to achieve sustainable travel and a level of self-containment. The size of the town equates with the theory, supported by evidence, that towns with a population of at least 25,000 tend to exhibit shorter annual travel distances and lower car mode share than the UK average.

2.15 The selection of Northstowe as the preferred location for a new town in South Cambridgeshire was the result of a transparent criteria-based process that compared numerous potential sites available for development in the area. Key site selection criteria included availability of public transport to Cambridge and considered economic benefits, environmental impacts, site capacity, effect on green belt and implementation costs (See *Assessment of New Settlement Locations*, Cambridgeshire County Council 2001). Based on 34 specific criteria, Cambridgeshire County Council, working closely with other authorities, ranked the Northstowe site highest in terms of potential locations for a new town in South Cambridgeshire.

2.16 This site selection process took place within the context of a broader strategy for the selection of areas for development as outlined in the Cambridge & Peterborough Structure Plan 2003. The strategic objectives for prioritising the location of new development sought to reduce travel, encourage high public transport mode share and provide other benefits to the local environment and region

Eco-towns

2.17 In 2007, the Government announced the eco-towns programme, a government-sponsored programme of new towns to be built in England which would address the twin priorities of a) increasing the rate of housing delivery; and b) achieving exemplary standards of social, economic and environmental sustainability. A competition to secure government endorsement as a 'preferred location' resulted in 57 submissions. The Eco-towns Planning Policy Statement (PPS), a supplement to PPS1, was published in 2009 and set out both locational criteria for the new settlement and standards which had to be achieved within the development. The locational criteria stipulated that the eco-town should have the functional characteristics of a new settlement yet could be linked to higher order settlements. This was a significant shift from previous policy which had consistently advocated the need for self-containment; the acknowledgement that a new settlement could function within a hierarchy of other settlements emphasised the need for good

efficient communications within and between settlements. Specifically the locational criteria required:

a) the ability to accommodate a new settlement of at least 5,000 homes;
b) proximity to a higher order centre where there is a clear capacity for public transport links and other sustainable access to that centre;
c) the proximity of the eco-town to existing and planned employment opportunities;
d) whether the econ-town can play an important role in delivering other planning, development and regeneration objectives; and
e) reference to a shortlist of 15 locations in the eco-town PPS.

2.18 The eco-town PPS also set out a number of standards which had to be achieved in the development:

a) the development should be 'zero carbon' i.e. over a year the net carbon dioxide emissions from all energy use within the buildings over the eco-town development as a whole should be zero or below;
b) the ability to be resilient to and appropriate for climate change, planned to minimise future vulnerability, with both mitigation and adaptation in mind;
c) homes should:
    - achieve Building for Life Silver Standard and Level 4 of the Code for Sustainable Homes as a minimum
    - meet Lifetime Homes standards and space standards
    - have real-time energy monitoring systems, real-time public transport information and high speed broadband access
    - provide for at least 30% affordable housing
    - demonstrate high levels of energy efficiency in the fabric of the building
    - achieve zero carbon reductions (from space heating, ventilation, hot water and fixed lighting) of at least 70% relative to current Building Regulations (Part L 2006)
d) there should be access to at least one employment opportunity for new development that is easily reached by walking, cycling and/or public transport;
e) priority should be given to sustainable transport options and all homes should be within 10 minutes walk of frequent public transport and neighbourhood services;
f) the development should be supportive of healthy and sustainable environments;
g) there should be a good level of services proportionate to size of the development including leisure, health and social care, education, retail, arts

and culture, library services, sport and play facilities and community and voluntary sector facilities;

h) 40% of the eco-town's total area should be allocated to green space, of which at least half should be public;

i) the implications of the development on landscape and historic environment must be assessed;

j) there must be a net gain in local biodiversity and no significant adverse effect on internationally designated nature conservation sites;

k) the development should be ambitious in terms of water efficiency across the whole development;

l) the location, layout and construction should reduce and avoid flood risk wherever practicable;

m) a sustainable waste and resources plan should be produced;

n) a master plan should be produced;

o) there should be a plan to organise the transition to higher levels of sustainability; and

p) new models of delivering services and facilities should be devised, appropriate to the size and scale of the town and the facilities provided.

2.19 Fifteen potential locations were identified in the Annex to the eco-town PPS and since that time four have been selected for further progression: Whitehill-Borden (Hampshire), St Austell (Cornwall), Rackheath (Norfolk) and North-West Bicester (Oxfordshire). Whilst the eco-town PPS remains part of the statutory planning system, the government's policy on eco-towns is being reviewed and the funding for local authority assessment of the remaining four proposals was cut by 50% in the 2010/11 financial year.

Key Messages

2.20 New towns planning has evolved significantly in the 110 years or so between the Social City concept of the late nineteenth century and the Eco-towns initiative of the twenty-first century. It is clear, however, that the underlying reasons for developing a new place, that provides for many of the daily needs for its new residents, have not changed. Over the years there have been notable successes, including the first garden cities at Letchworth and Welwyn, and equally notable disappointments including some of the post-war new towns where experimental architecture failed to deliver to its promises or where the economic rationale for the development proved to be ill-founded.

2.21 There are, however, some notable messages that can be learned from this process and which can be applied to new settlement planning in the twenty-first century:

a) The provision of new settlements is inexorably linked to the need to provide new housing and to improve or maintain the social, economic and environmental conditions within our major towns and cities. In acting as an alternative location for development pressures, new settlements can provide flexibility for existing towns and cities, allowing them to repair the urban fabric and to protect their special character.

b) New settlements can establish their own identities and act as development 'magnets' in their own right, thereby reinforcing the position of their 'central' town or city and supporting regional growth and development. Comprehensive master planning with 'place-making' at its heart will assist this process.

c) Self-containment has never really been achieved and, increasingly, is seen as an unrealistic objective. Recent research and the eco-town initiative advocate the concept of 'linked communities' and the importance of new settlements establishing their role within the hierarchy, a role that complements the higher order centre and is capable of change over time.

d) Significant development, planned and implemented on a large scale, allows higher overall standards of development to become attainable. It also allows for a greater degree of experimentation in building techniques and infrastructure provision than would otherwise be possible. This experimentation is a desirable and necessary requirement if the sustainability agenda is to be pushed ahead in a timely manner.

e) The potential for cross-subsidy, proper provision of social, community and green space facilities and alternative forms of management and governance is much greater in a new settlement where increases in land values can be captured for the benefit of the community as a whole.

f) The experience of the recent eco-towns initiative suggests that experimentation in terms of new building and infrastructure provision require the explicit support of central government, both political and financial. In a localism agenda, this requirement would apply equally at the local level although the availability of financial resources would be different.

g) There would appear to be a scale beyond which the private sector cannot extend itself. Current indications are that this is somewhere in the region of 5-10,000 dwellings but this is clearly dependent upon the location and mix of land uses and the amount of essential infrastructure that is required. It is likely, however, that anything more than this will require significant public

sector involvement, either as promoters of the scheme or partners in a joint venture arrangement with private sector partners.

h) New settlements relieve the development industry of strategic land promotion, focus on house-building rather than land trading and give certainty and continuity of supply

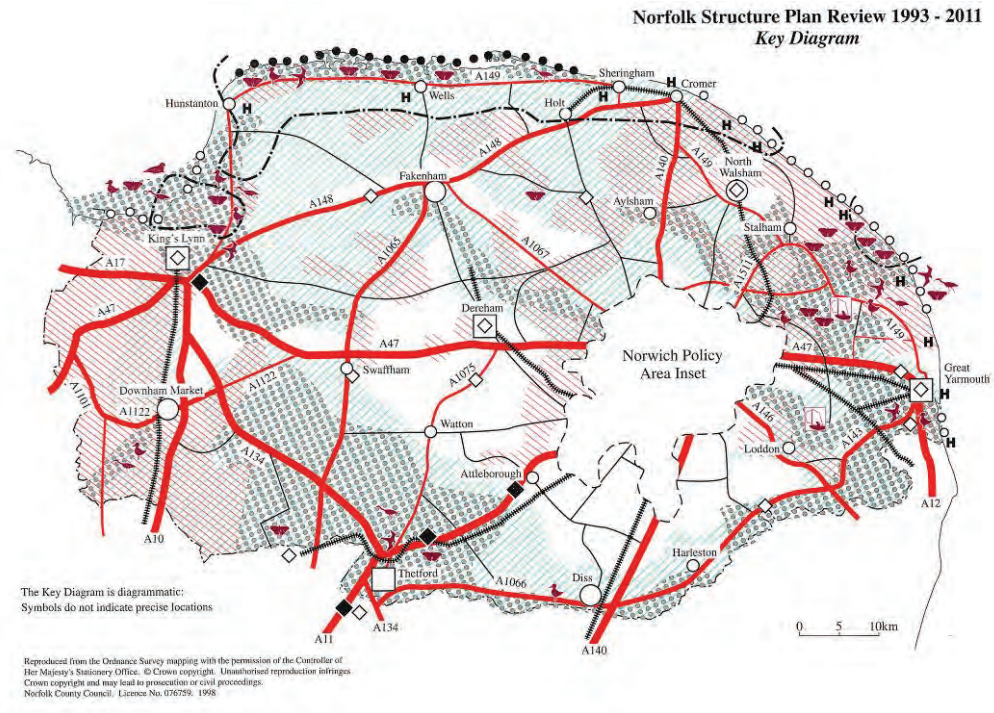
2.22 In conclusion, therefore, new settlements are an appropriate solution to providing for strategic growth and development which helps to alleviate pressures on existing towns and cities. Forming part of a palette of solutions that offers development within the urban area, strategic urban expansion, development within market towns and in rural areas with a good service base, they complement the other choices for strategic growth that are available.

3.0 STRATEGIC PLANNING FOR THE NORWICH POLICY AREA

3.01 Norwich started as a small Saxon settlement north of the River Wensum. In time it grew into a town, in all likelihood due to its situation on the river, thereby facilitating the movement of goods. By the time of the Doomesday Book in 1086, Norwich was one of the largest towns in England and had a thriving economy. Historically, development in the Norwich area was focused on what is now Norwich's city centre, with a limited number of smaller settlements in its rural hinterland. Construction started on Norwich Cathedral in 1096 but took nearly 200 years to complete. In 1194 Norwich was granted a charter and work on the city's walls began in 1297. The city walls contained Norwich within an area of 2km from north to south and 1.5km from east to west. Originally, building was prohibited outside the walls, inhibiting expansion of the city, but from 1790 to 1820 the gates were demolished and in 1845 a railway connection was established. By the late 1800s the city had expanded considerably beyond the earlier city walls. Growth in the twentieth century was marked by continuing urbanisation in north, east and west, with some smaller settlements established beyond Norwich's growing urban area.

Norfolk County Structure Plan

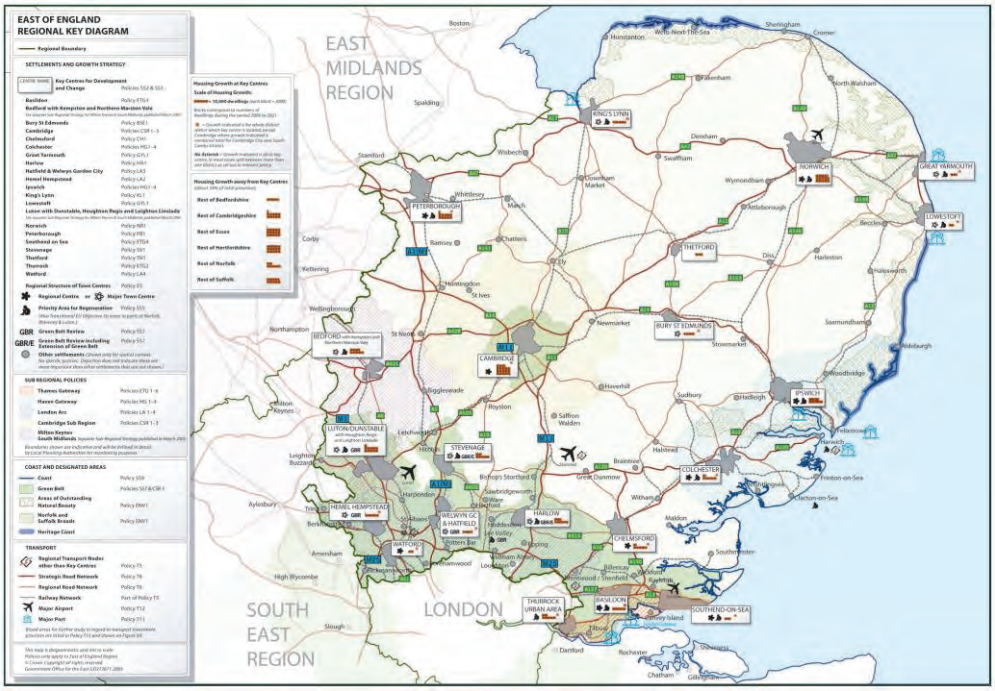
3.02 The last Norfolk County Structure Plan (NCSP) was published in 1999. Importantly, it represented a collaborative approach to strategic planning for local planning authorities across the County. It recognised the need to plan strategically for growth in the NPA, the same strategic area that is now covered by the Greater Norwich Development Partnership (GNDP) *Joint Core Strategy* recently adopted by the participant local authorities. The NCSP planned major housing and employment growth both in the NPA and across the remainder of the three districts. Over 21,000 new dwellings were planned for the period 1993 to 2011, of which 7,400 would be in the City of Norwich, 7,000 would be in the part of Broadland District in the NPA and 7,100 would be in the part of South Norfolk in the NPA. In mid-1993 when the NCSP was being prepared, committed sites already amounted to some 17,100 of the 21,000 requirement (paragraph 11.44). As a result, only 4,400 dwellings would need to be accommodated on new sites over the 18 year plan period.



3.03 The overarching strategy was for new development to be located in the following sequence: city centre; elsewhere in the built-up area; on the edge of the built-up area; and in settlements close to the built-up area. In addition, priority would be given to those locations with good public transport provision and close proximity to shops, schools, workplaces and places of entertainment in order to reduce any growth in private car use (para 11.48). The NCSP made no plans for new settlements in the Norwich Policy Area.

East of England Plan and Review

3.04 The East of England Regional Plan (EERP) was published in 2008 directing strategically significant development to the region's urban areas and prioritising previously developed land. Norwich was identified as a Key Centre for Development and Change, meaning that significant new development should be concentrated in this area. The EERP required minimum housing provision between 2001 and 2021 of 37,500 dwellings, of which 33,000 should be related to Norwich in the NPA. Beyond 2021, annual rates of housing delivery would be assumed to be at a similar rate of growth. This was a significant step up from growth identified in the Structure Plan but retained an emphasis on regeneration through prioritising development on previously developed land, and incremental expansion of existing settlements through concentrating development at the region's cities and other significant urban areas.



3.05 The draft *Review of the EERP* was presented to the Secretary of State in 2010. This required the phased release of greenfield land but continued to prioritise development on previously developed land and concentrated development at the region's cities and other significant urban areas.

3.06 As part of the process to prepare the draft *Review of the EERP*, Ove Arup was commissioned to undertake a study investigating the appropriateness of new regional scale development in the East of England. The study defined regional scale development as greater than 20,000 dwellings, but not necessarily a new stand alone settlement: it could be an aggregation of existing settlements or a significant urban extension (pg iii). Published in January 2009, the Study indicated that "*the development of a new regional scale settlement is not the most appropriate way to deliver long term development across [Norfolk]"* (pg 76). However, it does signal that Norwich could accommodate further growth, and that this further growth could be faster than recent plans or trends. In accommodating this growth, the aim would be to create a larger scale regional centre at Norwich of 300,000-400,000 population (currently the population is around 200,000). This would enable Norwich to become a 'regional city' and better able to compete with 'core cities' elsewhere in the UK or expanding cities in neighbouring regions, such as Milton Keynes.

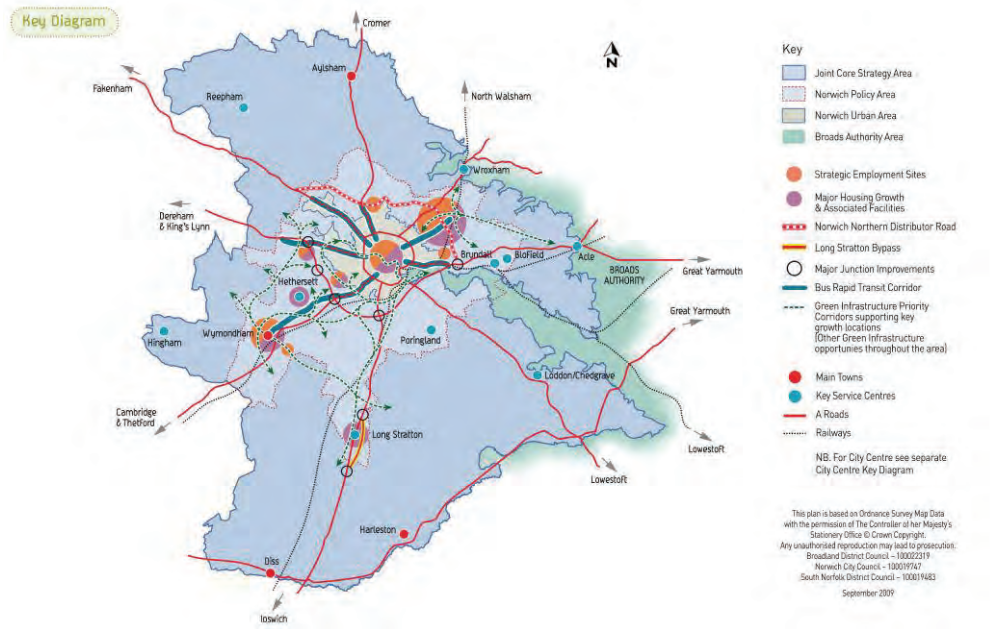
3.07 Since the draft Review of the EERP was published, the new government has announced its intention to abolish regional spatial strategies. Whilst the approved plan remains part of the statutory development plan, and the Review remains a

material consideration in any planning application, the local planning authorities may wish to review the provisions of both Plans in the event that the government's proposals for abolition are ultimately carried through.

Joint Core Strategy

3.08 The *Joint Core Strategy* (*JCS*) for Broadland, Norwich and South Norfolk has been prepared through joint working between Broadland District Council, Norwich City Council, South Norfolk District Council and Norfolk County Council as the Greater Norwich Development Partnership (GNDP). This partnership has come together to plan for significant growth in the NPA up to 2026 and the JCS was officially adopted by the participant authorities on 24 March 2011. Since that time there has been a legal challenge to certain provisions of the Plan but these do not affect matters relevant to this study.

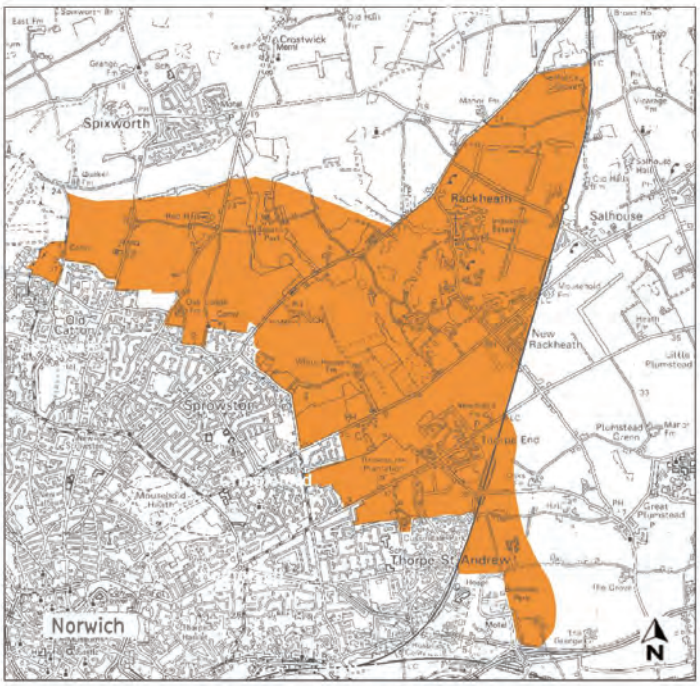
3.09 The strategy concentrates new growth on previously developed land in the urban area of Norwich, in expanded settlements in the surrounding towns and villages, and in a large mixed use urban extension in the Old Catton, Sprowston, Rackheath and Thorpe St Andrew growth triangle (7,000 dwellings by 2026 continuing to grow to 10,000 dwellings eventually). This urban extension is by far the most significant location for growth over the JCS plan period and has also been identified, in part, as the Rackheath Eco-town in the Eco-towns PPS (Appendix A).



3.10 These new and expanded communities will provide new social and physical infrastructure for existing and new communities with the underlying objective of directing new development to well-located, serviced settlements. Concentrating development in these locations will ensure they achieve high degrees of sustainability through being served by good access to local facilities and services, a range of sustainable transport modes, and good access to local job opportunities and strategic employment areas.

Rackheath/Thorpe St Andrew

3.11 The most significant development proposal for the Norwich Policy Area is at Rackheath/Thorpe St Andrew. The JCS defines this new development as a major urban extension and the Rackheath area to the north-east of the proposed Northern Distributor Road is also identified as a location for an eco-town in the Eco-towns PPS. New development at Rackheath/Thorpe St Andrew will need to meet higher standards than normal, such as the whole development achieving zero carbon dioxide emissions for all energy use within buildings both within the proposed eco-town area and within the remainder of the urban extension, so that there is consistency across the whole of the development area.



September 2009

3.12 If ultimately delivered in this way, the new settlement will realise a step change in the Norwich area for both standards and form: a new settlement has not been proposed as part of the preferred development strategy for the area, rather this has instead focused on regeneration in Norwich's urban area and incremental expansion of towns and villages in the rural areas surrounding the city. Rackheath has been identified as an appropriate location for growth because of its potential for achieving higher levels of sustainability.

Planning for post-2026

3.13 In February 2009 the GNDP Policy Group resolved to begin considering the options for growth beyond 2026, or earlier if required by the Review of the East of England Regional Plan. In the light of the possible likely revocation of the RSS, the GNDP and the participant local authorities may wish to re-consider their position but, as this is currently unknown, we have worked on the basis that the statutory development plan remains as existing; the focus for this Study therefore is on the post-2026 JCS plan period.

3.14 Mangreen has already been considered as a potential development location during the process of preparing the JCS; at that time it was assessed for its potential to accommodate approximately 4,500 dwellings (Technical Consultation August 2008) and 2,000 dwellings (December 2008). In February 2009 the GNDP Policy Group agreed that Mangreen should be omitted from the *Favoured Option Consultation* (March 2009) and that additional work would be undertaken at a later date to evaluate the potential of a new settlement in the NPA beyond 2026.

3.15 It is clear, however, that at the time of our instruction, the GNDP Policy Group considered Mangreen to be a 'preferred location within South Norfolk unless fundamental concerns arise as the result of this study work with regard to its justification' (GNDP Policy Group 19.02.09 Resolution). This study therefore informs the assessment of Mangreen but does so on an objective basis.

3.16 A range of factors will be critical determinants in setting out a forward planning strategy for the post-2026 period, not least the government's stated intention to abolish regional spatial strategies and to allow local authorities to determine the appropriate level of provision. The constituent authorities of the GNDP, therefore, will have to prepare their own forecasts for population growth, household formation, availability of housing for all types and tenures, and ambitions for economic growth and these will be among the most critical in determining the amount of development that will be needed to provide existing residents with a high quality of life,

opportunities to remain in the area throughout their lifecycle, and a stable economy with opportunities for business growth and a range of employment options. The other critical determinant will be the development strategy for the NPA, including the extent to which there is potential for focusing new development within the urban area of Norwich, and the extent to which existing towns and villages in the surrounding countryside are capable of further incremental growth.

3.17 In order to explore all potential options for the future it is therefore necessary to consider the potential for a new settlement to accommodate future growth pressures in the NPA, and both the form and function of a potential new settlement, including its relationship to Norwich and the towns and villages surrounding Norwich.

4.0 BEST PRACTICE: CRITERIA AND THRESHOLDS

4.01 This section sets out the evolution of best practice in developing new settlements in the UK over the last 20 years. It summarises the context for the criteria and thresholds identified later in the report, which are used to assess a potential new settlement in the Mangreen area. The following key studies and reports dealing with new settlements have been reviewed:

- *Alternative Development Patterns: New Settlements* (1993)
- *Sustainable Settlements* (1995)
- *Planning for Sustainable Development: Towards Better Practice* (1998)
- *Towards an Urban Renaissance* (1999)
- *PPS1: Delivering Sustainable Development* (2005)
- *Best Practice in Urban Extensions and New Settlements* (2007)
- *Eco-Towns Planning Policy Statement* (2009)

Alternative Development Patterns: New Settlements (1993)

4.02 *Alternative Development Patterns: New Settlements* was published in 1993 by the Department for Environment. It addresses how to accommodate new development in terms of scale, location, and consequences. A number of its findings are relevant to this Study:

- New settlements should not be planned for unless they are to be of sufficient size to offer the prospect of development as viable communities in their own right (pg 50);
- The minimum viable size of a new settlement would be that which, in a given county, would support a primary school (variously 750-1,500 dwellings) (pg 50);
- Greater emphasis on social and environmental considerations suggests that it would be preferable if new settlements were large enough to support a secondary school and contained sufficient employment to offer most of the residents of working age the choice of employment in the community (this would suggest a size in the range of 3,000-5,000 dwellings) (pg 50);
- A full mix of uses should be achieved to encourage the sustainability and economic vitality of the new settlement (pg 50);
- New settlements have the potential to provide all that is required, if they are of sufficient scale. 3,000-5,000 dwellings is considered a minimum, but preferably new settlements would be developed at a scale of around 10,000 dwellings (pg 80).

4.03 The report notes that new settlements of around 10,000 dwellings (25,000 population) also happens to be within the range of the population size proposed for the original Garden Cities. It further emphasises that this should not be surprising as '*economic, social structure and quality of life were amongst the considerations of the inventor of Garden Cities*.' (pp 50-51)

Sustainable Settlements (1995)

4.04 *Sustainable Settlements*, published in 1995 by the University of the West of England, provides a guide for considering development proposals through a lens of achieving sustainable development principles. The guide brings together good practice case studies at the time, and describes in some detail the principles, processes, and key considerations for creating a '*sustainable development'*.

4.05 The report identifies a number of key factors for assessing suitability and capacity of any particular location. These include:

- access to facilities
- transport networks
- energy use in buildings and carbon-fixing
- threats to biodiversity
- air quality
- water resources
- land and soil
- minerals and energy resources
- existing built environment
- quality and accessibility to open space
- cultural heritage

4.06 The report emphasises that localised provision of facilities and services improves sustainability by encouraging local trips to meet day-to-day needs, particularly by walking or cycling. It also reduces the need to travel further for day-to-day needs. The report warns against the difficulty of identifying one specific catchment for a particular service or facility because consumer choice and greater mobility means that local people may not choose to use local facilities. Nevertheless, an indicative table is created showing possible local facility catchments (based on city-scale not small towns); this table is reproduced below. For the purposes of this study it has been sorted and coloured into three categories in order to consider: a) population under 15,000; b) population between 15,000 and 30,000; and c) population over 30,000. A third column has been added for the purposes of this study to

demonstrate the way in which this relates to settlement size based on 2001 census data. The corresponding categories for settlement size are a) less than 5,000 dwellings; b) more than 5,000 dwellings; and c) more than 10,000 dwellings:

Facility	**Population (range)**		**Settlement size based on average 2.4* persons/household (range)**	
Corner Shop	2000	5000	833	2083
Primary School	2500	4500	1042	1875
Doctor's Surgery	2500	3000	1042	1250
Public House	5000	7000	2083	2917
Local Shopping Centre	5000	10000	2083	4167
Post Office	5000	10000	2083	4167
Secondary School	7000	15,000	2917	6250
Community Centre	7000	15000	2917	6250
Youth Club	7000	11000	2917	4583
Health Centres (4 doctors)	9000	12000	3750	5000
Church	9000	-	3750	-
Library	12000	30000	5000	12500
Sports Centre	25000	40000	10417	16667
Superstore/District Centre	25000	40000	10417	16667

* Greater Norwich SHMA (2007) indicates that Average Household size in South Norfolk in 2001 was 2.38

4.07 Clearly, many of these thresholds are variable dependent upon the local context, commercial standards applying at the time and standards applied by statutory bodies (e.g. the local education authority). In addition, current proposals for review of the NHS services and education provision (e.g. free schools) could have significant impacts which cannot be anticipated at this stage.

Planning for Sustainable Development: Towards Better Practice (1998)

4.08 *Planning for Sustainable Development: Towards Better Practice* was published in 1998 by the Department for Environment, Transport and the Regions (DETR). It

provides a useful guide for preparing more sustainable local plans and promoting more sustainable land-use patterns and use of resources.

4.09 Chapter 3 of the report sets out a range of key considerations for assessing urban extensions and new settlements. Of relevance to Norwich and considering a potential new settlement in the Mangreen area are the following criteria and thresholds identified in the report:

Criteria for New Settlements (pg 47)

- Relate positively to the immediate rural setting in terms of function (by supplementing provision for local needs in terms of services and housing type and tenure) and provide a range of facilities related to their population
- Include neighbourhoods with a variety of housing and employment, and mixed development in neighbourhood centres containing a range of facilities within walking distance of housing
- Have a centre at the core of the development, with convenience shopping (and comparison if the development is large enough), and supporting uses, including leisure, a secondary school, healthy care and cultural facilities
- Have public transport links to existing major employment centres (recognising that it is not feasibly to expect all residents of new settlements to work in the immediate locality), and
- Incorporate high quality urban and landscape design, including integrated open space, habitat areas, and energy efficiency in layouts and buildings

Thresholds (pp 64-65)

- **10,000 homes** or more (representing 25,000-30,000 population), may be able to achieve a degree of self-containment if it includes a full range of facilities and makes provision for attracting employment. This scale may also be able to secure higher standards of services and affordable housing through S106 agreements.
- **5,000 homes** would have a reasonable range of facilities (i.e. one secondary school), attract some employment and function effectively as a community.
- **1,500 homes** or less (small schemes) allow for a local solution, but are unlikely to be large enough to support basic facilities or attract wealth-generating employment. Developments at this scale risk becoming residential dormitory developments and S106 benefits may be modest.

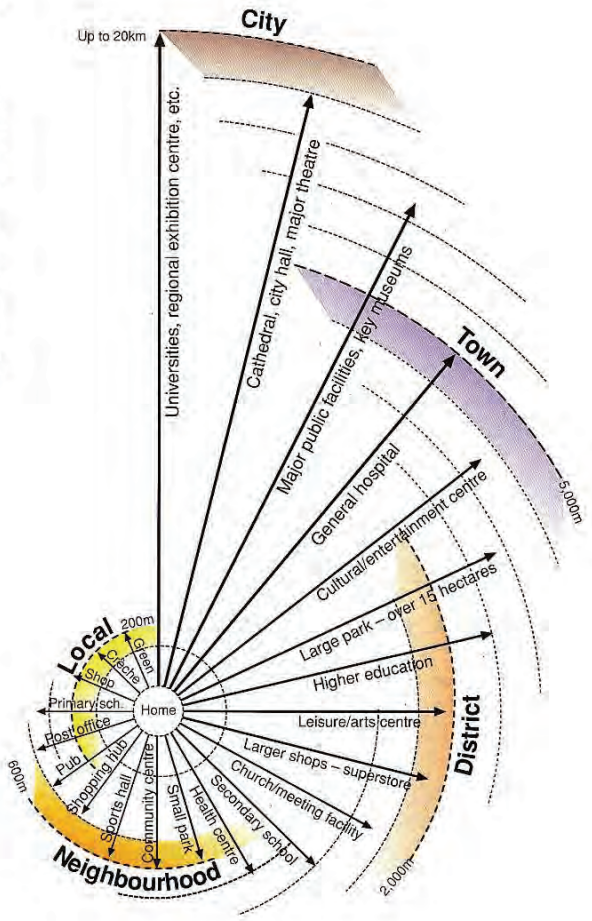
Towards an Urban Renaissance (1999)

4.10 Towards an Urban Renaissance was published in 1999 by the Urban Task Force, which was set up to investigate and respond to the question: "How can we improve the quality of both our towns and countryside while at the same time providing homes for almost 4 million additional households in England over a 25 year period?"

4.11 The report sets out over 105 recommendations covering a wide range of issues from streamlining the planning system, managing land supply, dealing with contaminated sites, attracting private investment and the role of public investment. Relevant to this study, it also adapts the catchments guidance set out in the *Sustainable Settlements* guide.

		Possible facility – Catchment population	
4–10km radius	City facilities	Stadium	City
		Cathedral	City
		City hall	City
		Theatre	City
2–6km	District or Town	Sports centre	25,000–40,000
		District centre	25,000–40,000
		Library	12,000–30,000
		Health centre	9,000–12,000
400–800m	Neighbourhood	Community offices	7,500
		Community centre	7,000–15,000
		Pub	5,000–7,000
		Post office	5,000–10,000
150–250m	Local hubs	Primary school	2,500–4,000
		Doctor	2,500–3,000
		Corner shop	2,000–5,000

This chart is indicative and is based upon city-scale urban areas. Catchments will vary in specific areas.



PPS1: Delivering Sustainable Development (ODPM Jan 2005)

4.12 *Planning Policy Statement 1: Delivering Sustainable Development* was published by the Office of the Deputy Prime Minister in 2005. It sets out the overarching national planning policies on the delivery of sustainable development.

4.13 The Government's key aims in delivering sustainable development include:

- social progress which recognises the needs of everyone
- effective protection of the environment
- prudent use of natural resources, and
- the maintenance of high and stable levels of economic growth and employment

4.14 In addition, PPS1 indicates that sustainable and inclusive patterns of urban and rural development should be facilitated through:

- making suitable land available for development in line with economic, social and environmental objectives to improve people's quality of life
- contributing to sustainable economic development
- protecting and enhancing the natural and historic environment, the quality and character of the countryside, and existing communities
- ensuring high quality development through good and inclusive design, and the efficient use of resources, and
- ensuring that development supports existing communities and contributes to the creation of safe, sustainable, liveable and mixed communities with good access to jobs and key services for all members of the community

Best Practice in Urban Extensions and New Settlements (2007)

4.15 *Best Practice in Urban Extensions and New Settlements* was published in 2007 by the Town and Country Planning Association (TCPA). It sets out the history and tradition of '*planned town-making'* in the UK and provides a number of recent case studies from which lessons can be drawn to establish good practice for developing new settlements and urban extensions.

4.16 A number of key factors are relevant to a potential new settlement at Mangreen. In particular, the report acknowledges the following:

- the concept of clustered towns and cities where a cluster can punch well above its weight and great benefits can be derived for the mutual advantage of linked settlements
- the basis of securing transport links that are public-transport rather than private-transport based
- high level functions do not have to be located all in the same place
- networked local economic development: clustering widens the economic and cultural frame for residents, increases innovation and economic growth, and assists international competitiveness, and
- the desirability of achieving a critical mass of 5,000-10,000 dwellings in order to be large enough to support a secondary school. "*A community that cannot provide for its children through to adulthood is not sustainable, and the quality of community life is impoverished if older children do not participate because they are sent elsewhere each day*".

Planning Policy Statement: eco-towns A supplement to Planning Policy Statement 1 (June 2009)

4.17 The eco-towns PPS sets out the Government's national policy for principles, criteria and standards to be applied to potential eco-towns. The standards are designed to ensure that eco-towns are a '*showcase for sustainable living'* (pg 1). As noted above, PPS1 sets out the Government's overarching objectives for planning: a) to promote sustainable development; and b) to reduce the carbon footprint of development.

4.18 The eco-towns PPS sets out a number of locational criteria:

- The area of land needed, which should be able to accommodate a minimum of 5,000 homes;
- Proximity to a higher order centre where there is capacity for public transport links and other sustainable access to that centre;
- Proximity to existing and planned employment opportunities;
- The extent to which the development can plan a role in delivering other planning, development or regeneration objectives.

4.19 A range of other criteria are to be applied to determining the suitability of eco-towns. Those of greatest relevance to considering the feasibility of a new settlement at Mangreen are provided below:

- **Climate Change adaptation:** eco-towns should be sustainable communities that are resilient to and appropriate climate change;

- **Employment**: eco-towns should be genuine mixed use communities with unsustainable commuter trips kept to a minimum;
- **Transport**: eco-towns should be designed so that access to it and through it gives priority to more sustainable modes, such as walking, cycling and public transport. Residents' reliance on private cars should be reduced;
- **Healthy Lifestyles**: eco-towns should be designed to promote and support healthier and more active living, and to support sustainable environments;
- **Local Services**: eco-towns should include a good level of services proportionate to the size of development, including leisure, health, social care, education, retail, arts, culture, library, sport and play facilities, and community facilities;
- **Green Infrastructure**: 40% of the total area should be allocated to green space, of which at least half should be public. It should be made up of network of high quality green/open spaces.
- **Landscape and Historic Environment**: eco-towns must adequately consider the implications for the local landscape and historic environment;
- **Biodiversity**: eco-towns should demonstrate a net gain in local biodiversity and should not have an adverse effect on internationally designated nature conservation sites or Sites of Special Scientific Interest (SSSI);
- **Water**: eco-towns should be ambitious about water efficiency and contribute towards improve water quality in the locality;
- **Flood Risk**: The location, layout and construction should reduce and avoid flood risk wherever practicable;
- **Waste**: Eco-towns should include a sustainable waste and resources plan

4.20 The conclusions that can be drawn from this analysis of criteria and thresholds are that:

a) Locational criteria can be helpful in identifying broad areas of search for potential new settlement locations;
b) Additional criteria should be defined to help shape the nature and form of the settlement and its response to social, economic and environmental considerations; and
c) Thresholds are likely to be highly variable, depending upon location and economic factors but nevertheless the provision of appropriate education facilities is an essential pre-requisite.

4.21 In most cases, the ideal size of a new settlements, that allows for a reasonable degree of self-containment, will make provision for a secondary school and therefore

is likely to be in the range of 7,000-10,000 dwellings or a population of 20,000-25,000 people.

5.0 SEIVE MAP ANALYSIS

5.01 The purpose of the sieve map analysis is to identify the broad areas of search for new settlements in the NPA. Potential new settlement locations will be identified via a desk top mapping exercise using 1:50,000 Ordnance Survey Landranger maps and development plan proposals maps. Broad areas of search for new settlements can be defined with reference to a series of primary and secondary constraints. Further assessment will then be undertaken with reference to an agreed set of criteria.

Primary constraints

5.02 The primary constraints are listed in Table 1 and shown on Figure 1 in relation to Mangreen. The primary constraints tend to be imposed at national and/or international levels and would effectively preclude areas from being considered for development except in the most exceptional of circumstances.

5.03 Each of these primary constraints has been given a weighting of 'fixed' and a 'traffic signal' colouring of red; this reflects the extent to which they should be given very careful consideration in the assessment of potential development proposals.

Table 1. Primary Constraints

Primary Constraints	**Weighting**
SSSI	Fixed
RAMSAR sites	Fixed
Special Protection Area (SPA)	Fixed
Special Area of Conservation (SAC)	Fixed
Area of Outstanding Natural Beauty (AONB)	Fixed
National Nature Reserve	Fixed
Historic Parks and Gardens	Fixed
Flood Plain	Fixed
Ancient Woodland	Fixed
Scheduled Ancient Monument	Fixed
Airport Public Safety Zones	Fixed
Cemeteries	Fixed

Figure 1. Primary Constraints

South Norfolk District

Norwich District

Outside Policy Area

Inside Policy Area

Inside Policy Area

Outside Policy Area

HETHERSETT CP

KETTERINGHAM CP

EAST CARLETON CP

MULBARTON CP

KESWICK CP

SWARDESTON CP

CAISTOR ST EDMUND CP

SWAINSTHORPE CP

STOKE HOLY CROSS CP

SHOTESHAM CP

NEWTON FLOTMAN CP

FLORDON CP

WRENINGHAM CP

Hethersett

Ketteringham

East Carleton

Lower East Carleton

Mulbarton

Hethel

Bracon Ash

Keswick

Swardeston

Dunston

Caistor St Edmund

Stoke Holy Cross

Swainsthorpe

Shotesham

Wreningham

Newton Flotman

Cringleford

Ancient Woodland

SSSI

Historic Parks & Gardens

Schedules Ancient Monuments

Flood Plains

Norwich Policy Area Boundary

District Boundary

Greater Norwich Development Partnership

New Settlement Study, Norwich

Primary Constraints (Figure 1)

Date		Scale	
06/06/2011		1:10,000 @ A0	
Drawn	Designed	Approved	Drawing Number	Revision
DKS	LMK	PW	GNDP01-009	01

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Secondary constraints

5.04 Secondary constraints are listed in Table 2 and shown on Figure 2 in relation to Mangreen. These constraints are given variable weightings of 'intermediate' or 'flexible' depending upon the extent to which it might be possible to ameliorate any adverse impact or to provide compensatory benefits. In the traffic signal colouring system these constraints have been given orange or yellow designations, again reflecting the extent to which it might be possible to modify the development proposals to minimise adverse impacts and/or provide benefits in these locations.

5.05 It should be noted, however, that neither the weightings nor the traffic signal system is based on exact science. In practice there might be some movement between the categories or in the geographical application of the designations. In some cases, further investigations will be required in order to allow any impact to be assessed in full.

Table 2. Secondary constraints

Secondary Constraints	**Weighting**
Local Nature Reserve	Intermediate
County Wildlife Site	Intermediate
Conservation Area	Intermediate
Listed Building	Intermediate
High Quality Agricultural Land	Intermediate
Areas of Great Landscape Value	Intermediate
Area of Archaeological Importance	Intermediate
Pylons and overhead cables (plus buffer zones)	Intermediate
Fuel/Gas Pipe Lines	Intermediate
Airport Noise Contours	Intermediate
Green Infrastructure	Flexible
Strategic Open Space	Flexible
Green Ways	Flexible
HSE Sites consultation zone	Flexible
Major Woodland Planting	Flexible
Existing and Emerging Minerals Sites	Flexible
Existing and Emerging Waste Sites	Flexible

Figure 2. Secondary Constraints

South Norfolk District

Norwich District

Outside Policy Area

Inside Policy Area

Outside Policy Area

Inside Policy Area

- Listed Buildings
- Conservation Areas
- Local Nature Reserves
- County Wildlife Sites
- Existing Mineral Sites
- Agricultural Land
  - GRADE 1
  - GRADE 2
- Emerging LDF Mineral Sites
- Emerging LDF Waste Sites
- Existing Waste Sites
- Southern Bypass Landscape Protection Zone
- Area of Historic Landscape Value
- Overhead Lines
- District Boundary
- Policy Area Boundary

Greater Norwich Development Partnership

New Settlement Study, Norwich

Secondary Constraints (Figure 2)

Date:	06/06/2011			Scale:	1:10,000 @ A0
Drawn:	Designed:	Approved:		Drawing Number:	Revision:
DKS	LMK	PW		GNDP01-010	02

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Results

5.06 These various constraints have been mapped in relation to the southern part of the NPA using Mangreen as a focus for the study. The 'Mangreen area' is loosely identified for the purpose of the study as being land to the south of the A47 and generally including the parishes of Swardeston, Mulbarton and Swainsthorpe. Subsequent clarification suggested that the A140 should generally be taken as the eastern boundary but for the purposes of the sieve map analysis we have considered a wider area.

5.07 Figure 1 shows the location and distribution of primary constraints, each marked and identified separately. This shows that there are virtually no primary constraints affecting the Mangreen area, just very localised areas of flood risk to the west of Swardeston. There are more substantial areas of flood risk to the east of the A140.

5.08 Figure 2 shows the location and distribution of secondary constraints, again each marked and identified separately. This shows that rather more of the Mangreen area is affected by designations with only the areas immediately around the villages of Swardeston and Mulbarton being largely unaffected. It should be said, however, that the two most expansive designations are the areas of Historic Landscape Value and the policy designation of the Southern Bypass Landscape Protection Zone, both of which are identified as being 'flexible' in terms of their constraint on development. More detailed analysis would need to be undertaken to understand the implications of specific development proposals in these areas.

5.09 More significant constraints, however, are the pylons and overhead cables (with their attendant buffer zones), the existing minerals site and several County Wildlife Sites. The pylons, cables and minerals sites have a significant impact in the northern and eastern part of the study area. There are no formal regulations that restrict development within a defined distance of pylons and cables but given the level of public interest in health and safety matters various sources suggest that there should be a no build zone of anything from 30m to 200m. In addition, proximity to pylons and cables has a negative impact on land values.

5.10 A further feature, not specifically highlighted on the constraints maps, but of great significance, is the Norwich-London railway which extends along the eastern part of the study area and has the effect of restricting access to the A140 in all areas other than the most northerly part of the study area. Elsewhere, there are limited opportunities for crossing the railway line, and with the exception a short stretch of the A140 nearest to Mangreen Hall and the A47 intersection, most use level crossings in existing villages. This matter, however, is discussed further in the detailed analysis of potential development locations.

5.11 Finally, to obtain a composite view of these constraints and to appreciate their relative distribution across the area (fixed, intermediate or flexible) we have prepared a third plan Figure 3. This suggests that very little of the study is free of constraints but that large parts are affected by constraints that are flexible in nature.

6.0 DEVELOPMENT SCENARIOS

6.01 Having determined through the sieve mapping exercise that the Mangreen area, in principle, has the potential to accommodate a new settlement, we turn to consider whether there might be any development thresholds in terms of settlement size. From this we can determine the amount of development land required, making appropriate provision for associated land uses.

The role of education provision

6.02 One of the essential requirements of new settlement planning is to understand local provision in terms of education facilities and how this would need to be augmented as a result of the new development. In our study, we took as our starting point for the new settlement the thresholds for education provision at both primary and secondary school levels.

6.03 One of the essential requirements of any new settlement is that it should make adequate provision for schools within the development. Conventionally, the primary school is seen as the building block of a new community but increasingly the view is being taken that a successful new community should educate its children through secondary school level. We have therefore considered what these requirements are in Norfolk and what they might mean in terms of new settlement planning in the Mangreen area.

Local Education Standards

6.04 Information for the NPA is available in the Norfolk County Council (NCC) report: Infrastructure, Service and Amenity Requirements for New Development - Planning Obligations Standards for Education, Library, Fire Hydrant and Social Service Provision published in April 2010. In the same month, additional information was provided by NCC about Norfolk Children's Services preferences for education provision. This information has been taken into account in estimating the scale of the proposed development that could be provided and is summarised below.

6.05 The Children's Services' preferred model for Primary Schools in Norfolk County Council is a 2-Form Entry (2FE) which is equivalent to a 420 places school (as a maximum).

6.06 Not stated in the document, but of considerable importance, is that the Children's Services' minimum preferred model for Secondary Schools in Norfolk County Council is 6 forms of entry (6FE) which is equivalent to approximately 900 11-16 year olds (as a minimum).

6.07 The Mangreen study area is currently within the Hethersett High School catchment. The number of children generated from this part of the catchment (Mulbarton/Swardeston/Swainsthorpe) is equivalent to about 1,000 dwellings. This has a potential advantage in that it provides a base

number of children for the school from surrounding villages but conversely a new school in the Mangreen area would remove pupils from Hethersett, possibly requiring equivalent compensatory development in that area. It is County Council policy that children (of primary or secondary school age) should not be expected to cross a major road (in this case the A140) to get to or from school.

Pupil Generation Figures

6.08 The report referred to above identifies the County Council's most recent analysis of the number of children likely to arise from new development and this is repeated in Table 3.

Table 3. NCC Pupil Generation Figures 2010

Age Range	No Years cohorts	Type of school	Multiplier (no. of children/100 dwellings)
3-5	2	Pre-School	8.4
5-11	7	Primary	25.4
11-16	5	High	14
16-18	2	Sixth Form	2.8

6.09 It is important to note that the NCC multipliers above apply to contributory dwellings only and assume the following:

a) no children from 1-bed accommodation or sheltered housing; and
b) a 50% discount on the above multipliers for flats, apartments and maisonettes reflecting the fact that fewer children are likely to arise from these types of dwellings.

Development Scenarios

6.10 Based on this information we have devised two development scenarios for Mangreen:

a) a scale of development that would support one primary school; and
b) a scale of development that would support one secondary school together with the requisite number of primary schools.

6.11 Table 4 demonstrates how we have derived the required number of dwellings for each scenario. In order to take account of non-contributory dwellings, NCC have advised that a notional 10% should be added to the contributory dwellings.

Table 4. Dwelling Requirements for Two Development Scenarios at Mangreen

Type of school	Multiplier (no. of children/ 100 dwellings)	Scenario 1: Contributory dwellings for one Primary School (420 student places)	Scenario 1+: Contributory dwellings for one Primary School plus 10% buffer for non-contributory dwellings	Scenario 2: Contributory dwellings for one Secondary School (900 student places)	Scenario 2+: Contributory dwellings for one Secondary School plus 10% buffer for non-contributory dwellings
Pre-School Age 3-5	8.4				
Primary Age 5-11	25.4	1653	1,818		
High Age 11-16	14			6,429	7072
Sixth Form Age 16-18	2.8				

6.12 At this early stage, it is proposed that a range be considered for each scenario rather than a specific figure in order to reflect a degree of uncertainty about the future context of a potential new development in this area post-2026 (e.g. capacity at nearby schools, pupil generation figures, multipliers, other factors). This therefore suggests scenarios based on:

a) 1,800 to 2,000 dwellings to accommodate one primary school (1653 to 1,818 contributory dwellings); and
b) 7,000+ dwellings to accommodate a secondary school (6,429 to 7,072 contributory dwellings).

Education Requirements for Scenarios 1 and 2

6.13 Assuming therefore that we proceed on the basis of these two scenarios we have calculated how many additional places would be required for the two scenarios (See Table 5). Each of the two scenarios would also have implications for other school requirements. For a new development in

the range of 7,000+ dwellings the following requirements would need to be met based on 2010 standards. In these calculations, we have also addressed the possibility of a development of around 8,000 dwellings to assess the sensitivity of these figures. Norfolk County Council has suggested that 7,000 dwellings might not deliver the requisite number of pupils to support a secondary school.

Table 5. Education Infrastructure Requirements for Scenarios 1 and 2

Type of school	Multiplier (no. of children/100 dwellings)	Requirement for 1,800 dwellings assuming 10% non-contributory dwellings	Requirement for 2,000 dwelling assuming 10% non-contributory dwellings	Requirement for 7,000 dwellings assuming 10% non-contributory dwellings	Requirement for 8,000 dwellings assuming 10% non-contributory dwellings
Pre-School Age 3-5	8.4	140 places	153 places	540 places	610 places
Primary Age 5-11	25.4	419 places = 1 primary school 2FE	461 places = 1 primary school 2FE + 40 extra places	1633 places = 4 primary schools 2FE	1847 places = 4 primary schools 2FE + 167 extra places
High Age 11-16	14	231 places at nearest high school	254 places at nearest high school	900 places = 1 secondary school 6FE	1018 places = 1 secondary school 7FE
Sixth Form Age 16-18	2.8	46 places	51 places	180 places	204 places

Illustrative master plans

6.14 Having determined these two scenarios we then considered how this scale of development might be accommodated in the Mangreen area. The results are shown on Figures 4, 5 and 6. There are three options, one for a new settlement of around 1,800 dwellings which provides a new primary school and two for significantly larger settlements, both of around 7,000, dwellings which would accommodate new primary schools and a new secondary school. An assessment of each option

relative to criteria is given in Section 9 of this report. This follows consideration of technical information on services, utilities, transportation, etc. which is needed to make these judgements.

6.15 We should explain at this stage that our detailed analysis of site constraints and potential suggested that we should locate the potential development areas some distance from:

a) the A47 bypass with its potential for noise and air pollution and visual impact; and
b) the overhead pylons and transformer station.

6.16 This had the effect of pushing the potential development area away from Mangreen Hall, and further to the south and west, towards Swardeston and Mulbarton. We are also aware of the sensitivity of the historical landscape in this general area and the general difficulties of crossing the Norwich-London railway line. We concluded that there was very limited prospect of:

a) securing a train station on the railway line – on grounds of cost and practicality;
b) constructing a bridge over or an underpass through the A47 embankment – again on grounds of cost and practicality, but also in terms of visual impact in the case of a bridge; and
c) undergrounding the pylons – these are 400Kv and 132 Kv lines and a major component of Norwich's electricity supply. Costs for undergrounding 400Kv lines are given in Section 7 of this report and are generally considered to be prohibitive. We also note that health and safety considerations are likely to have an adverse impact on the marketability of housing in close proximity. Given that the brief for the study rejected the idea of significant employment development within the development, this has significantly reduced the potential of land in this area.

6.17 Our options therefore are designed to test:

a) modest expansion of existing villages, akin to organic growth, which would provide a minimum level of development (1,800 dwellings and a primary school) and fit more neatly with the historic settlement pattern;
b) development on a scale to support a secondary school (7,000+ dwellings) focused in one location; and
c) a similar scale of development, with a more dispersed settlement pattern (to try to over come the limitations of access and to respond better to the historic landscape).

Option 1: expanding Mulbarton and Swardeston (Figure 3)

6.18 Option 1 is shown on Figure 4. This provides for a modest development of around 1,800 dwellings in total, some 1,100 in Swardeston and the remaining 700 in Mulbarton. In practice, however, this option does not provide for a 'new settlement' as such. The proposed 700 dwellings at Mangreen would function as an expansion of the existing village and although it would provide for a new local centre it would utilise existing social, community and education facilities within the local area. In the case of Swardeston, the proposed 1,100 dwellings would considerably exceed the size of the existing village (by a factor of 3-4) but it would provide a local centre and a new primary school. For

OPTION 1, 1800 dwellings

Figure 3

SWARDESTON
38.2 ha
1 Primary School
1 Local centre
1100 dwellings

MULBARTON
23.2ha
1 Local centre
700 dwellings

Keswick
CAISTOR ST EDMUND CP
Caistor St Edmund
Lower East Carleton
ERINGHAM CP
EAST CARLETON CP
East Carleton
MULBARTON CP
Mulbarton
Hethel
Bracon Ash
SWAINSTHORPE CP
Swainsthorpe
Dunston
Stoke Holy Cross

- Emerging LDF mineral sites
- Existing mineral sites
- Existing waste sites
- County wildlife sites
- Ancient woodland
- SSSI
- Listed buildings
- Conservation areas
- Flood plains
- Major settlements
- High voltage power cables
- National trail

Potential location of:

- New residential
- New community facilities
- New schools

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0km 500m

N

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the purposes of this option, It has been assumed that secondary school facilities would be dealt with by way of contributions to existing facilities elsewhere within the local area.

6.19 Considerations which influenced this option were that the expansion of Mulbarton would support existing facilities and substantial new development at Swardeston would create sufficient critical mass to allow new facilities to be provided. This option also focuses development on areas which are less affected by restrictive planning designations.

Option 2: a new/expanded village in the hierarchy (Figure 4)

6.20 Option 2 assumes that the new settlement needs to be sufficiently large to accommodate a new secondary school and therefore takes as its minimum size some 7,000 dwellings (See Figure 2). It is important to note that the County Council has indicated that, despite published guidelines on secondary school provision, it might prefer a higher level dwellings to support a school in this type of location but for the purposes of this study we have undertaken our technical assessments on the basis of some 7,000 dwellings.

6.21 Option 2 presents a genuinely 'new' settlement, occupying the space between Swardeston and Mulbarton, the existing and proposed mineral sites and the Norwich-London railway line. The development would extend from the eastern side of Swardeston southwards and eastwards, leaving a buffer between the new development and Mulbarton. The new settlement would be of such a scale that a significant new centre would be established and a genuinely new, small market town would be created.

6.22 Again, it is recognised that access to the A140 would be an issue. It is also recognised that the scale of development required to deliver a new settlement of some 7,000 dwellings is such that it would occupy a significant amount of land to the west of the A140, significantly urbanising this area and creating a new market town, as an additional and substantial element in the settlement hierarchy.

Option 3: A more dispersed pattern of development (Figure 5)

6.23 Option 3 similarly proposes a new settlement of some 7,000 dwellings but seeks to accommodate the development in a manner that is more respectful of the existing settlement hierarchy (See Figure 3). It therefore proposes a series of connected villages, either new or expanded, on both sides of the A140. This also helps to reduce the problem of accessibility to the A140.

6.24 More detailed consideration of each of these options is given in Section 9 of this report where they are assessed against the agreed criteria. Clearly, a variety of master plans could be created for the levels of development proposed but the three options presented allow clear choices to be made, and test the criteria that have been prepared. In order to assess the options against the criteria, however, it is necessary to have a better understanding of the infrastructure, utilities and transportation requirements that will apply; this is considered in the next section of this report.

OPTION 2, 7000 dwellings

Figure 4

SWARDESTON
7000 dwellings
4 Primary Schools
1 Secondary School
2 Local centres
1 District centre

Keswick
CAISTOR ST EDMUND CP
Caistor St Edmund
Marshall
Lower East Carleton
ERINGHAM CP
EAST CARLETON CP
East Carleton
Dunston
MULBARTON CP
Mulbarton
Hethel
Bracon Ash
SWAINSTHORPE CP
Swainsthorpe

- Emerging LDF mineral sites
- Existing mineral sites
- Existing waste sites
- County wildlife sites
- Ancient woodland
- SSSI
- Listed buildings
- Conservation areas
- Flood plains
- Major settlements
- High voltage power cables
- National trail

Potential location of:

- New residential
- New community facilities
- New schools
- Enhanced Roads

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0km 500m

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OPTION 3, 7000 dwellings

Figure 5

SWARDESTON
38.4 ha
1 Primary School
1 Local centre
1150 dwellings

SWAINSTHORPE
116 ha
2 Primary Schools
3 Local centres
3500 dwellings

NEW SETTLEMENT
66 ha
1 Secondary School
1 Primary School
1 District centre
2080 dwellings

MULBARTON
8.9 ha
1 Local centre
270 dwellings

- Emerging LDF mineral sites
- Existing mineral sites
- Existing waste sites
- County wildlife sites
- Ancient woodland
- SSSI
- Listed buildings
- Conservation areas
- Flood plains
- Major settlements
- High voltage power cables
- National trail

Potential location of:

- New residential
- New community facilities
- New schools
- Enhanced Roads

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7.0 TECHNICAL INFORMATION TO SUPPORT ASSESSMENTS

7.01 Physical infrastructure requirements will be also important in the assessment of the potential of the Mangreen area to accommodate a new settlement. In order to enable an assessment of the three options against the recommended criteria, our team has gathered information on a number of technical matters.

7.02 This section of the report considers the main water, energy and solid waste infrastructure thresholds relating to the two possible sizes of new settlement, with indications of required mitigation measures and order of magnitude costs. We have assumed that a new settlement of 7,000 homes could take up to 20 years to build.

Physical infrastructure requirements

Water Supply

7.03 The WCS Stage 2b final report (February 2010) states that demand for water in the GNDP area over the next 35 years will increase by 10 million litres a day (Ml/d) to 17 Ml/d, depending on the degree of water efficiency achieved in new and existing homes. The report also concludes that most of the planned growth areas in the JCS can be largely serviced through existing water mains, using Heigham Water Treatment Works (WTW) as the focal point for distributing new resources.

7.04 The Norwich and the Broads water resources zone (WRZ8) is an area of scarce water resources. According to the WRMP, this zone currently relies on water storage within the Chalk aquifer to provide a reliable base flow to the intakes on the River Wensum which are used to supply Norwich with potable water, as well as for direct abstraction from Chalk boreholes to supply the city and the rural area. Water quality in the boreholes is variable, and some boreholes will require treatment to achieve suitable quality standards under the Water Framework Directive.

7.05 The study area is in WRMP Planning Zone PZ44 (Hethersett). This zone is projected to have a water supply deficit by 2036/7 of 0.57 ML/d in the average dry year. AW plans to manage this potential deficit through leakage control, household metering and the promotion of water efficiency measures, and by transferring water between planning zones. In Norwich, AW also proposes to introduce a new urban groundwater source and to re-use wastewater for aquifer recharge towards the end of the period to 2036.

7.06 For the two sizes of settlement under consideration, the approximate domestic water consumption is estimated as 0.4 to 0.6 ML/d for 2,000 homes, and 1.4 to 2.1 ML/d for 7,000 homes. These figures, which exclude non-domestic consumption, are based on average home occupancy of 2.3 people, daily consumption of 80 to 120 L per head, and 10% system losses.

7.07 Based on the WRMP and WCS reports, it is therefore assumed that a new settlement at Mangreen can be supplied with potable water without reinforcement of water supply infrastructure capacity.

7.08 If this assumption were incorrect, then the order-of-magnitude water supply infrastructure costs for a new settlement at Mangreen could be in excess of £5 million, for a settlement of 7,000 homes. This rough estimate assumes a new 9 km-long water supply pipeline to Mangreen from the AW Costessey borehole. The estimated cost for a settlement of 2,000 homes would be similar. The estimate does not include capital costs for additional water treatment and abstraction facilities.

Wastewater Treatment and Foul Drainage

7.09 According to the WCS Stage 2b final report (February 2010):

a) all of the increases in wastewater flow generated as a result of new housing and employment can be transferred and treated at existing wastewater treatment works (WwTW) without the need for further treatment facilities in compliance with the water quality requirements of the Water Framework Directive and the Habitats Directive;
b) a new interceptor foul sewer is required around the northern and southern boundary of Norwich to transfer flow from the existing sewers in the planned growth areas to Whitlingham WwTW and
c) The Mangreen area is currently served by WwTW at Swardeston, which currently has headroom for another 568 dwellings, out of which 503 dwellings are proposed in the JCS up to 2026.

7.10 It is assumed that:

a) there will be sufficient capacity in Whitlingham WwTW to serve a new settlement of up to 7,000 homes at Mangreen, including compliance with the Water Framework Directive in respect to water quality objectives[1]

b) there will be sufficient capacity in the proposed interceptor foul sewer to serve a new settlement of up to 7,000 homes at Mangreen.

7.11 Based on the WCS study and the above assumptions, therefore, there do not appear to be any constraints on new development on the scale proposed in terms of waste water treatment and foul drainage.

7.12 Investment will be required for new foul sewers to connect Mangreen to the proposed southern interceptor sewer, and may also be required as a contribution towards for the interceptor sewer, which is likely to be operational in 2019, according to the WCS report.

7.13 If the proposed southern interceptor sewer did not have capacity to serve a new settlement at Mangreen, then order-of-magnitude infrastructure costs for a new foul sewer could be in the range of £5 million to £12 million, for a settlement of 7,000 homes. This rough estimate assumes a new

8 km-long gravity foul sewer/pumped rising main from Mangreen to Whitlingham WwTW. The estimated cost for a settlement of 2,000 homes would be similar.

Flood Risk and Surface Water Drainage

7.14 According to the Environment Agency website and the SFRA and WCS reports, the Mangreen area is in the low flood risk zone allowing for climate change impact.

7.15 The main requirements of a new settlement would be to use sustainable drainage systems (SUDS) as part of a surface water management strategy to ensure that drainage runoff rates and volumes are not increased as a result of the development, allowing for climate change impacts. As much of the site is located over clay subsoil, infiltration drainage is unlikely to feasible on the west part of the site. Other SUDS such as rainwater harvesting, surface or underground attenuation storage, pervious paving, green roofs may be appropriate, discharging via watercourses or storm sewers into the River Tas and River Yare.

Energy

7.16 Mangreen lies immediately west of the EDF Energy Norwich Main 400 kV/132 kV national grid station. Five 400 kV or 132 kV conductors on towers cross or run close to the site. The three options that have been prepared have assumed that the existing apparatus is left in situ but it is highly visible and likely to have an adverse impact on the amenity of future residents. The costs of diversion, however, are considered to more than could be borne by the development in terms of viability; these are set out below.

7.17 Depending on the size and extent of the settlement, the two overhead HV lines that cross the site (either above ground or underground) could be diverted to avoid siting homes close to these power lines, or to leave a reservation corridor across the site. The very approximate order of magnitude costs to divert the two power lines are listed below, based on information from EDF Energy and National Grid.

Table 6. Cost of undergrounding electricity cables

	Underground diversion		**Above ground diversion**	
	Minimum	**Maximum**	**Minimum**	**Maximum**
400 kV line, length 2 km	£20 million	£30 million	£6 million	£10 million
132 kV line, length 2 km	£5 million	£8 million	£2 million	£4 million
Totals	**£25 million**	**£38 million**	**£8 million**	**£14 million**

[1] However, it is understood that the EA has still to issue its Review of Consents for the Norwich area.

7.18 For a new settlement at Mangreen, the visual impact of the existing electricity pylons would need to be mitigated as part of the development, since these towers are such large structures. The layout of scheme, the orientation of the main views out of a building, and the location of structural site planning including public open space by the developer could assist in reducing the visual impact on residents and other users.

7.19 According to EDF Energy, there are currently no significant capacity restrictions within the 132 kV network, and there is spare electricity capacity in the local networks to supply power for a new settlement of 7,000 homes or more. Assuming power supply from the grid, a new primary sub-station 33kV/11kV for a new settlement of 7,000 homes would be required with a cost range of £3 million to £5 million, while a new settlement of 2,000 homes might be supplied from the existing sub grid station at Mulbarton (subject to a capacity check). A study by EDF Energy would be required to check the effect on the rest of the 33 kV network, and to assess whether any reinforcement might be needed.

7.20 If low carbon energy strategies were adopted for the settlement, in line with Government policy to encourage the use of renewable energy, then energy supply options for consideration might include communal systems based on biomass/biogas CHP, medium to large scale wind turbines, and micro-renewables such as solar power, photovoltaic and solar hot water heating, and small scale wind power (as discussed in the JCS Sustainable Energy Study). The choices and size of plant would depend on the density of the housing and the number of dwellings proposed. Approximately one 2.5MW, 120 metre hub height wind turbine would be required per 1,000 homes. Grid connections would still be required as a back up and for export of surplus energy generated.

Solid waste

7.21 Mangreen's nearest Household Waste Recycling Centres (HWRC) for public disposal are at Ketteringham and Morningthorpe. Morningthorpe HWRC (located just off the A140 to the north of Long Stratton) is a small site with little capacity for increased tonnages. Ketteringham HWRC however does have additional capacity and has recently been improved to increase capacity. Ketteringham HWRC is also used by residents in South Norwich as it is deemed more convenient than the Mile Cross city centre facility. If, prior to 2026, the County Council were to provide additional HWRC facilities on the southern side of the city, then there is the potential for some of the existing users of Ketteringham HWRC to switch to these new facilities, thus freeing up capacity at Ketteringham.

7.22 A Materials Recovery Facility (MRF) has been developed in Costessey, operated by Norfolk Environmental Waste Services (NEWS) which receives recyclables from all seven of the Waste Collection Authorities (extract from Joint Municipal Waste Management Strategy for Norfolk, Norfolk Waste Partnership, Second Revision March 2006, period 2006 – 2020). Recyclables are currently sent from SNDC to Costessey MRF.

7.23 Since 2002, SNDC have been operating a twin bin collection system. Each property in South Norfolk has been given one green bin for recycling and one grey bin for rubbish (or a suitable alternative if the property cannot accommodate bins). We are not aware that this is changing in the near future, but future government waste targets will drive additional segregation of waste by householders. This will probably lead to additional bins/receptacles at each household. This should be carefully considered when designing new communities which, as a minimum, should meet the Code for Sustainable Homes (distance from door to bin storage area <30m), plus storage space for recyclables.

7.24 Based on the current rule of thumb of 1 tonne of waste for disposal per household per year, the SNDC would need to collect either 2,000 tonnes of waste or 7,000 tonnes of waste per year (based on current waste arising per household). Changes in packaging, lifestyle, recycling etc. between 2010 and 2026 should help reduce this figure, but this cannot be forecast with accuracy.

7.25 Estate roads should be designed to ensure that recycling lorries can access the site. In addition, the developer should consider providing "bring-bank" facilities (bottles, textiles books etc.) at convenient central locations within the development (adjacent to community shops/village hall). If the District Council is given the chance to provide the bring-banks it can help raise revenue for the Council.

7.26 In addition to domestic waste, schools and commercial/industrial premises also generate waste. WRAP give figures of 45 kg/pupil/year for primary pupils, and 22 kg/pupil/year for secondary pupils. Commercial waste would be dealt with by commercial waste companies.

Sand and gravel extraction sites

7.27 As shown in the emerging Norfolk Minerals & Waste Local Development Framework (LDF), four emerging LDF Minerals sites and one existing minerals site are located between the east boundary of the Mangreen site and the London to Norwich railway line. The presence of these sites would have an impact on a new settlement at Mangreen, depending on the specific proposals for re-use after completion of minerals extraction. If used for landfill, there could be negative potential impacts on nearby residential users due to site contamination, leachate and landfill gas unless stringent landfill planning conditions were imposed. After land filling, gravels pits could also be suitable for redevelopment as part of a new settlement if ground conditions are suitable. Alternatively, after completion of minerals extraction, the quarries could be landscaped for public open space, water features or balancing ponds. It is understood that the dates for emerging LDF sites is under review by the Government, and will not be confirmed for some time.

Transportation

7.28 Given the location of the proposed new settlement in an essentially rural location, separated from the A140 by the London to Norwich railway line, existing and proposed mineral extraction sites and with limited access through existing villages the transportation impacts of the proposed development will be an important consideration.

7.29 As part of this process, our team has reviewed the numerous transport studies and background documentation in relation to the Mangreen site. The main points from each report are noted below.

Existing transport situation

7.30 The A47 currently runs from the Midlands to Norfolk on a broad east west axis from the Midlands to Great Yarmouth and forms the Norwich Southern Bypass. The A47 in Norwich is primarily dual carriageway, apart from small lengths to the west of Norwich, near to East Dereham and beyond towards Swaffham.

7.31 The A140, running on a north to south axis, is almost entirely single carriageway and subject to a range of speed restrictions. It links Norwich to Cromer to the north and Diss and Stowmarket and the A14 to the south.

7.32 Bus services that route along the A140 near to the Mangreen site include First bus services 10 and 18. Both services start north of the city centre with the number 10 heading south to Mulbarton and the number 18 heading south towards Swainsthorpe and Long Stratton. A summary of the services is presented below.

Table 7. Bus services and frequency

Operator	Service number	Route	Frequency
First	10	Mulbarton – Spixworth via Norwich City Centre	Every 30 mins
First	18	Long Stratton - Old Catton via Norwich City Centre	Every 30 mins
Anglian Buses	003	Harleston to Norwich via the Pulhams	Every 2-2.5 hours

7.33 Another significant road central to Mangreen is the B1113. This road is accessed from the A140 Ipswich Road, north of the A47 and leads to Swardeston and Mulbarton, routing underneath the A47, before continuing on to Stowmarket and the western fringes of Ipswich via numerous Norfolk and Suffolk villages.

7.34 In terms of cycle routes, according to the Norwich Cycle Map, the A140 and roads within the vicinity are marked as useful on-road cycle routes but are unprotected. There is also the Lakenham Way cycle route along the disused railway line running from Sandy Lane to Brazengate, which is traffic free.

7.35 Norwich has one of the most comprehensive Park and Ride networks in the UK, with 6 sites based around the edge of the city. The Harford Park and Ride site has 1,088 spaces available and operates on a 10 minute frequency from 7am to 6pm (15 minute frequency after 6pm). The journey time to Norwich Bus Station takes 15 – 20 minutes.

Transport studies and documentation

Norwich Area Transport Strategy

7.36 The Norwich Area Transport Strategy (NATS) was consulted on in October 2009 and sets out future transport plans for the city from the present time until 2025. The Strategy covers all modes of transport and is based around the key themes of providing a transport system that is 'reliable and practical, sustainable and accessible'. Highlights of the Strategy include:

a) extending the cycling and walking network;

b) Bus Rapid Transit System and Core Bus Routes on radial routes into the City Centre;

c) tram train services potentially to Rackheath and Broadland Business Park;

d) improving long distance rail services (particularly to London);

e) the Northern Distributor Road;

f) junction improvements on the A47 Norwich Southern Bypass;

g) potential expansion of the Park and Ride network to include a possible Park and Ride site at Trowse junction on the A47

Within the NATS, the A140 is designated as a Core Bus Route.

JCS 2011

7.37 The adopted JCS primarily encompasses the most recent version of the NATS (as described above) and discusses and proposes the transport requirements (elements of NATS) to support the growth of Norwich including the need for improvements to the A47 at Longwater, Thickthorn and Postwick as well as at Harford.

7.38 Development at Long Stratton (a minimum of 1,800 houses) is promoted in the JCS period and in order to deliver this, transport improvements including bus priority improvements on the approach to the A140/A47 junction and an enhanced route, through bus priority measures, on the A140 corridor to the city centre are required.

7.39 The cost of the bus priority improvements to the Harford Junction approach, which is critical to the Long Stratton growth, is estimated to be £2million. The improvements would be funded by Norwich

County Council, DfT, Growth Point Funding and developer contributions. The work is timetabled to be delivered between 2011 and 2016.

A47 Junction Capacity Report

7.40 The A47 Southern Bypass Junctions Capacity Assessment Study was undertaken by Mott MacDonald on behalf of Norfolk County Council, reporting in November 2008. The assessment was undertaken to model the impact of one of the JCS's growth scenarios, known as Option D (which is similar to Option 1, and did not include growth at Long Stratton), using the NATS SATURN model. No account was taken of any emerging sustainable transport measures. The three junctions considered were:

a) Junction 1 - A47 / B1108 (Watton Road) roundabouts

b) Junction 2 - A47 / A11 (Thickthorn) roundabout

c) Junction 3 – A47 / A140 (Harford) roundabout

7.41 The Harford junction is obviously the most relevant in relation to the Mangreen site. The report identifies problems at the Harford roundabout due to the levels of growth tested, in the form of very long queue lengths (90 vehicles over 3 lanes or approximately 240 metres per lane) on the A140 (s) approach to the roundabout. To mitigate the impact of these problems with capacity, 2 options have been put forward:

a) Option 1 - Partial signalisation of the roundabout – partial signalisation of the A140 (s) and the A47 (west) off slip.

b) Option 2 – Proposed alterations to the roundabout layout – this option is a more radical solution for junction improvement and is linked to greater amounts of development at Long Stratton. The alterations include the stretching of the roundabout to the south.

7.42 The report notes that if significantly more housing growth is allocated onto the A140 corridor (similar to option 3 that included 4,500 dwellings at Mangreen/Swardeston/Mulbarton and 1,500 at Long Stratton) then a more radical solution may be required similar to that at Thickthorn, i.e. major realignment, potentially involving further elements of grade separation. High level cost estimates have been provided for this work and are stated in Table 8. Costs associated with major realignment at Thickthorn have been included for comparison purposes.

Table 8. Cost estimates for junction improvements

Junction	Option	Cost reference	Cost	Optimism bias	Total

A140 Harford Roundabout	Option 1 Partial signalisation	Harford Minor	£125,000	£55,000	£180,000
A140 Harford Roundabout	Option 2 Proposed alterations	Harford Major	£820,000	£370,000	£1,190,000
A11 Thickthorn Roundabout	Option 2 Major realignment	Thickthorn Major	£24,620,000	£16,000,000	£40,620,000

7.43 The study concludes, amongst other things, that further modelling of the preferred JCS option should be undertaken with consideration of junction modifications to accommodate emerging sustainable transport measures e.g. BRT and junction modifications to improve cycle and pedestrian movements.

Greater Norwich Joint Core Strategy Public Transport Requirements of Growth

7.44 This report was also undertaken by Mott MacDonald and reported in November 2008. The aim of the study was to identify the best performing growth options, from scenarios A, B, C and D and investigate their potential to support a high quality public transport service.

7.45 The report references an earlier study conducted by EDAW - Norwich Growth Area – Infrastructure Need and Funding Study (EDAW, December 2007). The study proposed increases in bus mode share across the Norwich Policy Area to 13% by 2021 and 15% by 2031. Mott MacDonald suggest that, in order to meet this overall policy area target, it would be necessary to set higher public transport mode share targets for the major growth locations. Therefore, assumptions were made in terms of stretching the public transport mode share targets in major growth locations to 16% by 2021 and 20% by 2031. Stretched bus mode share targets of 20% by 2021 and 25% by 2031 were also considered as sensitivity tests.

7.46 The recommendations section of the report briefly discusses development at Mangreen commenting that development at Long Stratton would work better from a public transport perspective in conjunction with development at Mangreen/Swardeston/Mulbarton. It also recognises that employment development at Mangreen would help to reduce the level of commuting into Norwich and therefore concludes that demand from Mangreen/Swardeston/Mulbarton would help to support a more frequent bus service between Long Stratton and Norwich.

7.47 The report also considers the potential for rail to accommodate additional trips from the south of the city. Examination of the developable land at Mangreen/Swardeston/Mulbarton and the location of a

potential new station at Mangreen show that potential for this infrastructure is lower than first envisaged.

7.48 Appendix A of the document examines public transport issues relating to development at Long Stratton and development at Mangreen. Examining the issues at Long Stratton first, the report identifies a number of constraints on the A140 corridor including the Dunston and Harford railway bridges and the A47 interchange. There is potential to provide a continuous bus lane on the A140 from the Harford Park and Ride site to the B1113 junction and also to provide an inbound bus lane on Ipswich Road north of the Outer Ring Road but this would involve the removal of existing on street car parking on this section of Ipswich Road. Potential also lies in the development of Hall Road as a bus priority route in place of Ipswich Road.

7.49 The report notes that options 6 and 6a (which include 4,500 dwellings at Mangreen/Swardeston/Mulbarton) would require expansion of the Harford Park and Ride site or the construction of a site at Trowse to pull existing demand from the A146/B1332 corridor away from Harford.

Growth Option Assessment Mangreen (for 4500 dwellings)

7.50 The GNDP has examined development at Mangreen (4,500 dwellings) previously during the discussion of the final preferred option for the JCS. It is clear that to facilitate any development at Mangreen, a significant amount of funding will be required to apply modifications to junctions and a radial route into the city centre (A140 or possibly Hall Road). Transport costs are estimated to be in the region of £60 million to £75 million.

7.51 Mangreen evidently presents a significant challenge in terms of transport, access and movement. The A140 is a particularly constrained radial route into Norwich City centre and the removal of trees and car parking, to enable bus priority/lanes is likely to be a particularly contentious issue, especially in and adjacent to a conservation area. With existing bus services in place there is potential for greater frequency of services but the development would need to be of a scale to justify such frequencies. The A140/B113 and A147/A140 junctions especially would require significant enhancement to ensure the relatively smooth movement of vehicles into and out of Norwich.

7.52 To maximise the use of sustainable transport from new development of any size at Mangreen, it will be important to create sustainable transport networks from the outset. Any master plan will need to demonstrate a logical network of streets with safe and attractive routes, promoting and prioritising the movement by walking and cycling. Also central to the take-up of sustainable travel to and from the area will be the promotion and incentivisation of these modes, for example, making residents aware of all sustainable travel options in the form of maps and other information materials and providing them with incentives e.g. discount vouchers or free bus tickets for certain periods.

7.53 Research undertaken by the Department of Transport over the past years has shown that smarter travel choices have a significant role to play in reducing traffic congestion and also in reducing

carbon emissions. *Smarter Choices – Changing the Way We Travel* (2005) reviewed all existing literature relating to the various Smarter Choices measures and also undertook further case study research to determine the impact of smarter choices on traffic congestion in the future, looking at varied scenarios and intensity of measures. The research suggested that a major programme of soft factors including workspace and school travel plans, personalised travel planning and travel awareness campaigns could result in a major reduction in traffic congestion in urban areas across the UK in the order of 21% during peak periods and 13% during off peak periods could be achieved if the measures were implemented intensively.

7.54 Recent DfT research report *Making Personal Travel Planning Work* (2008) examined a range of case studies from the UK and abroad to evaluate the results that these projects can have and their effect on encouraging people to use sustainable modes of transport for a wide variety of journeys. The research showed that within the UK, PTP can reduce car driver trips by 11% among the targeted population and reduce the distance people travel by car by 12%.

7.55 Another DfT research report Making Travel Plans Work (2002) studied the findings from 20 employment-based travel plans and found that, on average, the travel plans reduced single occupancy car use by 18%.

7.56 Finally, in 2005, the DfT released the Good Practice Guidance Note Making Residential Travel Plans Work. This note gives detailed advice on preparing residential travel plans for new developments and is based on case study evidence from 9 sites located across the UK.

Previous development proposals

7.57 Whilst not influencing this study the notable sustainable transport proposals put forward in a previous master plan include a dedicated priority off-road bus transit system, a bus/cycle/pedestrian bridge over the A47 (Southern Bypass) and a new parkway railway station at Mangreen.

The Northern Distributor Road

7.58 The coalition government has recently reviewed funding for major infrastructure programmes. The NDR is on a shortlist for DfT funding pending the submission of further information by the County Council.

A140 corridor statistics

7.59 The A140 has a width of approximately 10 metres south of the outer ring road and approximately 8.5 metres north of it. A standard lane width for buses only is 3.65 metres but if the bus lane were also to cater for cyclists the width would need to increase to 4.5metres. Other general traffic lanes need to achieve a width of 3.65 metres.

Trip generation and distribution

7.60 We have also considered how the local transportation network might be impacted by the proposed development. We have interrogated the TRICS database to ascertain how many trips could be generated by a development on the scale proposed. Historic trip rates from residential sites in East Anglia were used in the analysis. The resulting trip rates are outlined in Table 9.

Table 9. Person Trip Rates taken from TRICS Residential sites in East Anglia

	Arrivals	Departures
08:00-09:00	0.301	0.864
17:00-18:00	0.584	0.405

7.61 Table 10 identifies the number of trips generated under each scenario:

Table 10. Overall Number of Person Trips

	1,800 dwellings		7,000 dwellings	
	Arrivals	Departures	Arrivals	Departures
08:00-09:00	542	1555	2107	6048
17:00-18:00	1051	729	4088	2835

7.62 The distribution of trips was obtained from investigation of journey to work information recorded as part of the 2001 census. The distribution of journey to work trips from the existing residential areas within the study area to all other geographical areas was obtained. These geographic areas were grouped into four categories based upon the most likely vehicular route from the study area. These categories, and the associated distribution, are set out in Table 11:

Table 11. Distribution of trips

North into Norwich	59%
West on A47	7%
East on A47	24%
South	10%

7.63 On this basis, the overall number of people travelling to and from Norwich from the development area would be as set out in Table 12.

Table 12. Overall Person Trips to/from Norwich

	1,800 dwellings		7,000 dwellings	
	From Norwich	To Norwich	From Norwich	To Norwich
08:00-09:00	319	917	1242	3566
17:00-18:00	620	430	2410	1672

7.64 This gives an idea of the likely number of people that would travel to/from Norwich from the development area under each scenario, although it is worth pointing out that this may be an over-estimation. Person trip rates derived from TRICS includes all trips, such as work trips, trips to local schools, trips to local shops etc. The only information available for distributing these trips is based on journey to work information, however for trips to local schools, for example, the journey to work distribution might not be suitable, as people generally travel less distance to school than they do for work. Therefore, these estimates can be considered upper end estimates.

7.65 The next question to ask is how many of these people might be driving, compared to those using other modes of travel. The journey to work modal split of people living within the study area and travelling to Norwich was derived from the 2001 Census is set out in Table 13.

Table 13. Modal Split to/from Norwich

Car Driver	Car Passenger	Bus	Motorcycle	Bicycle	On Foot
73%	8%	13%	2%	2%	1%

7.66 Applying these modal splits to the number of people travelling to Norwich results in the multi-modal trip generation under each scenario set out in Table 14:

Table 14. Multimodal Trips to/from Norwich

Time Period	Modal Split		1,800 dwellings		7,000 dwellings	
			From Norwich	To Norwich	From Norwich	To Norwich
08:00-09:00	Car driver	73%	233	669	907	2603
	Car pass.	8%	26	73	99	285
	Bus	13%	42	119	162	464
	Motorcycle	2%	6	18	25	71
	Bicycle	2%	6	18	25	71
	On foot	1%	3	9	12	36
17:00-18:00	Car driver	73%	452	314	1760	1220
	Car pass.	8%	50	34	193	134
	Bus	13%	81	56	313	217
	Motorcycle	2%	12	9	48	33
	Bicycle	2%	12	9	48	33
	On foot	1%	6	4	24	17

7.67 This would be the potential trip generation if travel trends were to remain as existing. However, a significantly sized development would require significant increase in public transport provision, which in itself would be likely to encourage a higher proportion to travel by public transport.

7.68 '*The Demand for Transport: A practical Guide'* (TRL Note 593) is a recognised industry source of evidence on public transport demand and its determinants. The document presents a review of research and evidence on passenger response to service and fare changes. Chapter 7 relates to the impact of service levels on patronage. There is a negative correlation between the time people need to wait for a bus, and the potential level of patronage. The elasticity of this relationship is quoted as -0.65.

7.69 At present there are two bus services per hour along the A140 and two bus services per hour along the B1113, which are the only two services available for people currently living within the study area to travel to Norwich. The average wait time for each service is 15 minutes (half of the 30 minute bus headway). If each service level were increased to 6 buses per hour, then average wait time would decrease from 15 minutes to 5 minutes, a decrease of 67%. Multiplying this by the elasticity of -0.65 gives a potential increase in patronage of 43%. Therefore ramping up services 10 and 18 to 6 buses per hour could increase patronage by 43%.

7.70 The effect of increasing bus patronage figures by 43% has been represented within the following table. This assumes a proportional decrease in trips associated with other modes as set out in Table 15.

Table 15. Multimodal Trips to / from Norwich, with improved bus services

Time Period	Modal Split		1,800 dwellings		7,000 dwellings	
			From Norwich	To Norwich	From Norwich	To Norwich
08:00-09:00	Car driver	69%	218	626	849	2436
	Car pass.	8%	24	69	93	267
	Bus	19%	59	170	231	663
	Motorcycle	2%	6	17	23	67
	Bicycle	2%	6	17	23	67
	On foot	1%	3	9	12	33
17:00-18:00	Car driver	69%	423	294	1647	1142
	Car pass.	8%	46	32	180	125
	Bus	19%	115	80	448	311
	Motorcycle	2%	12	8	45	31
	Bicycle	2%	12	8	45	31
	On foot	1%	6	4	23	16

7.71 In summary, therefore, a proposed development of 1,800 dwellings could lead to an additional 626 vehicles heading to Norwich from the study area in the AM peak. With a proposed development of 7,000 dwellings, this could increase to 2,436 vehicles.

Capacity considerations

7.72 Key constraints of the highway network include the route into Norwich along the A140. Traffic from the proposed study area heading to Norwich would have little choice other than to use either the

A140 or the B1113, which converge on a relatively small signalised T-junction to the north of the A47.

7.73 Furthermore, to the north of the B1113/A140 junction, the A140 is a relatively constrained single carriageway two-way road with road side access and numerous side roads. Significant widening may require land acquisition and the removal of a large number of mature trees along the road side, which would be likely to be met with strong opposition. The road also passes over the Norwich to Thetford railway line, and therefore this bridge structure would need widening at significant cost.

7.74 It has therefore been assumed that significant widening would be unacceptable. With this in mind, information is needed on what the existing, and potential future levels of traffic are along this route in order to provide an indication of available capacity. To answer this question with any level of certainty would require the use of a large scale traffic model, such as the NATS Saturn model.

7.75 The level of capacity can be very crudely derived from *'Traffic Capacity of Urban Roads'*, which was issued by the Highways Agency as part of the *Design Manual for Roads and Bridges* (DMRB) in February 1999. Following guidelines within this document, it is considered that the A140 north of the B1113 junction can be described as a 'UAP2' road, with more than 2 side roads per kilometre and some at grade pedestrian crossings. Assuming the road is on average 9m in width, based on aerial photography measurements, then the overall one-way hourly capacity of the road is 1,550 vehicles.

7.76 Information on potential existing and future traffic volumes has been obtained from the Junction Capacity Report for the A47 Southern Bypass Junctions, prepared by Mott MacDonald in November 2008. Traffic flows at the A140/A47 (Harford) Roundabout are quoted for a potential 2027 scenario, which includes traffic associated with Joint Core Strategy Option D. Traffic flows along the A140 immediately north of the Harford Roundabout are quoted as follows. These flows are applicable for the link south of the B1113 junction, and not for the link north of the B1113 junction which is of particular concern.

Table 16. Hourly Traffic Volumes on A140 north of Harford Roundabout – AM Peak

Traffic Volumes	A140 Northbound	A140 Southbound
2006	1168	884
2027 with JCS Option D	1193	1551
Potential flow from 1,800 dwellings	626	218
Potential flow from 7,000 dwellings	2436	849
Potential 2027 flow with 1,800 dwelling development	1,819	1,769
Potential 2027 flow with 1,800 dwelling development	3,629	2,400
Potential road capacity	1,550	1,550

7.77 Table 16indicates that in the northbound direction in the AM peak, the A140 would be operating at 117% capacity with a development of 1,800 dwellings. With a development of 7,000 houses, traffic levels would theoretically reach 234% of the capacity of the road.

Table 17. Hourly Traffic Volumes on A140 north of Harford Roundabout – PM Peak

Traffic Volumes	A140 Northbound	A140 Southbound
2006	745	1,013
2027 with JCS Option D	1,018	1,195
Potential flow from 1,800 dwellings	294	423
Potential flow from 7,000 dwellings	1,142	1,647
Potential 2027 flow with 1,800 dwelling development	1,312	1,618
Potential 2027 flow with 1,800 dwelling development	2,160	2,842
Potential road capacity	1,550	1,550

7.78 Table 17 indicates that in the southbound direction in the PM peak, the A140 would be operating at 104% capacity with a development of 1,800 dwellings. With a development of 7,000 houses, traffic levels would theoretically reach 183% of the capacity of the road.

Potential measures to suppress vehicle demand

7.79 There is a range of measures that can be implemented in order to alter travel behaviour. Table 18 presents a 'tool kit' of measures/strategies that may reduce demand to manageable measures.

Table 18. Measures which may help to reduce demand to manageable levels

Measure	1800 homes		7000 homes		Comments
	Need	Potential Cost/Complexity	Need	Potential Cost/ Complexity	
Mixed use development to maximise self-containment and improve viability of public transport services by generating two-way demands	Essential	Low	Essential	Low	With limited employment opportunities within the development area, there would be no option for many people but to continue to commute to Norwich. It is therefore considered essential in transport planning terms, even with a development of 1,800 dwellings, to provide employment opportunities locally to potentially reduce the need for people to travel. This also improves the potential viability of public transport services by creating demand in both directions.
Layout to encourage movement by walking, cycling and public transport	Essential	Low	Essential	Low	With both options, pedestrian, cycle and public transport routes should be at the heart of the layout design. Potential for bus only links should be explored, to provide advantages to public transport users over the car.
Bus priority along A140	Essential, especially on approach to junctions	High	Essential – likely to require full segregation	Very High	High quality public transport is considered essential even with a development of 1,800 houses. In order to maximise it's use, and given the likely congestion on the route to Norwich, segregation of buses from general traffic would be crucial. With 1,800 dwellings this might involve segregated bus lanes on approach to key constrained junctions to enable buses to bypass queuing traffic. With 7,000 dwellings, it is difficult to envisage that anything less than full bus segregation (Bus Rapid Transit) would be required, which would involve the complete reconstruction of the A140 and A146 all the way into Norwich Town Centre.
High frequency high quality bus service and high quality infrastructure/branding to city centre and key destinations	Essential	Low	Essential	Low	With both development scenarios, the bus service should be an attractive, easy to use 'turn up and go' service.
Expansion of park and ride with associated links to development	Potentially Desirable	Medium	Potentially Desirable	Medium	Although preferable for residents to use public transport for their entire journey, The Harford park and ride may provide alternatives in terms of route choice and service provision.
New rail station within	Desirable	Very High	Highly	Very High	A new rail station located within the development area may have potential

the proposed development			desirable		to provide significant relief to the highway network. Whilst this may not be a realistic option for 1,800 houses, for 7,000 dwellings it warrants serious consideration, as it could carry a significant proportion of the estimated 3,500 people that would need to commute into Norwich in the morning peak hour. Existing levels of service would need to be maintained, i.e. fast services to London from Norwich would need to remain unaffected. Potential problems include capacity issues on approach to and within Norwich Station. However, as this could be an alternative to providing a completely segregated bus route into Norwich, the costs of implementing a solution would need to be considered within the context of providing full bus segregation all the way into Norwich.
Major improvements to junctions of A47/A140, and junctions along A140 into Norwich	Significant improvement required	High	Major works required which may require significant third party land acquisition	Very High	A development of 1,800 dwellings, even with significant mode shift away from private car use, would still require significant and costly highway improvements to maintain highway network capacity. Two junctions which are likely to be key bottlenecks include the A47 / A140 junction, and the A140 / B1113 junction. Solutions at the level of 1,800 dwellings are likely to be significant but perhaps achievable, but at the level of 7,000 houses could be an order of magnitude greater especially when also considering the need to deliver bus priority through the junctions, and as such might necessitate the acquisition of large amounts of third party land.
Policy measures (e.g. parking charges/supply) to manage and reduce car trips to city centre	Desirable	Very High	Essential	Very High	One potential policy measure to suppress car use is to reduce the availability and increase the price of car parking throughout the centre of Norwich. Making parking difficult / costly at the point of destination is proven to have an effect on modal choice. Obviously this would need the full support of the local authorities, and would be politically very difficult.
High quality external cycle infrastructure to facilitate and support cycle trips to Norwich	Essential	Low	Essential	Low	The site is approximately 7.5km from the centre of Norwich, along relatively flat terrain, which may be beyond the range of most, but attractive, segregated cycle routes may encourage some people to cycle to Norwich.
Introduction of Car Club	Highly desirable	Low	Essential	Low	Car clubs a particular successful in London at encouraging low car ownership.
Car sharing promotion	Essential	Low	Essential	Low	Norfolk already has a car share database (Carshare Norfolk), which would need to be promoted amongst residents.
Travel Planning	Essential	Low	Essential	Low	Applying travel planning measures to existing villages is a method of

Measures not only to the proposed but also existing surrounding villages					reducing existing car trips on the network, which can create spare capacity.

Conclusions on transportation matters

7.80 Our assessment has concluded that, with a 1,800 dwelling development, there could be in the order of 900 people needing to travel from the proposed site to Norwich within the morning peak hour, and with the 7,000 dwelling development, this could increase to 3,500 people.

7.81 The capacity of the A140 to the north of the B1113 would be a key constraint on the size of any new development within the proposed study area, both in its role as a primary traffic route and a public transport corridor. The calculations contained within this report are crude and are based on very limited data, but they indicate that the road network could be significantly overloaded with a development of 1,800 dwellings, and could be completely overwhelmed with a development of 7,000 dwellings. A more detailed investigation of the potential deliverability of a significant new development to the south of Norwich would require the use of a large scale traffic model.

7.82 A toolkit of measures is included with measures/strategies which may have potential to reduce demand to manageable measures.

Existing settlements and facilities

7.83 The settlements in the vicinity of Mangreen are Swardeston, Mulbarton, Dunston, Swainsthorpe and East Carleton. Key statistics are set out in Table 19*.

Table 19. Existing Settlements – Key statistics

Settlement	Area (sq. km)	Population	Households
Swardeston	3.95	540	246
Mulbarton	5.34	2,827	1,131
Swainsthorpe	3.38	374	159
East Carleton	4.96	358	115

* Source: 2001 Census

7.84 Swardeston has developed as a street village along the B1113. There sis some small-scale estate development to the east of the B1113 beyond which the landscape is relatively open. To the west the Common gives the settlement a very rural character. It has a village hall and a food shop; there are no schools.

7.85 Mulbarton has developed around a triangle of roads that bounded The Common and this remains the village centre where local facilities are concentrated. Facilities include a primary school, a medical centre, village hall complex, a food shop, church

and public house. The rural character of the village has been maintained. The Common has a range of Listed buildings and is a conservation area.

7.86 Significant estate development has taken place to the south of the village and this has had a significant impact on the form and character of the settlement. Further significant development to the north and south would potentially create coalescence with Swardeston and Bracon Ash.

7.87 Swainsthorpe is a small rural community centred around its church with no real facilities.

8.0 ASSESSMENT CRITERIA

8.01 In this section of our report we consider the locational criteria that should be used to identify broad areas of search for potential locations for new settlements in the NPA. Although later stages of this report focus on the Mangreen area specifically, the intention is that these criteria should be capable of application across the NPA as a whole, hence the list of constraints used in the sieve map analysis refers to features that are known not be in the current study area.

Fundamental principles

8.02 We consider that the assessment process should be underpinned by three fundamental principles:

One:Creating a linked community – Complementarity and a clearly defined role in the hierarchy

8.03 A new settlement must be appropriately positioned in relation to other components of the settlement hierarchy. It must:

- be responsive to historical, morphological, topographical, geological and geographical considerations
- be well-connected in the network
- have the propensity to grow
- be located where people want to be
- add to the choices of opportunity and quality of life of other places in the network
- contribute to the vitality and viability of Norwich and other centres in the area
- well-connected to Norwich and defer to it for major services

Two: Embracing Sustainability Principles – climate change mitigation and adaptation from the start

8.04 The principles of sustainable development underpin the planning system. Government guidance increasingly emphasises the need to make different choices about the way we live and go about our business, and the government's commitment to securing demonstrable change. Sustainable development is also becoming increasingly embedded in other regulatory regimes. A new settlement provides the opportunity to:

- embed sustainability from the outset

- use the economies of scale offered by the development to embrace new technology and new practices that would otherwise prove to be impossible
- embed climate change mitigation and adaptation from the outset from the way in which the community is designed and planned to the way in which essential infrastructure and services are provided

Three: Empowering communities - incentivising and taking responsibility

8.05 In a regime where there is no external imposition of regional housing targets and where incentivisation plays a significant role in the decision-making process local communities need to be assured that the development will deliver tangible benefits that they themselves will enjoy. A new settlement must:

- demonstrate to existing communities why development, on this scale, is needed to support their own way of life and to provide for their families
- include in its preparation extensive engagement with existing communities so that they can be involved in the decision-making process and know that their views will be taken into account

Assessment criteria

8.06 Specific criteria are required to help assess the locational benefits and disbenefits of individual proposals. Our proposed criteria use, reflect or adapt national planning policy guidance, best practice guidance and research from case studies. The selection process is based on the identification of sustainable development objectives, formulating criteria against which a development might be tested and identifying the indicators that should be used in measuring the impact. This will assist in undertaking a consistent and transparent assessment of potential locations.

8.07 The framework for the assessment is provided by the four sustainability objectives of PPS1:

- social cohesion and inclusion
- protection and enhancement of the environment
- prudent use of natural resources
- sustainable economic development

8.08 We have identified a number of criteria against which these sustainability objectives might be tested. The criteria may be used to assess the impact of development in proposed locations, cover a wide range of considerations, and are drawn from the key information sources.

Table 20. Assessment criteria

Social Cohesion and inclusion		
S1	The new settlement should be of an appropriate scale to create a mixed community for all ages and incomes by providing a range of housing types, sizes and tenures suitable for all types of occupier, at all stages of their lives, from single people, couples and families to the independent elderly and those needing assisted care.	Dwelling size and mix, tenure, density
S2	The new settlement should support a mix of uses including at least one secondary school, local shops and services, health facilities, community meeting places and public transport. Higher order goods and services such as commercial offices should be easily accessible by means other than the private car and major employment uses should be provided only where this can be shown not to have an adverse impact on Norwich as the regional centre.	Accessibility to existing or proposed facilities – list the various elements
S3	The new settlement should promote healthy lifestyles with excellent provision of, or facilitated access to, open space, sports, leisure and recreation facilities.	Accessibility to play areas, formal recreation and leisure facilities, sports facilities, etc
S4	Where the new settlement expands, adjoins or otherwise impacts on existing communities the new settlement should have the potential to provide for the needs of the wider community to ensure that the development proposal has a positive impact on the existing community and protects its interests.	The nature and form of existing services and facilities within other settlements
Protection and enhancement of the environment		

E1	The new location should minimise the impact on the character and heritage of the area.	Knowledge and understanding of the existing settlement pattern plus any formal or statutory designations
E2	**PPS1 Sustainable Development Objectives**	**Criterion**
E3	The new settlement must be designed to support public transport and have the potential to deliver good transport links. It should also be located where it can, and be of a scale to, minimise car journeys and maximise public transport use.	Accessibility and frequency of public transport (buses and trains - existing and proposed) Availability of cycleways and footpaths (existing and proposed) Accessibility to the strategic road network (including impact of planned highway schemes)
E4	The appropriate location should provide for the protection and enhancement of the environment so as to benefit the landscape and wildlife, to improve recreation and access, and to provide an attractive setting for development~~,~~ which should have a minimal ~~the~~ impact on agriculture and the landscape.	Proximity to sensitive sites. Potential for new wildlife habitats to be established, creating an ecological network linking the settlement with the surrounding areas. Presence of damaged and despoiled land that could be enhanced.
E5	The proposed development should not be located close to sources of pollution or other installations raising health and safety considerations	Proximity to sources of pollution e.g. landfill, ground contamination, noise, dust, odour, overhead electricity cables, airport

		safeguarding, etc.
Prudent use of natural resources		
NR1	The location should minimise the take up of productive agricultural land.	Agricultural land quality and quantity - land removed from agricultural use.
NR2	Where there are known mineral reserves the phasing of development should allow the extraction of such reserves and the provisions for restoration should be such as to enhance the nature conservation, biodiversity and landscape quality of the area.	Proximity to known mineral reserves and proposals for the phasing of development
NR3	The appropriate location should seek to minimise the amount of water that is used within the development and maximise the potential for water neutrality and reduced infrastructure costs.	Availability of water resources.
NR4	The appropriate location should adopt the highest standards and maximise the potential for renewable energy production.	Potential of the site to produce renewable energy
NR5	The location should maximise the use of existing infrastructure and minimise new infrastructure costs.	The need for additional infrastructure e.g. roads, utilities, etc.
Sustainable economic development		
EC1	The rate of development should not prejudice satisfactory progress, in other parts of Greater Norwich, on the development of housing on regeneration, brownfield or other strategic sites.	Monitoring of the take-up of brownfield and other land within the urban area relative to development in the new settlement
EC2	The scale of employment use should be	Major employment areas

	compatible with the role of the settlement within the hierarchy and the locations of other strategic economic development; generally, all development should enhance the status of Norwich as the principal city in the hierarchy.	should be promoted only in the largest settlements
EC3	The potential for digital connectivity should be embedded in the new settlement from the outset to reduce the need to travel, particularly by car, and to maximise accessibility to facilities and services	Potential for inclusion of enhanced communication technologies
EC4	The new settlement should have the propensity to assist further economic development within the Norwich area and to attract new local employment opportunities.	Proximity to catalysts for further growth and related business activity
EC5	The location should be able to promote sustainable growth in locations close to, or with easy access to by public transport, major centres of employment	Distance from such centres and accessibility by non-car modes of transport

9.0 ASSESSMENT OF POTENTIAL LOCATIONS

9.01 We conclude the process by assessing the three potential development locations against the criteria. The results are shown in Table 21.

9.02 A traffic light system has again been used to indicate whether the results are:

a) largely positive or where issues are capable of being readily resolved (green)
b) require further investigation (the results of which cannot be determined at this stage) (orange);
c) or where it appears that there are substantial impacts that cannot be ameliorated at this stage (red)

Table 21. Assessment of potential locations

PPS1 Sustainable Development Objectives	Criteria	Option 1: 1,800 dwellings Expansion of Swardeston and Mulbarton	Option 2: 7,000 dwellings New market town to south and east of Swardeston	Option 3: 7,000 dwellings in dispersed pattern around Swardeston, Swainsthorpe and Mulbarton plus a new village
Social Cohesion and inclusion				
S1	The new settlement should be of an appropriate scale to create a mixed community for all ages and incomes by providing a range of housing types, sizes and tenures suitable for all types of occupier, at all stages of their lives, from single people, couples and families to the independent elderly	The scale of development in each location is sufficient to allow for an appropriate mix of dwelling size, tenure and density. The illustrative master plans assume an average density across the development areas of 30-35 dph but this is expected to vary within development parcels in recognition of affordable housing and property market requirements.	The scale of development in each location is sufficient to allow for an appropriate mix of dwelling size, tenure and density. The illustrative master plans assume an average density across the development areas of 30-35 dph but this is expected to vary within development parcels in recognition of affordable housing and property market requirements.	The scale of development in each location is sufficient to allow for an appropriate mix of dwelling size, tenure and density. The illustrative master plans assume an average density across the development areas of 30-35 dph but this is expected to vary within development parcels in recognition of affordable housing and property market requirements.

	and those needing assisted care.			
S2	The new settlement should support a mix of uses including at least one secondary school, local shops and services, health facilities, community meeting places and public transport; higher order goods and services such as commercial office should be easily accessible by means other than the private car and major employment uses should be provided only where this can be shown not to have an adverse impact on	The scale of new development is insufficient to support a new secondary school. It would provide for one new primary school in Swardeston and would allow for the expansion of Mulbarton primary school. Secondary education facilities would need to be accommodated elsewhere. A new local centre would be provided at Swardeston and new development at Mulbarton would support and encourage additional provision at Mulbarton. Health and other community facilities could be accommodated within the local centres.	The scale of development is sufficient to support a new secondary school in the centre of the new settlement together with the necessary primary school provision in other locations. A new town centre and additional local centres would be provide a full range of local shops and services, community meeting places, etc. Health and other community facilities could be accommodated within these centres. The scale of development would necessitate and justify improvements to public transport and thereby facilitate access by non-car modes.	The scale of development is sufficient to support a new secondary school although the location of this would be problematical given the proposed settlement pattern. A dispersed settlement pattern would require some children to cross the A140 to go to school, contrary to NCC's stated policy. A new town centre to the west of the A140 would be provided together with additional local centres to provide a full range of local shops and services, community meeting places, etc. Accessibility, however, is restricted due to the dispersed nature of the settlement. The scale of development would necessitate and justify

	Norwich as the regional centre.	Limited support for additional public transport improvement would be available. Limited additional employment would be created largely in the form of local support services for the new community. Public transport is limited so it is likely that access to higher order goods and services would be by private car.	No additional employment provision has been shown on the illustrative master plan but the scale of development is such as to justify local employment opportunities to reduce the number of trips out of the development.	improvements to public transport and thereby facilitate access by non-car modes. No additional employment provision has been shown on the illustrative master plan but the scale of development is such as to justify local employment opportunities to reduce the number of trips out of the development.
S3	The new settlement should promote healthy lifestyles with excellent provision of, or facilitated access to, open space, sports, leisure and recreation facilities.	Informal open space, and formal play areas and playing fields can be accommodated in the development in line with standards. Access to higher order facilities would be limited with many	Informal open space, and formal play areas and playing fields can be accommodated in the development in line with standards. Some higher order facilities could be accommodated given the scale of development.	Informal open space, and formal play areas and playing fields can be accommodated in the development in line with standards. Some higher order facilities could be accommodated given the scale of development but access

		residents having to travel to Norwich for such facilities.		would be restricted given that the A140 bisects the community.
S4	Where the new settlement expands, adjoins or otherwise impacts on existing communities the new settlement should have the potential to provide for the needs of the wider community to ensure that the development proposal has a positive impact on the existing community and protects its interests.	Expansion of Swardeston would significantly increase the facilities available in the village and development areas could be designed to minimise adverse impact on the existing villages. Existing residents might prefer the status quo.	Expansion of Swardeston would significantly increase the facilities available in the village and the new town centre would provide a higher order range of goods and services reducing trips to Norwich. Residents of Mulbarton would not be immediately affected by new development, and would have access to higher order facilities and services but might nevertheless prefer the status quo.	The scale of development would allow a significant increase in the range of facilities and services available. The dispersed settlement pattern however would create more trips across the A140.
Protection and enhancement of the environment				
E1	The new location should minimise the impact on the character and heritage of the area.	The proposed development would have significant impacts on Swardeston and Mulbarton but the limited scale of development would	The proposed development would have a significant impact on the areas of historic landscape value and would introduce a new market town	The proposed development would reflect the settlement pattern of the historic landscape but would have significant impacts at the local level and on

		minimise impact on other constraints particularly the areas of historic landscape value.	into an area that has historically been characterised by small villages and hamlets.	several existing settlements.
E2	Surface water management should be an integral part of the development and the location should minimise the risk from flooding	There are no issues regarding flood risk and the design of the settlement can encompass sustainable urban drainage systems.	There are no issues regarding flood risk and the design of the settlement can encompass sustainable urban drainage systems.	There are no issues regarding flood risk and the design of the settlement can encompass sustainable urban drainage systems.
E3	The new settlement must be designed to support public transport and have the potential to deliver good transport links. It should also be located where it can, and be of a scale to, minimise car journeys and maximise public transport use..	The new development would be limited in scale and therefore its potential to improve public transport systems is limited. There would be some reductions in journeys through use of the new local centres but this is likely to be outweighed by residents travelling further afield for employment.	The new development would be of sufficient scale to provide for improvements to public transport but there are significant localised accessibility issues (e.g. crossing the Norwich-London railway line and potential 'rat-running' through existing villages) that are difficult and/or expensive to resolve.	The new development would be of sufficient scale to provide for improvements to public transport but there remain significant localised issues in relation to accessibility (e.g. crossing the Norwich-London railway line, 'rat-running' through existing villages and right-turning on to the A140) that are difficult and/or expensive to resolve.

E4	The appropriate location should provide for the protection and enhancement of the environment so as to benefit the landscape and wildlife, to improve recreation and access, and to provide an attractive setting for development; which should have a minimal impact on agriculture and the landscape	There are no designations of national, international or County level importance that are affected by the proposed development nor is there any impact on agricultural land of Grade 1 or Grade 2 quality. The proposal avoids the Southern Bypass Landscape Protection Zone. There will be impacts on long range views and environmental quality but given the limited scale of the development it is likely that this can be managed within the detailed design process.	There are no designations of national, international or County level importance that are affected by the proposed development nor is there any impact on agricultural land of Grade 1 or Grade 2 quality. The proposal avoids the Southern Bypass Landscape Protection Zone. Given the scale of the development it is likely that there will be adverse impacts on landscape generally that can be reduced but not removed. The impact however will be created only on land to the west of the A140.	There are no designations of national, international or County level importance that are affected by the proposed development nor is there any impact on agricultural land of Grade 1 or Grade 2 quality. The proposal avoids the Southern Bypass Landscape Protection Zone. Given the scale of the development it is likely that there will be adverse impacts on landscape generally that can be reduced but not removed. Given that the development will be located on both sides of the A140 and will include development within Swainsthorpe it is likely that there will be significant adverse impacts on the landscape that cannot be moderated.
E5	The proposed	There are no known	There are no known sources of	There are no known sources of

	development should not be located close to sources of pollution	sources of pollution close to or within the development area although the pylons, transformer station and overhead cables will have a significant adverse impact in visual terms.	pollution close to or within the development area although the pylons, transformer station and overhead cables will have a significant adverse impact in visual terms.	pollution close to or within the development area although the pylons, transformer station and overhead cables will have a significant adverse impact in visual terms.
Prudent use of natural resources				
NR1	The location should minimise the take up of productive agricultural land.	The development would take place on agricultural land but this is not of the highest quality.	The development would take place on agricultural land but this is not of the highest quality.	The development would take place on agricultural land but this is not of the highest quality.
NR2	Where there are known mineral reserves the phasing of development should allow the extraction of such reserves and the provisions for restoration should be such as to enhance the nature conservation,	There are known mineral reserves to the east of the development area. This will affect the phasing of the development. Once completed the restoration conditions will enhance the nature conservation, biodiversity and landscape quality of the area.	There are known mineral reserves to the east of the development area. This will affect the phasing of the development. Once completed the restoration conditions will enhance the nature conservation, biodiversity and landscape quality of the area.	There are known mineral reserves to the east of the development area. This will affect the phasing of the development. Once completed the restoration conditions will enhance the nature conservation, biodiversity and landscape quality of the area.

	biodiversity and landscape quality of the area.			
NR3	The appropriate location should seek to minimise the amount of water that is used within the development and maximise the potential for water neutrality and reduced infrastructure costs.	The development area lies in an area of water scarcity. It will be necessary to minimise the amount of water that is needed by the development by applying sustainable water use principles.	The development area lies in an area of water scarcity. It will be necessary to minimise the amount of water that is needed by the development by applying sustainable water use principles	The development area lies in an area of water scarcity. It will be necessary to minimise the amount of water that is needed by the development by applying sustainable water use principles
NR4	The appropriate location should adopt the highest standards and maximise the potential for renewable energy production.	There are no known problems in terms of energy supply and the scale of development is such that renewable energy technologies can be incorporated at the detailed design stage.	There are no known problems in terms of energy supply and the scale of development is such that renewable energy technologies can be incorporated at the detailed design stage	There are no known problems in terms of energy supply and the scale of development is such that renewable energy technologies can be incorporated at the detailed design stage
NR5	The location should maximise the use of existing infrastructure	The proposed development is modest in scale and will be able to use existing	The proposed development is likely to require significant upgrades of existing	The proposed development is likely to require significant upgrades of existing

	and minimise new infrastructure costs.	infrastructure. In the event that new infrastructure is required, however, this will be more expensive to provide on a pro rata basis than for a larger settlement.	infrastructure.	infrastructure.
Sustainable economic development				
EC1	The rate of development should not prejudice satisfactory progress, in other parts of Greater Norwich, on the development of housing on regeneration, brownfield or other strategic sites.	The scale of development is relatively modest and will offer a range of complementary development locations to those that are available within Norwich.	The scale of development is significant given the range of other development opportunities within Norwich. It is likely to be a competitor against the Rackheath/Thorpe St Andrew urban extension/eco-town so it will be necessary that the restrictions on both sites secure a 'level playing field' in terms of development costs in the absence of which there would be prejudice.	The proposed development, by creating a number of development opportunity sites, is likely to be attractive to the property market. It is likely to be a competitor against the Rackheath/Thorpe St Andrew urban extension/eco-town so it will be necessary that the restrictions on both sites secure a 'level playing field' in terms of development costs in the absence of which there would be prejudice.
EC2	The scale of employment use should	Employment opportunities within the development	The new settlement is of a scale whereby new employment	The proposed development is of a scale whereby new

	be compatible with the role of the settlement within the hierarchy and the locations of other strategic economic development; generally, all development should enhance the status of Norwich as the principal city in the hierarchy.	would be limited to that which is required to service the development. There would be no prejudice to Norwich as the principal city in the hierarchy.	development could be accommodated within it. This would assist in meeting principles of sustainable development by providing employment opportunities close to home. Whilst this would compete with other employment locations within the city, it can be managed so that it performs a complementary function to that of Norwich.	employment development could be accommodated within it. This would assist in meeting principles of sustainable development but, given its prominent location, the scale would need to be controlled to avoid potential conflict with other employment locations around Norwich.
EC3	The potential for digital connectivity should be embedded in the new settlement from the outset to reduce the need to travel, particularly by car, and to maximise accessibility to facilities and services	There are no problems in principle with connectivity but costs would be reduced with a larger scale of development.	The scale of development is such that digital connectivity could be delivered as part of the development.	The scale of development is such that digital connectivity could be delivered as part of the development
EC4	The new settlement	The scale of development is	The scale of development is	The scale of development is

	should have the propensity to assist further economic development within the Norwich area and to attract new local employment opportunities.	too small to allow much more than limited employment in services and facilities generated by the development itself but the population generated will support other activities in Norwich.	sufficient to support employment development and the population generated will support other activities in Norwich.	sufficient to support employment development and the population generated will support other activities in Norwich.
EC5	The location should be able to promote sustainable growth in locations close to, or with easy access to by public transport, major centres of employment	The proposed development is in a rural area with limited public transport facilities. The scale of development is such that it will be impossible to deliver significant improvements to the public transport system.	The proposed development is in a rural area but is of sufficient critical mass to effect public transport improvements. It is likely however that these would be limited to bus service frequencies as the nature of the existing road system render further improvements highly problematical.	The proposed development is in a rural area but the dispersed pattern of settlement is such that effective improvements to public transport will be difficult to share widely across the whole of the development area. It is also likely that these improvements would be limited to bus service frequencies as the nature of the existing road system render further improvements highly problematical.

10.0 CONCLUSIONS

10.01 The purpose of this study has been to prepare a set of locational criteria for the assessment of potential new settlement locations and to assess the specific potential of the area around Mangreen. Our literature confirms that new settlements are an appropriate solution to providing for strategic growth and development which helps to alleviate pressures on existing towns and cities. Forming part of a palette of solutions that offers development within the urban area, strategic urban expansion, development within market towns and in rural areas with a good service base, they complement the other choices for strategic growth that are available.

10.02 Our review of best practice in setting criteria and thresholds suggests that:

a) locational criteria can be helpful in identifying broad areas of search for potential new settlement locations;

b) additional criteria should be defined to assess the nature and form of the settlement and its response to social, economic and environmental considerations; and

c) thresholds are likely to be highly variable, depending upon location and economic factors but nevertheless the provision of appropriate education facilities is an essential pre-requisite.

10.03 In most cases the essential building block for a new community will be the primary school (suggesting some 1,500-2,500 dwellings depending on the particular requirements of the local education authority) but there are current trends which suggest that a larger settlement, which allows for the provision of a secondary school (around 7,500 dwellings) is preferable. This will facilitate a greater degree of self-containment and a stronger sense of community within the settlement.

10.04 Sieve mapping analysis has suggested that there are virtually no 'primary constraints' affecting the Mangreen area, just very localised areas of flood risk to the west of Swardeston.

10.05 Rather more of the Mangreen area is affected by 'secondary constraints' with only the immediate environs of the villages of Swardeston and Mulbarton being unaffected by statutory or policy designations. These tend to be policy designations, however, which we have defined as being 'flexible' in terms of their constraint on development.

10.06 More significant constraints, however, are the pylons and overhead cables which together with the existing and proposed minerals sites have a significant impact in the northern and eastern part of the study area. A further feature, of great significance, is the Norwich-London railway which extends along the eastern part of the study area and has the effect of restricting access to the A140 in all areas other than the most northerly part of the study area.

10.07 We consider that these characteristics and their attendant complications significantly restrict the potential of Mangreen to accommodate a new settlement. Using education provision as the essential building block of a new community we therefore sought to test the impact of three development scenarios:

a) modest expansion of existing villages, akin to organic growth, which would provide a minimum level of development (1,800 dwellings and a primary school) and fit more neatly with the historic settlement pattern;

b) development on a scale to support a secondary school (7,000+ dwellings) focused in one location; and

c) a similar scale of development, with a more dispersed settlement pattern (to try to over come the limitations of access and to respond better to the historic landscape).

10.08 Option 1 provides for a modest development of around 1,800 dwellings in total, some 1,100 in Swardeston and the remaining 700 in Mulbarton. In practice, however, this option does not provide for a 'new settlement' as such: the proposed 700 dwellings at Mangreen would function as an expansion of the existing village and although it would provide for a new local centre it would utilise existing social, community and education facilities within the local area. In the case of Swardeston, the proposed 1,100 dwellings would considerably exceed the size of the existing village (by a factor of 3-4) but it would provide a local centre and a new primary school.

10.09 Option 2 assumes that the new settlement needs to be sufficiently large to accommodate a new secondary school and therefore takes as its minimum size some 7,000 dwellings. Option 2 presents a genuinely 'new' settlement, occupying the space between Swardeston and Mulbarton, to the west of the existing and proposed mineral sites and the Norwich-London railway line. The development would extend from the eastern side of Swardeston southwards and eastwards, leaving a buffer between the new development and Mulbarton. The new settlement would be of such a scale that a significant new centre would be established and a genuinely new, small market town would be created.

10.10 Option 3 similarly proposes a new settlement of some 7,000 dwellings but seeks to accommodate the development in a manner that is more respectful of the existing settlement hierarchy. It therefore proposes a series of connected villages, either new or expanded, on both sides of the A140. This also helps to reduce the problem of accessibility to the A140 but does not eradicate it. Problems remain further north.

10.11 Our technical studies on physical infrastructure concluded that there would be no problems in connecting to water supply, wastewater treatment and foul drainage, flood risk and surface water drainage, energy or waste collection/disposal although there may be a need for upgrades particularly in the case of the larger development proposals.

10.12 There would, however, be significant constraints in terms of access and transportation sufficient to raise serious concerns about the desirability of pursuing development on the scale proposed in this general location. Key constraints on the highway network include:

a) the route into Norwich along the A140 - traffic from the proposed study area heading to Norwich would have little choice other than to use either the A140 or the B1113, which converge on a relatively small signalised T-junction to the north of the A47;

b) to the north of the B1113/A140 junction, the A140 is a relatively constrained single carriageway two-way road with road side access and numerous side roads. Significant widening may require land acquisition and the removal of a large number of mature trees along the road side, which would be likely to be met with strong opposition. The road also passes over the Norwich to Thetford railway line, and therefore this bridge structure would need widening at significant cost.

c) The capacity of the A140 to the north of the B1113 would be a key constraint on the size of any new development within the proposed study area, both in its role as a primary traffic route and a public transport corridor. The calculations contained within this report are crude and are based on very limited data, but they indicate that the road network could be significantly overloaded with a development of 1,800 dwellings, and could be completely overwhelmed with a development of 7,000 dwellings.

10.13 The final stage of the study was to identify locational criteria that could be used to assess new settlement proposals and to apply these to the three illustrative master plans prepared to articulate the three development scenarios. It was decided not to

apply a crude weighting system to these criteria as the criteria were not of equal weigh. Instead, a simple 'traffic signal' colouring system was used to highlight where particular impacts would be created. Further work would then be necessary to consider how any adverse impacts might be mitigated in the detailed design.

10.14 Given that the master planning process was designed to test three very different scenarios it is not possible to recommend one over the other; each raises very different issues and poses different questions which require local input. It is reasonable to say, however, that each would merit further assessment but only on the basis that significant transportation impacts could be overcome. It is also desirable that a final decision on whether to pursue a new settlement in this general location would not be made until a wider assessment of alternative locations around Norwich had been undertaken.

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