City of York Council

Renewable Energy Study

Final Report

AMEC Environment & Infrastructure UK Limited

September 2014

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City of York Council

Renewable Energy Study

Final Report

AMEC Environment & Infrastructure UK Limited

September 2014

Report for

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Executive Summary

Purpose of this Report

This report has been produced for the purpose of providing an evidence base for City of York Council regarding the potential renewable energy generation options available within the City. It builds on a previous study carried out in 2010 by AEA, reviewing the findings of this work and expanding upon the range of technologies considered.

It forms part of the overall evidence base supporting the Local Plan for York, a draft version of which was published in June 2013 (Preferred Options). The Local Plan is a citywide plan which will help shape future development in York up to 2030 and include policies for renewable energy and climate change.

AMEC's report can be used in the following way:

- To set renewable energy and climate change policies in the emerging Local Plan;
- To establish York's baseline performance in terms of energy demands and take-up of renewable energy against which the effectiveness of future policies can be measured;
- To identify key sites and areas with most potential for renewable and low carbon energy generation (be it, for example, a solar farm, wind farm or heating network);
- To help support potential site allocations for renewable and low carbon energy; and
- To help developers of the Local Plan's strategic site allocations understand what technologies are most likely to be feasible when they come to prepare energy strategies in response to national and local policy requirements.

Baseline Energy Demand

National figures for York show that electricity consumption reached 810 Gigawatt hours (GWh – see Glossary for definition of units used in this study) in 2011, while natural gas demand reached 1,764 GWh. This is equivalent to some 726,000 tonnes of CO_2 per year (tCO_{2e}/yr) as set out in Table 1. In both cases the general trend in York is a reducing demand for energy, particularly in the case of natural gas. Average domestic consumption of electricity per household is below the UK national average, while average domestic gas consumption is above the national average.

Table 1 Baseline Energy Demand for City of York (2011)

Energy Source	Annual Consumption (GWh/yr)	Annual Carbon Emissions (tCO_{2e}/yr)
Electricity	810	366,000
Natural Gas	1,764	360,180
Total	2,574	726,180

Source: DECC Figures, interpreted by AMEC

Existing Renewable Energy Generation

There are a number of renewable energy schemes already in place across York, including solar photovoltaic (PV – see Glossary for definition of renewable energy technologies) installed at the Council's own West Offices and Hazel Court Eco Depot. There has been considerable uptake of solar PV supported by the Feed-in tariff (FiT) with over 1,500 installations across the City. Uptake of technologies eligible for the renewable heat incentive (RHI) has been very limited to date.

The extent of district heating is also limited at present. The largest scheme is operated by the University of York on its main campus, using a combination of combined heat and power (CHP) and biomass. A scheme supplying heating only has been installed within a 540 dwelling development at Derwenthorpe.

► **Renewable energy generation capacity presently in City of York makes a limited contribution to overall energy supply. Existing renewable energy generation capacity within City of York is estimated to generate around 40.5 GWh/yr or 1.6% of total existing energy demand.**

A number of strategic sites have been identified in the Local Plan to provide new residential-led mixed use development, including new employment and community facilities. Based on the level of development that these sites could accommodate, it is estimated that the new homes and jobs could result in an increase of 10% in overall energy related carbon emissions. This however assumes that all proposals are taken forward and built to existing building regulations, but it is clear that these standards are being progressively tightened by government in the move to make new housing more energy efficient. Increasing tightening of building regulations requires new buildings to be very energy efficient and include increasing amounts of on-site energy generation. From 2016 onwards new domestic buildings will be very low/zero carbon buildings; this will also be true of non-domestic buildings from 2019 onwards.

- **New development on strategic sites could increase York's energy demand and emissions by up to 10%, however the impacts are likely to be lessened as national building regulations progressively tighten to ensure greater energy efficiency and a move to low/zero carbon buildings.**

It is clear that new development will not have a significant impact on York's energy demand and emissions so one of the key considerations will be how the 726,000 tonnes of CO_2 associated with York's existing demand for heat and power can be reduced. Whilst national changes to energy policy will help in this regard (e.g. decarbonisation of the National Electricity Grid and shift to renewables) there may also be local measures that the Council could help support or implement, explored in more detail in AMEC's policy recommendations.

- **The Council should consider what actions it can take to reduce the energy demand and related emissions from existing homes and business in York against a 2011 baseline of 726,000 tonnes CO_2 per annum.**

Renewable Energy Potential

As part of our work we investigated what level of renewable energy could be realised in York, based on the findings from the 2010 study. Table 2 highlights the technologies investigated and their potential energy generation capacity, with Figure 1 summarising areas where specific technology options were explored. Further details are provided in the main body of this report.

If the full potential from all of these technologies could be exploited, then some 230,000 tonnes of CO_2 per year could be offset, equivalent to one third of the City's annual emissions from a 2011 baseline. Solar PV provides by far the biggest opportunity to supply renewable energy and reduce emissions, followed by district heating and wind turbines. Of course, the figures in Table 2 are indicative, and based on a number of assumptions, but they demonstrate a helpful order of magnitude as to what could potentially be achieved.

Table 2 Estimated Potential Deployment by Technology

Technology	Potential Capacity (MW)	Electricity Generation (MWh/yr)	Heat Generation (MWh/yr)	Abatement Potential* (tCO_{2e}/yr)
Wind	24	42,000	NA	20,300
Solar PV	341	297,000	NA	143,500
Hydro	1.4	5,970	NA	2,900
Solar Thermal	1.0	NA	480	100
Biomass - Wood Fuel	NA	NA	91,425	16,800
Biomass - Food Waste	NA	800	NA	400
Biomass - Energy Crops	NA	NA	70,000	12,900
District Heating	14	35,000	85,000	32,600
Heat Pumps	3.8	NA	6,050	1,100
Micro-CHP	< 0.05	-	-	-
Geothermal	-	-	-	-
Total	385	380,770	252,955	230,600

*Abatement potential means what level of CO_{2e} could be offset through the use of the different technologies, (rounded to 2 significant figures)

Source: AMEC

► **Renewable and low carbon energy technologies could potentially help reduce York's existing CO_2 emissions by up to one third, depending on take-up of projects, developer interest and site-specific constraints.**

Encouraging Renewable Energy Generation through Planning

The potential contribution of renewable and low carbon energy generation to reducing York-wide CO_2 emissions is significant, so we need to consider the role of planning policies in helping to realise this potential. In doing so, we have identified three core policy areas for the emerging City of York Local Plan, linked to the evidence base provided in this study:

A. Providing a policy which actively encourages renewable energy projects, as a positive 'hook' for energy developers and businesses to respond to. The policy would make clear that any proposals for renewable energy schemes would be supported, which would be an important material consideration in the

determination of planning applications. Of course, qualifications could be provided to the policy to ensure that community and environmental effects are properly understood and, where necessary, mitigated by the developer.

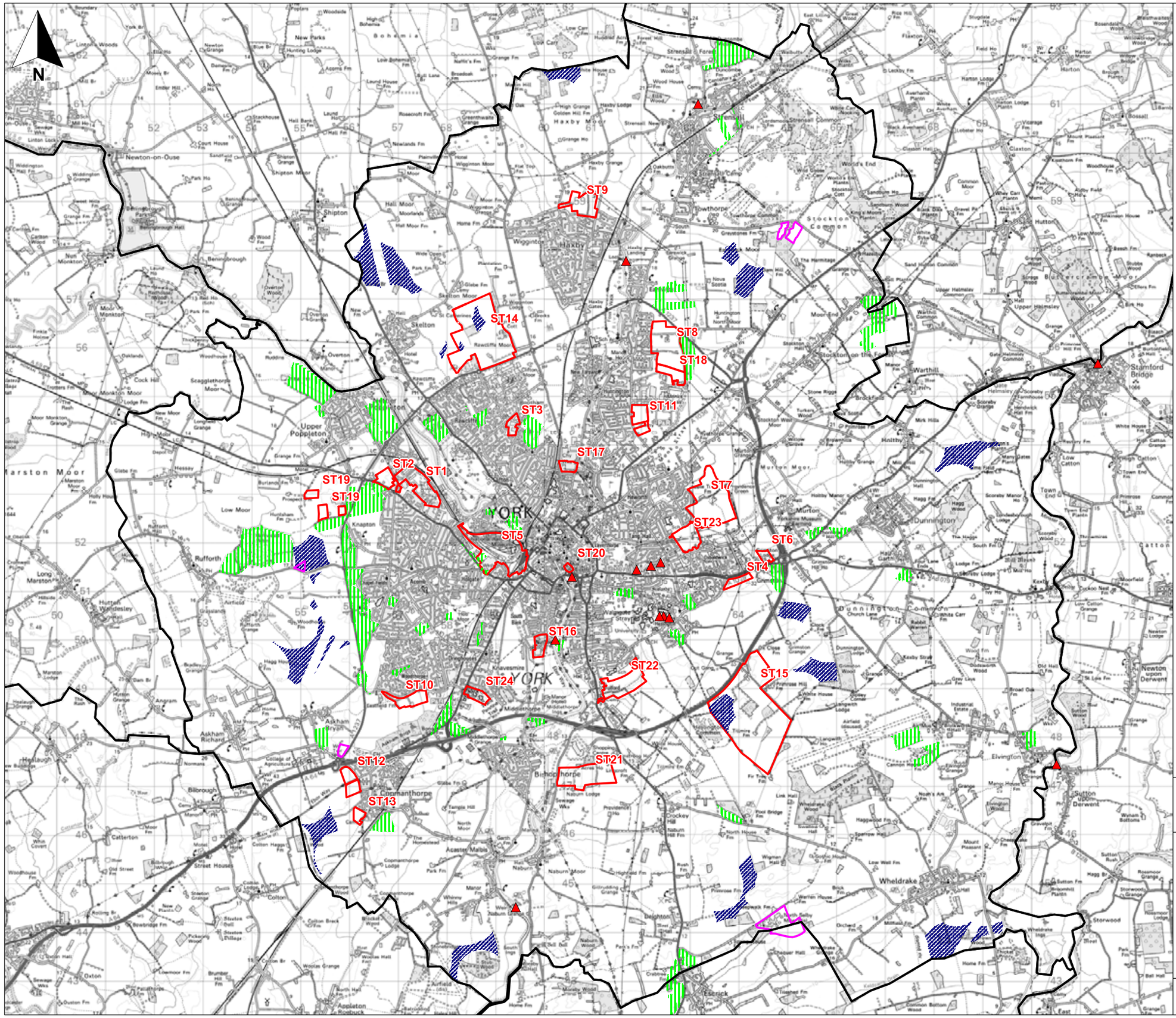
B. Providing a policy which specifically allocates sites for renewable or low carbon energy generation (e.g. a solar park) where there is landowner/developer interest to do so and where there are no other planning or environmental constraints to this type of use coming forward. Particular sites identified in this study include Knapton Moor and Land to NW of Hermitage where the landowners have expressed an interest in pursuing solar schemes.

   In addition, the Council asked AMEC to assess the potential of a wide-range of other sites proposed for residential or commercial development via the plan-making process (otherwise deemed unsuitable/not required for such uses at this stage) to assess their renewable and low carbon energy potential. The developers of these sites may want to consider the findings of this study and their appetite to progress a renewable or low carbon energy scheme. Whilst the evidence does not predetermine planning decisions (any site would still need to be assessed against planning, environmental constraints and community impacts) it is a helpful starting point for a landowner considering the future use of their land if residential or commercial development is unlikely to come forward in the short term.

C. Provides a policy which encourages or requires developers of strategic sites (e.g. residential, commercial and employment) to both reduce energy demand, CO_2 emissions and make use of renewable and low carbon energy technologies.

This study provides a technical evidence base to develop such policies, with the main body of the report providing cost information which will be crucial to understanding the viability of setting such policies. The Council is undertaking a separate piece of work on plan-wide viability which this evidence will help to support.

► **The City of York Local Plan will have a key role to play in supporting the delivery of renewable and low carbon energy schemes, ensuring energy efficiency and reducing CO_2 emissions. AMEC's study provides the evidence to support the development of new planning policies.**



Key

- Council boundary
- Strategic development area
- Potential Allocated Sites
- Areas of wind development potential
- Areas of solar development potential
- Areas of Hydro-power development potential

Strategic Sites

ST 1 - British Sugar
ST 2 - Former Civil Service Sports Ground, Millfield Lane
ST 3 - The Grainstores, Water Lane
ST 4 - Land adjacent Hull Road and Grimon Bar
ST 5 - York Central
ST 6 - Land East of Grimston bar
ST 7 - Land East of Metcalf Lane
ST 8 - Land North of Monks Cross
ST 9 - Land North of Haxby
ST 10 - Land at Moor Lane, Woodthorpe
ST 11 - Land at New Lane, Huntington
ST 12 - Land at Manor Heath Road, Copmanthorpe
ST 13 - Land at Moor Lane, Copmanthorpe
ST 14 - Land North of Clifton Moor
ST 15 - Whinthorpe
ST 16 - Terry's
ST 17 - Nestle South
ST 18 - Monks Cross
ST 19 - North Minster Business Park
ST 20 - Castle Piccadilly
ST 21 - Naburn Designer Outlet
ST 22 - Germany Beck
ST 23 - Derwenthorpe
ST 24 - York College

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CITY OF YORK COUNCIL

City of York Council
Renewable and Low Carbon Energy Generation Options Update

Figure 1

York Renewable Development Areas of Search

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Contents

1. Introduction

1.1 Purpose of the Study

City of York Council appointed AMEC to review how planning policies in the emerging Local Plan can ensure energy efficiency, reduce CO_2 emissions and help support the deployment of renewable and low carbon energy projects. The study provides key evidence for the Council to draft planning policies and, crucially, understand the feasibility and viability implications of adopting such policies in the plan. The National Planning Policy Framework (NPPF) is clear that in order to be considered 'sound' local plan policies need to be justified based on evidence, viable and deliverable.

The work builds on the findings of a previous renewable energy study undertaken in 2010[1]. The Study sits within a context of the Council's wider commitments in responding to climate change, including its Climate Change Framework and Action Plan for York, which commits the City to a 40% reduction in CO_2 emissions by 2020 and an 80% reduction by 2050.

1.2 Context for the Study: Role of the Local Plan

City of York Council published a draft Local Plan document in June 2013 (Preferred Options)[2] setting a framework for future development in the City through to 2030 and beyond. Preparation of this plan is on-going, with the Council currently consulting on potential sites for residential and mixed-use development. It is expected that the plan will be submitted to the Secretary of State for examination by the end of 2014, with examination and plan adoption in 2015.

The Local Plan will have a key role to play in the Council's response to climate change, both ensuring the City's communities are resilient to the impacts that are already faced and helping to mitigate future climate change by reducing CO_2 emissions alongside the Council's commitments via its Climate Change Framework and Action Plan. The NPPF is clear regarding the need to respond to climate change through local plans, including key guidance in relation to managing flood risk, ensuring sustainable transport (reducing reliance on the car), supporting renewable energy and delivering low carbon developments.

Within the scope of this study, we are looking to support the development of policies for renewable energy and low carbon developments. The Council will be considering the wider aspects of responding to climate change separately (e.g. flood risk and transport) supported by a wider evidence base including Sustainability Appraisal (SA) and Strategic Environmental Assessment (SEA). Focussing on renewable energy and low carbon developments, there are two key areas they we consider as part of this study:

- What the potential is for new renewable and low carbon energy projects, including wind farms, solar parks and heating networks, and how planning policies can help to support this. This would support

[1] 'Renewable Energy Strategic Viability Study for York', AEA (2010)
[2] 'City of York Local Plan, Preferred Options (June 2013)

the further development of Policy CC1 which the Council has already consulted on via its Local Plan Preferred Options.

- What scope there is to require higher standards of development in Local Plan policy, via asking developers to go beyond energy efficiency standards in adopted building regulations, requesting on-site renewable energy systems or ensuring that they build to specific levels of the Code for Sustainable Homes or BREEAM (for non-residential buildings).

1.3 Structure of Report

The report is structured is as follows:

- Section 2: provides an overview of present energy demand in the City of York and what impact future development proposed by the emerging Local Plan (through to 2030) could have;
- Section 3: reviews the existing renewable energy capacity within City of York;
- Section 4: provides an overview of the wind resource;
- Section 5: provides an overview of solar resource;
- Section 6: provides an overview of the biomass resource;
- Section 7: provides an overview of the hydro resource;
- Section 8: provides an overview of other technologies supplying heat;
- Section 9: reviews the potential for decentralised energy networks (district heating); and
- Section 10: sets out how the study's evidence can be used to inform planning policies in the emerging Local Plan.

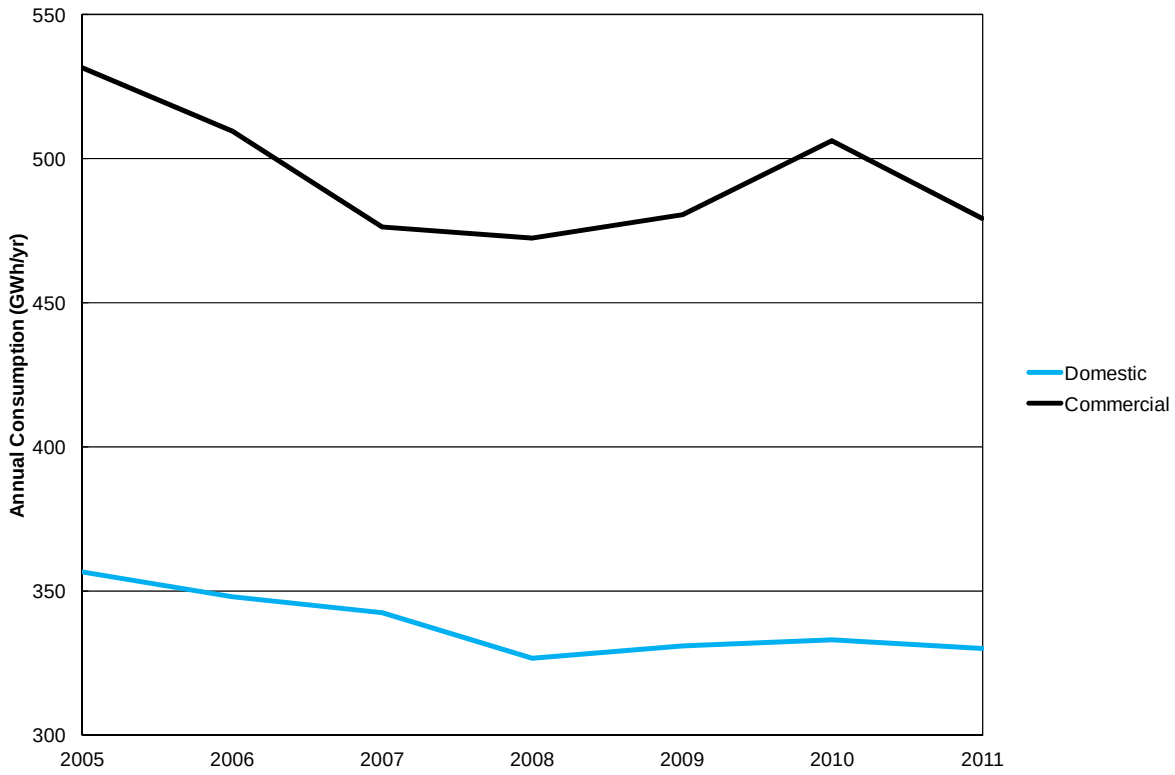
The report is accompanied by a Glossary which should be referred to for definitions of key technical terms, units of measurement and relevant national policy initiatives. Technical Appendices are also provided setting out key assumptions and supporting calculations used as part of the study.

2. Energy Demand in City of York

2.1 Current Demand for Electricity

National statistics are available from the Department for Energy and Climate Change (DECC) that provide a breakdown of energy consumption at local authority area (the latest figures are from 2011)[3]. In the case of the City of York the trend in electricity consumption for domestic and commercial customers 2005-2011 is shown in Figure 2-1, with a steady decline in domestic energy demand in particular.

Figure 2-1 City of York Existing Electricity Consumption (Gigawatt hours per year [GWh/yr])



Note: Energy consumption figures are given as per total sales figures for City of York

Source: DECC

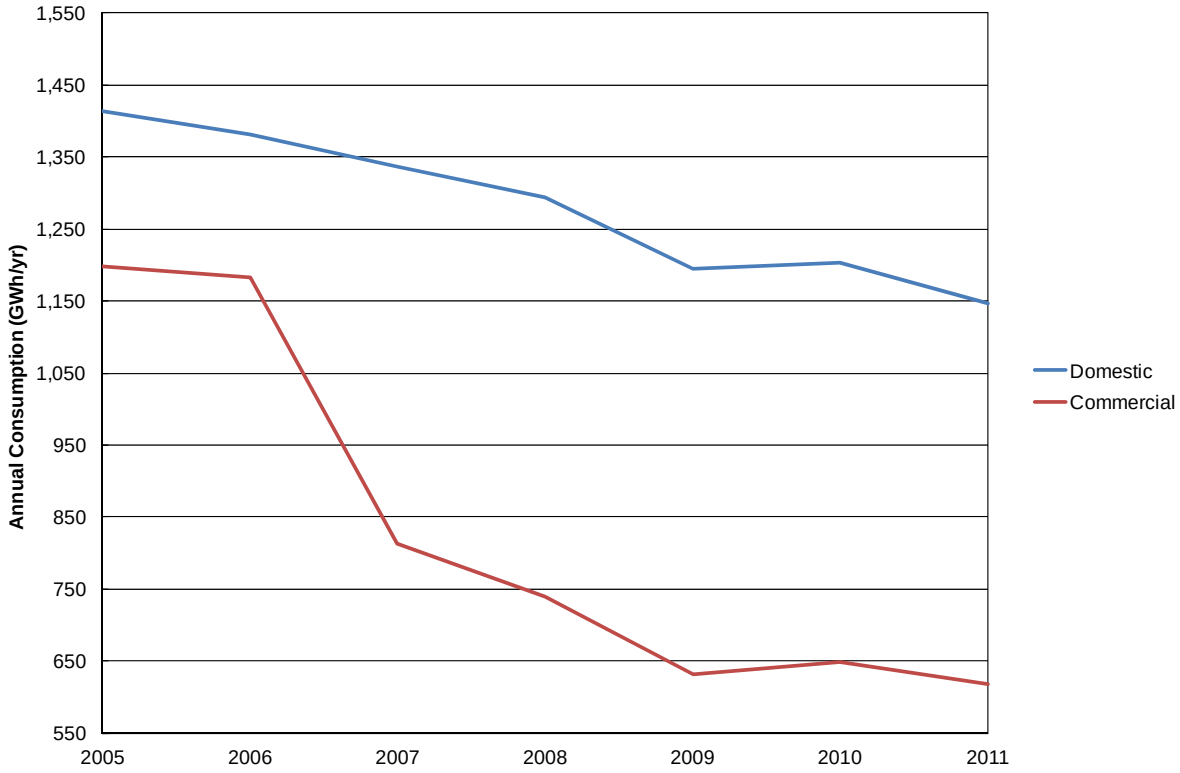
In the case of domestic energy consumption, average consumption of electricity in 2011 was 3,779 kilowatt hours per year (kWh/yr – see Glossary) which is below the UK average figure of 4,221 kWh/yr.

[3] https://www.gov.uk/government/statistical-data-sets/mlsoa-electricity-and-gas-2011 (Accessed October 2013)

2.2 Current Demand for Natural Gas

DECC data is also available for natural gas demand. In the case of the City of York the trend in natural gas consumption for domestic and commercial customers is shown in Figure 2-2. The trend in average consumption within York for both domestic and commercial customers is broadly a downward one.

Figure 2-2 City of York Existing Natural Gas Consumption (GWh/yr)



Note: Energy consumption figures are given as per total sales figures for City of York

Source: DECC

In the case of domestic energy consumption, average consumption of natural gas in 2011 was 14,792 kWh/yr which is above the UK average demand of 13,252 kWh/yr.

2.3 Current Heat Demand

While natural gas is used by the majority of domestic and commercial consumers to provide heating in their homes and businesses, it is not the only fuel used for heating. The National Heat Map[4] provides a high level estimate of heat demand across the City of York. It provides a guide for the density of heat demand across the City. The latest

[4] http://tools.decc.gov.uk/nationalheatmap/ (Accessed November 2013)

figures are summarised in Figure 2-3. It is clear that the residential sector presents by far the largest heat demand, at 64% of the total demand in the City of York.

Figure 2-3 National Heat Map Data – City of York

Sector	Heat Demand (kWh)	Number of Addresses	Heat Density (kWh/m^2)
Commercial Offices	60,200,000	1,636	0.221
Education	36,300,000	124	0.133
Government Buildings	26,500,000	58	0.0974
Health	28,900,000	248	0.106
Hotels	48,600,000	716	0.179
Industrial	182,000,000	201	0.669
Other	4,490,000	214	0.0165
Postal	4,290,000	176	0.0158
Recreational	36,600,000	385	0.135
Residential	1,030,000,000	87,388	3.79
Retail	96,600,600	2,314	0.355
Science	2,230,000	4	0.00819
Transport	40,200,000	486	0.148
TOTAL	1,600,000,000	93,950	5.87

Source: DECC

In developing these details there a number of working assumptions applied uniformly across all areas of the UK. It is therefore possible to improve the accuracy of these heat maps through the collection of actual energy consumption data from major energy users within York. This process is ongoing as part of a wider study for the Leeds City Region (LCR).

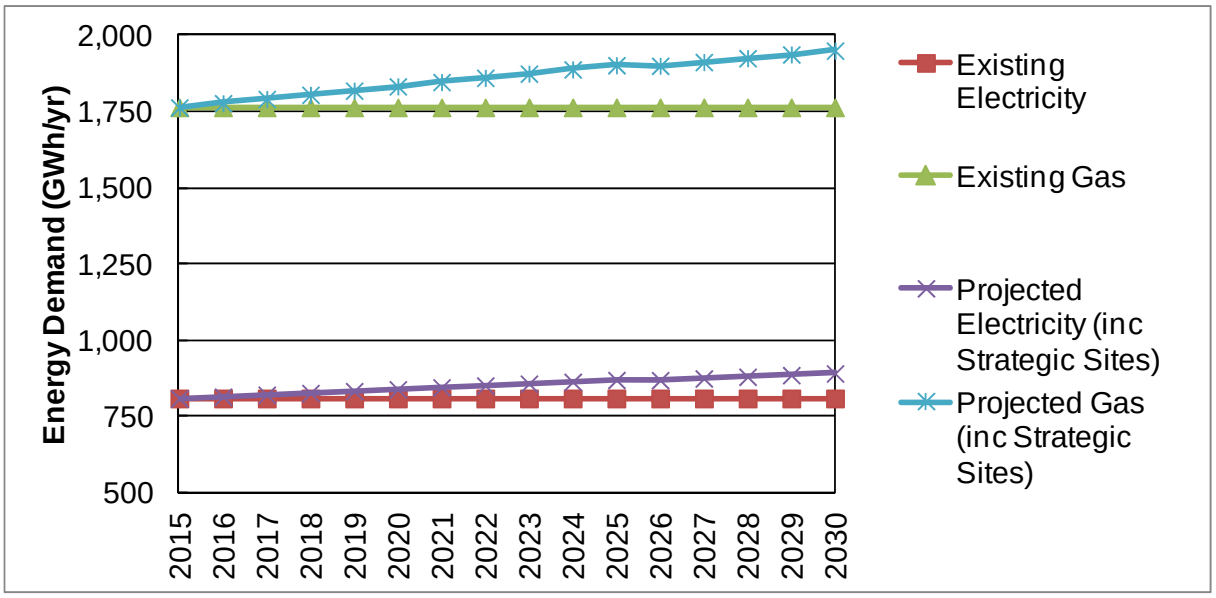
2.4 Projected Energy Demand

The Local Plan will help ensure the delivery of new homes and business across York through to 2030 so we need to look at what impact this will have on the City's energy demand and related CO_2 emissions. In doing so, we specifically consider the 'strategic sites' which the Council has identified as having a key role to play in delivering future growth and development, sites that will deliver a combination of new housing, employment, retail and community facilities.

In projecting energy demand (Figure 2-4) we have of course had to make a number of assumptions at this stage, including indicative development mixes for the site in advance of future masterplans being progressed. In addition, we have assumed that all buildings will be built to *current* standards – no allowance is made for national initiatives

which are likely to enhance energy efficiency and reduce demand (e.g. changes to building regulations and Green Deal) but it provides a helpful baseline from which to monitor performance. Together, these strategic sites could deliver approximately 19,000 new homes and associated uses (details of the estimated energy demand attributed to each strategic site are provided in Appendix B).

Figure 2-4 Projected Energy Consumption to 2030 based on development at strategic sites

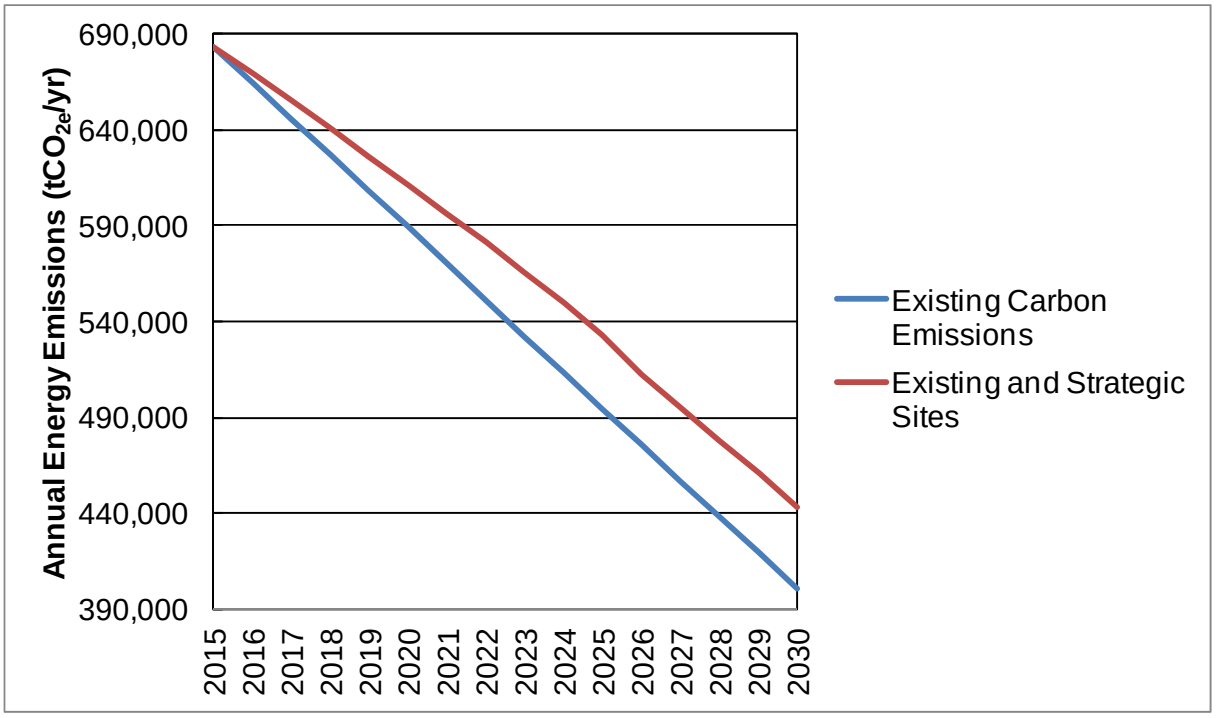


Note: Projected heating demand associated with strategic sites assumed to be natural gas demand

Source: AMEC

In terms of carbon emissions, based on this energy demand, this indicative demand profile is shown in Figure 2-5.

Figure 2-5 Projected Energy Related Carbon Emissions (2015 – 2030)



Note: Electricity emissions calculated based on Committee on Climate Change projected grid decarbonisation targets (see Glossary)

Source: AMEC

Fundamentally, what this analysis shows is that if all of the proposed strategic development sites were to be fully implemented then this is projected to result in an increase in total carbon emissions of 10% by 2030 (relative to existing carbon emissions – 2011 baseline). However, it is anticipated that initiatives such as the Green Deal, coupled with incentives to install renewable energy generation (e.g. feed-in tariffs) will result in a reduction in carbon emissions across existing buildings. This is likely to offset much of any increase in carbon emissions associated with development on strategic sites.

2.5 Implications for the emerging Local Plan

The information presented in this section is relevant to the emerging Local Plan and wider planning decisions because:

- It presents a 2011 baseline (energy demand and CO_2 emissions) against which the success and effectiveness of future planning policies and decisions can be assessed (810 GWh/yr electricity demand and 1,764 GWh/yr gas demand).
- It shows that whilst the strategic sites will have an impact on energy demand and emissions, particularly in relation to gas/heating, by far the biggest challenge will be to target demand for heating from existing residential properties. This section shows that York's gas demand per household is some

12% higher than the national average and when considering heating demand City-wide, residential properties account for 64% of the City's total heating demand.

In the following sections of this report we consider the existing contribution from renewable and low carbon energy schemes and the potential for new schemes in terms of how this could potentially reduce CO_2 emissions associated with the City's energy demand *and* what national and local planning policy can do to ensure energy efficiency in both new and existing homes.

3. Existing Renewable and Low Carbon Energy Generation

3.1 Overview

In the City of York, as across the rest of the UK, there is a continuing growth in the extent of energy generation available from renewable or low carbon sources. This is in line with UK policies to combat the impacts of climate change, including the introduction of Feed-in tariffs (FiT) and the renewable heat incentive (RHI) providing a payment to generators for each kilowatt hour (kWh) of energy they produce.

Renewable energy and low carbon generation can come in the form of either stand alone devices used at individual building level (e.g. roof mounted solar PV or a small scale wind turbine) or in decentralised systems supplying a number of buildings (e.g. district heating) (see also Glossary for description of technologies).

Before considering what new potential exists for renewable and low carbon energy, it is first helpful to look at what *existing* schemes are operational in the City of York. A summary of known existing renewable energy capacity is provided in Table 3-1.

Table 3-1 Existing Renewable / Low Carbon Energy Generation Capacity in the City of York

Technology	Number of Installations (No.)	Installed Capacity (kW)	Estimated Output (MWh/yr)	Commentary
Renewable Heat Incentive (Biomass, Heat Pumps, Solar Collectors, Biogas)	1 – 5	Not Known	Not Known	DECC Statistics for September 2013 include suppressed figure for number of installations in York
Solar PV	1,809	6,250	5,475	Feed in Tariff - DECC Statistics for September 2013
Solar PV	1		0	West Offices, City of York Council
Solar PV	1		0	Hazel Court Eco Park
Solar Thermal	1	80	70.1	York High School
Solar Thermal	1	Not Known	Not Known	Wheldrake with Thorganby Primary School
Wind	6	120	105.3	Feed in Tariff - DECC Statistics for September 2013
Hydro	0	0	0	Feed in Tariff - DECC Statistics for September 2013
Anaerobic Digestion	0	0	0	Feed in Tariff - DECC Statistics for September 2013
Micro CHP	5	5	34.7	Feed in Tariff - DECC Statistics for September 2013

Technology	Number of Installations (No.)	Installed Capacity (kW)	Estimated Output (MWh/yr)	Commentary
Biomass Boilers	1	850	3,276	University of York
	1	640	2,467	Joseph Rowntree Housing Trust – Derwenthorpe
	1	2,250	2,956	York High School
	1	300	394	Joseph Rowntree School
	1	Not Known	Not Known	Clifton with Rawcliffe Primary School
	1	450	591	Danesgate Skills Centre
	1	140	184	Acomb Library
Gas CHP	1	1,500	10,512	University of York
Landfill Gas	1	2,370	14,532	Harewood Whin Landfill Site
Ground Source Heat Pump	1	Not Known	Not Known	Our Lady Queen of Martyrs Primary School
	Total		40,599	

Source: RESTATS database, DECC statistics, ECO/Green Deal statistics

Note: Estimated energy outputs are based on typical load factors for each technology. The load factor represents the fraction of output typically achieved over a year compared with the output that would be achieved if the equipment operated permanently at full output. Depending on the technology this could take into account, for example, reduced energy demand (e.g. heating), periods when the resource is not available (e.g. wind, solar) and any equipment downtime.

Whilst the majority of these installations serve individual buildings there are two existing heat supply networks. The University of York operates a district heating scheme across its main campus. This is presently supplied by two 1.5 MW combined heat and power (CHP) units alongside a biomass boiler. The Joseph Rowntree Housing Trust provides heating for 540 dwellings at the Derwenthorpe site through the combination of two 320 kW biomass boilers and four 620 kW gas boilers.

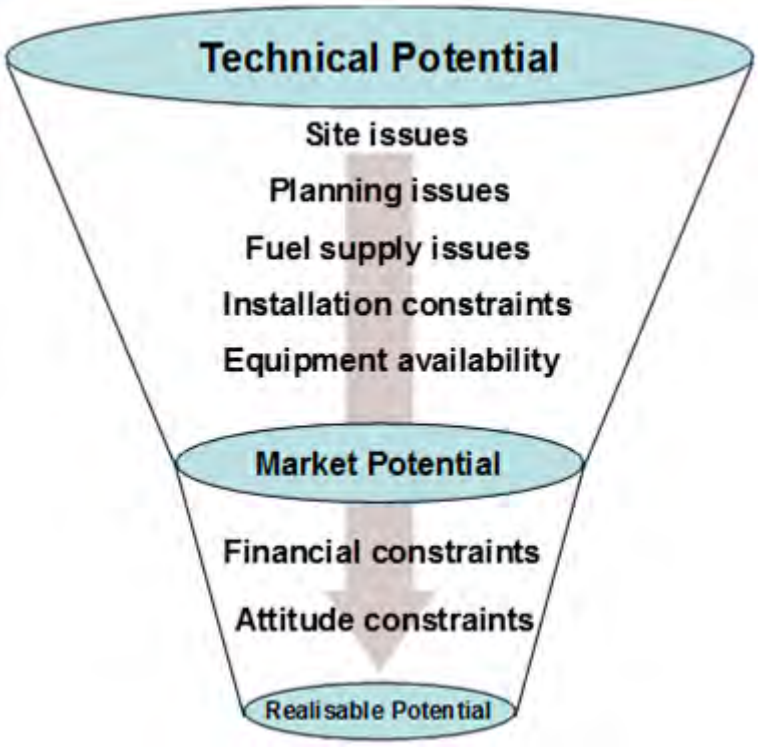
3.2 Implications for the emerging Local Plan

The information presented in this section is relevant to the emerging Local Plan and wider planning decisions because it shows that the output from existing renewable energy generation is estimated at just over 40,500 Megawatt hours per year (MWh/yr) (or 40.5 GWh/yr), representing 1.6% of total existing energy demand for heat and power at 2011 (2,573 GWh/yr) – we therefore need to consider how planning policy and decision-taking can increase this proportion and the measures required to do so.

The following sections of the report considers a range of renewable and low carbon technologies in terms of what and where the potential is to bring forward new schemes and understand how a greater proportion of the City's energy supply could be met. In doing so, our assessment builds on the findings of the 2010 Study, through the application of additional constraints information and a broadening of the technologies considered. For each

technology considered, the ‘theoretical’ potential for each resource (wind, solar, hydro, district heating etc) has been subject to review given real world constraints that are relevant to development, as illustrated in Figure 3-1.

Figure 3-1 Moving from technical potential to realisable potential



4. Renewable Resource: Wind

4.1 Wind Resource in York

The amount of energy any single wind turbine can generate is directly related to the speed of the wind it experiences. The first requirement when assessing the potential for use of wind turbines is therefore to consider the annual average wind speed in a given area. DECC's UK wind speed database is based on use of the NOABL model, a wind flow model based on a mass-consistent model[5] method. The NOABL database[6] contains estimates of wind speed at 10 m, 25 m and 45m above ground level to 1km grid square resolution assuming ground cover of short grass and no obstacles (e.g. trees or buildings). The model makes some important assumptions and approximations. However, the results are useful as a rough guide and have been shown to match reasonably well to observed wind conditions.

At a height of 45m above ground level (agl) the average annual wind speed in York is shown in Figure 4-1a. It can be seen that the majority of average wind speeds are in the range 6.3 – 6.6 ms^{-1}. Developers will typically consider wind turbines in areas where the average wind speed is 6 ms^{-1} or higher. On this basis the City of York offers viable potential for wind turbine generating capacity. By way of comparison, average annual wind speed data (at a height of 45 m agl) is shown for the UK as a whole in Figure 4-1b.

Wind speed is only one factor influencing the commercial viability of wind turbines of course. The other relevant factors are considered in the following sections.

4.2 Wind Turbine Development

The preceding section showed that there is sufficient wind resource across York to make wind turbines viable. When considering the installation of any turbine the owner or developer needs to consider what size of turbine is best suited for the wind resource available. The feed-in tariffs (FiTs) for wind turbines are structured according to the rated output of the turbine (in kW). The physical size of turbines within each FiT band is summarised in Table 4-1.

5 http://webarchive.nationalarchives.gov.uk/+/http://www.berr.gov.uk/whatwedo/energy/sources/renewables/explained/wind/windspeed-database/page27708.html (Accessed November 2013)

6 https://restats.decc.gov.uk/cms/annual-mean-wind-speed-map (Accessed November 2013)

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ST15
ST10
ST24
ST21
ST12
ST13

YORK

Key

Council boundary

Strategic development area

NOABL Windspeed at 45m a.g.l. (m/s)

- 11.6
- 7.2
- 6.6
- 6.3
- 1.4

Strategic Sites

ST 1 - British Sugar
ST 2 - Former Civil Service Sports Ground, Millfield Lane
ST 3 - The Grainstores, Water Lane
ST 4 - Land adjacent Hull Road and Grimon Bar
ST 5 - York Central
ST 6 - Land East of Grimston bar
ST 7 - Land East of Metcalf Lane
ST 8 - Land North of Monks Cross
ST 9 - Land North of Haxby
ST 10 - Land at Moor Lane, Woodthorpe
ST 11 - Land at New Lane, Huntington
ST 12 - Land at Manor Heath Road, Copmanthorpe
ST 13 - Land at Moor Lane, Copmanthorpe
ST 14 - Land North of Clifton Moor
ST 15 - Whinthorpe
ST 16 - Terry's
ST 17 - Nestle South
ST 18 - Monks Cross
ST 19 - North Minster Business Park
ST 20 - Castle Piccadilly
ST 21 - Naburn Designer Outlet
ST 22 - Germany Beck
ST 23 - Derwenthorpe
ST 24 - York College

0 km 4.5 km

Scale 1:75,000 @ A3

CITY OF YORK COUNCIL

City of York Council
Renewable and Low Carbon Energy Generation Options Update

Figure 4.1a

York Wind Resource

April 2014
34848-edi007a.wor fitzs

amec

N

Key

Council boundary

Noabl UK Wind Speed 45 m A.G.L.
(m/s)

- 11.6
- 7.2
- 6.6
- 6.3
- 1.4

0 km 4.5 km

Scale 1:75,000 @ A3

CITY OF YORK COUNCIL

City of York Council
Renewable and Low Carbon Energy Generation Options Update

Figure 4.1b

UK NOABL Wind Resource

April 2014
34848-edi023a.wor fitzs

amec

Table 4-1 Working definition of wind turbine sizes

Feed-in Tariff Band (Installed Capacity) (kW)	Hub Height (m)		Blade Diameter (m)		Total Height (m)		Comment
	Min	Max	Min	Max	Min	Max	
Less than or equal to 1.5	10	18	1	3.2	10.5	19.6	
1.6 – 15	10	25	2.8	9	11.4	29.5	
16 – 100	15	39	9	22	19.5	50	
101 – 500	30	65	13.5	56	36.75	93	
501 – 1,500	30	80	40	77	50	118.5	
1,501 – 2,000	60	105	60	93	90	151.5	Most common max size is 127 m
2,001 – 3,000	60	105	76	126	98	168	145 m is maximum consented currently

Note: Hub height measures the distance from the ground to the centre point of the rotating blades of the turbine. Total height measures the height from ground level to the tip of the blades when at their greatest vertical extent.

Source: AMEC

4.3 Methodology

Previous work identified a number of areas with potential for installation of medium to large scale wind turbines[7]. These areas were identified by applying a number of constraints, summarised in Table 4-2.

Table 4-2 2010 Renewable Energy Strategic Viability Study[7] constraints considered for wind assessment

Constraint	Description	Impact on siting of wind turbine
Wind Resource	Reviewing published average wind speed data for areas within the City of York boundary	Wind turbines best sited where mean average wind speeds are highest.
Land availability / Ecology	Green belt, green infrastructure, designated environmental sites, built heritage sites	Development should avoid green belt, designated environmental sites or other sensitive natural heritage sites
Infrastructure	Roads, railways, power lines, airfields, airports	Turbines need to be sited away from major infrastructure
Noise	Separation distances to buildings and development areas	Wind turbines must be sited at sufficient distance from existing buildings to ensure noise levels meet national requirements.

[7] Renewable Energy – Strategic Viability Study for York, Final Report (AEA, 2010)

Constraint	Description	Impact on siting of wind turbine
Flood Risk	Proximity to water courses	Siting turbines in areas of flood risk would require expensive foundations and make access for maintenance more costly
Ministry of Defence	MOD owned sites and related radar operation issues	Turbines need to be at a distance from MOD sites that avoids any compromising of MOD activities.

Each of these constraints reduces the available land area where there is greatest potential for wind development. Figures A-1 - A-6 in Appendix A show the areas of land affected by each constraint.

As part of AMEC's assessment, York City Council has asked us to add an additional layer of constraints, including:

- Grid Connection: proximity to a feasible grid connection point which will indicate whether substantial cabling and support infrastructure may be required.
- Grid Capacity: availability of the distribution network to incorporate the additional power output. Lower network capacity may require upgrades to grid infrastructure such as substations and safety systems (at a cost to the wind developer).
- Safeguarded CAA sites, NERL and other radar systems (aviation issues): potential issues of interference with radar systems. Careful siting will minimise impacts on radar systems and reduce any potential mitigation costs[89].
- Radio / Communications Links / fixed microwave links: careful siting will minimise impacts on the links and reduce any potential mitigation costs.
- Construction: avoiding complex development areas (e.g. wetland areas), minimising the need for more complex wind turbine infrastructure.
- Access: ease of access to site for construction / maintenance. Due to the size of medium to large scale wind turbine components access can determine if a site will be physically and economically feasible.

Views analysis work recently completed by City of York has also been applied as a constraint to development in certain areas, ensuring protection of views of the Minster. This work considers views of the Minster from the different areas of the City. It provides a guide as to areas where the height of any proposed wind turbines would likely be restricted so as to protect the existing view of the Minster. A summary figure showing how this analysis overlaps with potential development sites is provided in Appendix A.

[8] To aid developers with radar impact assessment, a number of maps have been produced corresponding to turbines with tip heights from 20 to 200m describing the areas where turbines of the relevant height would be within line-of-sight of at least one of the primary surveillance radars operated or used by NATS En-Route.

[9] http://www.nats.aero/services/information/wind-farms/self-assessment-maps/ (accessed July 2014)

4.4 Technical Potential

Application of the constraints outlined in the previous section suggests that the technical potential available for medium to large scale wind within the City of York amounts to 24 MW of capacity. The spatial extent of this capacity is indicated in Figure 4.2a and 4.2b.[10]

A breakdown of individual sites as originally identified in the AEA report is provided in Table 4-3. A breakdown of the strategic sites outlined in the draft Local Plan is provided in Table 4-4. This is included for completeness to show where areas of greater wind potential overlap with allocated sites.

Where the technical potential capacity is assessed as zero no further consideration of construction and access is provided. Where potential development capacity is identified commentary on construction and access issues is included in the Comments section of the tables.

[10] Note that in Figure 4.2b only those sites with identified potential are shown. Those sites assessed as having no potential for wind development are excluded from the figure.

Table 4-3 Technical Potential for Medium to Large Scale Wind Development (by site)

Ref	Wind Resource > 6 ms-1	Radar Constraints	Aviation Constraints	MOD Constraints	Infrastructure (Roads, Railways, Power Lines, Airfields, Airports)	Communications Links	Grid Connection Issues	Distance to Closest Substation	Ecology issues	Within View area of Minster	Flood Risk	Other constraints	Estimated Energy Generating Capacity (MW)	Comments
1	Y	Very High	Not within an airport safeguard area	High	None	Number cross site and with 150 m safeguarding buffer space remaining limited	Has capacity, 33 kV local distribution network (LDN) has over 20% capacity.	Approximate distance to Poppleton substation - 4 km	None	No	Low	Close to local historic feature / area	4	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. A golf course is next to this site. High development risk site for larger turbines due to NERL radar, MOD and microwave constraints. No significant additional construction issues due to ground conditions. Site access adequate for construction components (via A19). Possibility for small scale turbines.
2	Y	Very High	Not within an airport safeguard area	None	None	Number cross site and with 150 m safeguarding buffer space remaining very limited	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Poppleton substation - 3 km	None	No	Low	Close to local historic feature / area	1	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Overlaps with ST14 Clifton Gate. High development risk site for larger turbines due to NERL radar, MOD and microwave constraints. No significant additional construction issues due to ground conditions. Site access adequate for construction components (via A1237). Possibility for small scale turbines. As there is space for a one 2.5MW footprint it is assumed that a turbine could be installed. Aviation and radar risks may mitigate against this size of turbine.
3	Y	Very High	Not within an airport safeguard area	None	None	None	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Huntington substation - 8 km	None	No	Low	Close to local historic feature / area	1	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. No significant additional construction issues due to ground conditions. Site access may need improvement if large scale turbine is proposed. As there is space for a one 2.5 MW footprint it is assumed that a turbine could be installed. Aviation and radar risks may mitigate against this size of turbine.
4	Y	Very High	Yes, edge of 15 km safeguard zone	None	132 kV transmission line passes through available area	None	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Huntington substation - 4 km	300 m from SAC and SSSI	No	Low	Close to local historic feature / area	2	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. No significant additional construction issues due to ground conditions. Site access adequate for construction components (via A64). As there is space for a one 2.5MW footprint it is assumed that a turbine could be installed. Aviation and radar risks may mitigate against this size of turbine.
5	Y	Very High	Yes, edge of 15 km safeguard zone	None	None	None	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Huntington substation - 7 km	Beside a SINC	No	Low	Close to local historic feature / area	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems.
6	Y	Very High	Yes, edge of 15 km safeguard zone	None	None	None	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to OSBA4 substation - 5 km	None	No	Low	Close to local historic feature / area	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems.

Ref	Wind Resource > 6 ms-1	Radar Constraints	Aviation Constraints	MOD Constraints	Infrastructure (Roads, Railways, Power Lines, Airfields, Airports)	Communications Links	Grid Connection Issues	Distance to Closest Substation	Ecology issues	Within View area of Minster	Flood Risk	Other constraints	Estimated Energy Generating Capacity (MW)	Comments
7	Y	Very High	Yes, edge of 15 km safeguard zone	None	None	Number cross site and with 150m safeguarding buffer space remaining very limited	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to OSBA4 substation - 2 km	300 m to a SINC	No	Low	Close to local historic feature / area	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems.
8	Y	Very High	Yes, edge of 15 km safeguard zone	None	None	One link at edge of site, likely limited impact.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to OSBA4 substation - 5 km	300 m to a SINC	No	Low	None	2	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. No significant additional construction issues due to ground conditions. Site access adequate for construction components (via A166).
9	Y	Very High	Yes, edge of 15 km safeguard zone	None	None	None	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Elvington substation - 4 km	50 m to a SINC	No	Low	Site beside ancient woodland.	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems.
10	Y	Very High	Yes, edge of 15 km safeguard zone	None	100m from a 400 kV transmission line	Number cross site and with 150m safeguarding buffer space remaining very limited	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Elvington substation - 2 km	None	No	Low	Close to a site of local interest.	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems.
11	Y	Very High	Yes, edge of 15 km safeguard zone	None	None	None	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Elvington substation - 2 km	Close to an international bird area, SPA, sssi and Ramsar.	No	Low	None	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems.
12	Y	Very High	Yes, edge of 15 km safeguard zone	None	None	Link goes straight through site	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Elvington substation - 2 km	Next to nationally significant river, international bird area, SPA, sssi and Ramsar	No	Low	None	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Ornithology will be a major concern for this location.
13	Y	Very High	Yes, edge of 15 km safeguard zone	None	None	One link across site would have layout impact but not show stopper.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Elvington substation - 4 km	Next to nationally significant river, international bird area, SPA, sssi and Ramsar	No	Low	Close to local historic feature / area	3	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Ornithology will be a major concern for this location. No significant additional construction issues due to ground conditions. Site access may require improvement.
14	Y	Very High	Yes, edge of 15 km safeguard zone	High	None	One link across site would have layout impact but not show stopper.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Elvington substation - 5 km	None	No	Low	Close to local historic feature / area	2	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. No significant additional construction issues due to ground conditions. Site access adequate for construction components (via A19).
15	Y	Very High	Possible near York Aviation museum, which operates fly overs for special events	High	None	None	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to York Uni substation - 2 km	500 m to a nationally significant site and site next to a SINC	No	Low	Close to local historic feature / area	1	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Land parcel beside golf course. Overlaps with ST15 Heslington Estate Land. No significant additional construction issues due to ground conditions. Site access adequate for construction components (via A64).

Ref	Wind Resource > 6 ms-1	Radar Constraints	Aviation Constraints	MOD Constraints	Infrastructure (Roads, Railways, Power Lines, Airfields, Airports)	Communications Links	Grid Connection Issues	Distance to Closest Substation	Ecology issues	Within View area of Minster	Flood Risk	Other constraints	Estimated Energy Generating Capacity (MW)	Comments
16	Y	Very High	Possible near York Aviation museum, which operates fly overs for special events	High	None	None	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to OSBA4 substation - 3 km	None	No	Low	None	1	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. No significant additional construction issues due to ground conditions. Site access adequate for construction components (via A64).
17	Y	Very High	Possible near York Aviation museum, which operates fly overs for special events	High	None	None	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to OSBA4 substation - 1 km	None	No	Low	None	1	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. No significant additional construction issues due to ground conditions. Site access adequate for construction components (via A64).
18	Y	Very High	Possible near York Aviation museum, which operates fly overs for special events	High	None	One link across site would have layout impact but not show stopper.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to OSBA1 substation - 1 km	None	No	Low	Close to local historic feature / area	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems.
19	Y	Very High	Yes, edge of 15 km safeguard zone	High	None	One link at edge of site, likely limited impact.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Campleshon substation - 7 km	Site next to site of local interest	No	Close to Extreme flood zone but not within.	None	1	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. No significant additional construction issues due to ground conditions. Site access adequate for construction components (via A64).
20	Y	Very High	Yes, edge of 15 km safeguard zone	High	None	None	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Gale lane substation - 5 km	None	No	Low	None	1	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. No significant additional construction issues due to ground conditions. Site access may need improvement.
21	Y	Very High	Near, ~1 km, Rufford airfield and glider centre.	None	None	A number of links across site reduces available space significantly.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Gale lane substation - 2 km	None	No	Low	Part of site designated local historic feature / area	2	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Potential impact for Rufford airfield, ~1 km from land pocket, therefore this would ultimately decide on viability of site. No significant additional construction issues due to ground conditions. Site access adequate for construction components (via A64).
22	Y	Very High	Near, ~1 km, Rufford airfield and glider centre.	None	A road passes through south side of site area. Impact on layout rather than show stopper.	One link at edge of site, likely limited impact.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Gale lane substation - 2 km	None	No	Low	None	2	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Potential impact for Rufford airfield, ~1 km from land pocket, therefore this would ultimately decide on viability of site. No significant additional construction issues due to ground conditions. Site access adequate for construction components (via A1237).
23	Y	Very High	Near, ~1 km, Rufford airfield and glider centre.	None	None	One link at edge of site, likely limited impact.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Poppleton substation - 4 km	None	No	Low	None	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems.
24	Y	Very High	Yes, edge of 15 km safeguard zone	None	None	One link goes through centre of site. Potential impact	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Elvington substation - 4 km	100 m to nationally significant river and beside a site of local interest.	No	Low	None	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems.

Ref	Wind Resource > 6 ms-1	Radar Constraints	Aviation Constraints	MOD Constraints	Infrastructure (Roads, Railways, Power Lines, Airfields, Airports)	Communications Links	Grid Connection Issues	Distance to Closest Substation	Ecology issues	Within View area of Minster	Flood Risk	Other constraints	Estimated Energy Generating Capacity (MW)	Comments
25	Y	Very High	None	High	Minor road passes through site area	One link at edge of site, likely limited impact.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Campleshon substation - 6 km	Site next to site of local interest	No	Low	Within a local historic feature / area	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems.
26	Y	Very High	None	High	None	3 links cover site	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Campleshon substation - 5 km	None	No	Low	None	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems.
	Total Estimated Energy Generating Capacity (MW) - All Sites												**24**	

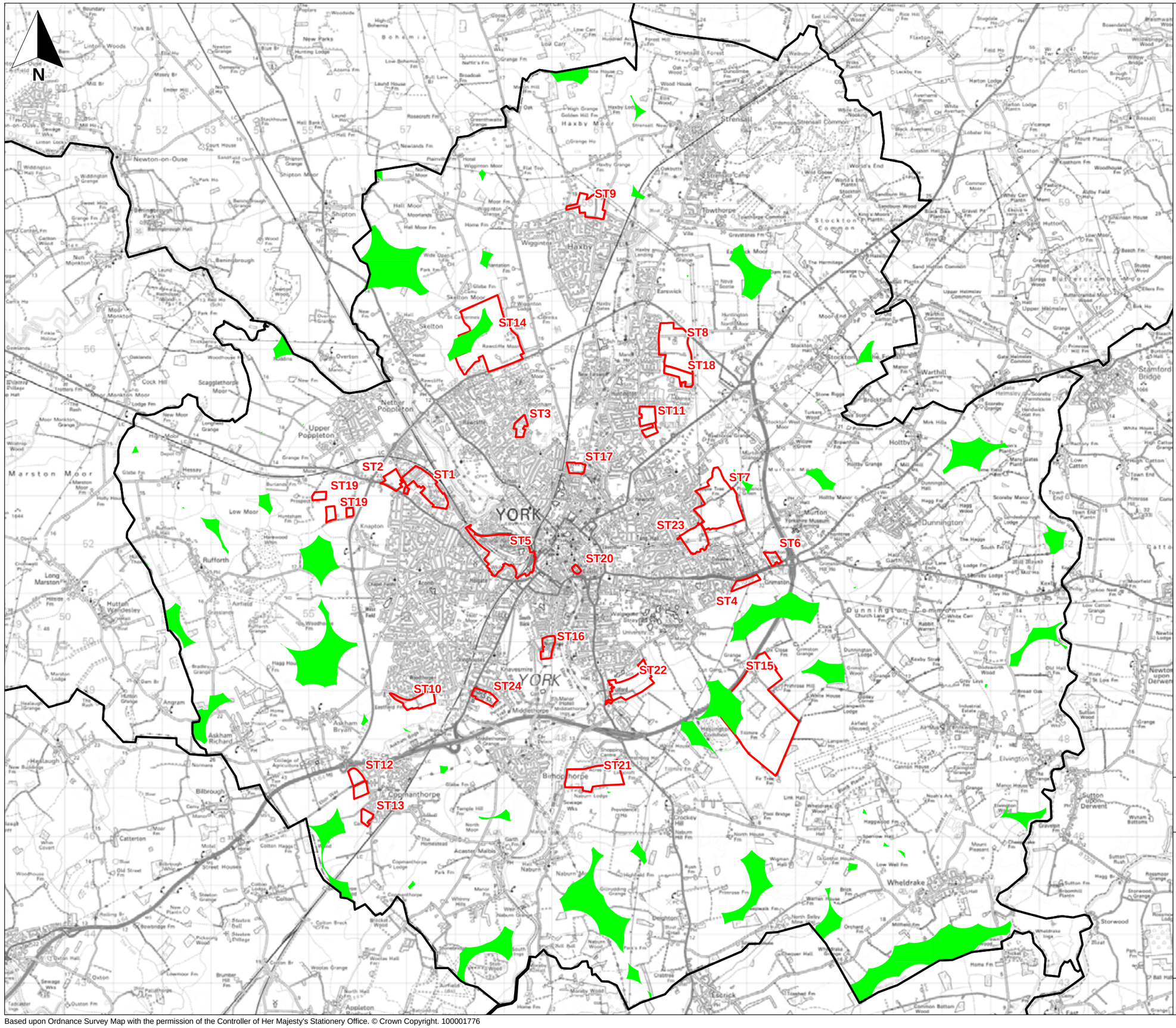
Table 4-4 Technical Potential for Wind Development (by Strategic Site)

Ref	Site Name	Wind Resource > 6 ms-1	Radar Constraints	Aviation Constraints	MOD Constraints	Infrastructure (Roads, Railways, Power Lines, Airfields, Airports)	Communications Links	Grid Connection Issues	Distance to Closest Substation	Ecology issues	Within View area of Minster	Flood Risk	Other constraints	Estimated Energy Generating Capacity (MW)	Comments
ST1	British Sugar	Y	Very High	Yes, edge of 5 km safeguard zone	None	Beside railway. Impact on layout rather than show stopper.	3 links cover site	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Poppleton substation - 0.08 km	None	Yes	Low	Within city so likely to have major impact.	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Within York Minster visual zone. Noise constraints restrict land availability due to close proximity to housing.
ST 2	Former Civil Service Sports Ground, Millfield Lane	Y	Very High	Yes, edge of 5 km safeguard zone	None	Beside a number of roads. Could significantly impact on available space.	A number of links: significant impact on available space.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Poppleton substation - 0.2 km	None	Yes	Low	Within city so likely to have major impact.	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Within York Minster visual zone. Noise constraints restrict land availability due to close proximity to housing.
ST 3	The Grainstores, Water Lane	Y	Very High	None	None	33 kV power line passes through site.	A number pass over site.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Haxby road substation - 1.4 km	None	Yes	Low	Within city so likely to have major impact.	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Within York Minster visual zone. Noise constraints restrict land availability due to close proximity to housing.
ST 4	Land adjacent Hull Road and Grimon Bar	Y	Very High	Yes, edge of 15 km safeguard zone	High	33 kV and 132 kV power line passes through site and it's beside a road.	A number pass over site.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to OSBA1 substation - 0.2 km	None	No	Low	None	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Noise constraints restrict land availability due to close proximity to housing.

Ref	Site Name	Wind Resource > 6 ms-1	Radar Constraints	Aviation Constraints	MOD Constraints	Infrastructure (Roads, Railways, Power Lines, Airfields, Airports)	Communications Links	Grid Connection Issues	Distance to Closest Substation	Ecology issues	Within View area of Minster	Flood Risk	Other constraints	Estimated Energy Generating Capacity (MW)	Comments
ST 5	York Central	Y	Very High	None	None	33kV power line passes through site and it's beside a road.	A number of links significant impact on available space.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to OSBA4 substation - 0.1 km	None	Yes	Close to flood zone 3b	Within city so likely to have major impact.	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Within York Minster visual zone. Noise constraints restrict land availability due to close proximity to housing.
ST 6	Land East of Grimston bar	Y	Very High	Yes, edge of 15 km safeguard zone	High	Beside a number of roads. Could significantly impact on available space.	1 link crosses site	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Huntington substation - 1.6 km	None	No	Low	Within city so likely to have major impact.	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Noise constraints restrict land availability due to close proximity to housing.
ST 7	Land East of Metcalf Lane	Y	Very High	Yes, edge of 15 km safeguard zone	None	A road passes through centre of site, with a farm building in the centre and POW passes through site.	4 links cross the site	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Huntington substation - 4.7 km	None	Yes	Close to flood zone 3b	Within city so likely to have major impact.	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Within York Minster visual zone. Noise constraints restrict land availability due to close proximity to housing.
ST 8	Land North of Monks Cross	Y	Very High	Yes, edge of 15 km safeguard zone	None	Beside a number of roads. Could significantly impact on available space.	None	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Gale lane substation - 1.8 km	None	No	Low	None	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Noise constraints restrict land availability due to close proximity to housing.
ST 9	Land North of Haxby	Y	Very High	Yes, edge of 15 km safeguard zone	None	Major power lines beside site	None	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Gale lane substation - 3.6 km	None	No	Low	None	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Noise constraints restrict land availability due to close proximity to housing.
ST 10	Land at Moor Lane, Woodthorpe	Y	Very High	Yes, edge of 5 km safeguard zone	None	None	None	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Gale lane substation - 4.3 km	None	Yes	Low	None	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Within York Minster visual zone. Noise constraints restrict land availability due to close proximity to housing.
ST 11	Land at New Lane, Huntington	Y	Very High	Yes, edge of 15 km safeguard zone	None	Beside a number of roads. Could significantly impact on available space.	3 links pass over site.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Poppleton substation - 2.2 km	None	Yes	Low	Scheduled monument on site.	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Within York Minster visual zone. Noise constraints restrict land availability due to close proximity to housing.
ST 12	Land at Manor Heath Road, Copmanthorpe	Y	Very High	Yes, edge of 5 km safeguard zone	None	Beside a number of roads. Could significantly impact on available space.	None	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to York Uni substation - 1.8 km	None	No	Low	None	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Noise constraints restrict land availability due to close proximity to housing.

Ref	Site Name	Wind Resource > 6 ms-1	Radar Constraints	Aviation Constraints	MOD Constraints	Infrastructure (Roads, Railways, Power Lines, Airfields, Airports)	Communications Links	Grid Connection Issues	Distance to Closest Substation	Ecology issues	Within View area of Minster	Flood Risk	Other constraints	Estimated Energy Generating Capacity (MW)	Comments
ST13	Land at Moor Lane, Copmanthorpe	Y	Very High	Yes, edge of 5 km and 15 km safeguard zone	High	Beside a number of roads. Could significantly impact on available space.	None	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Haxby road substation - 0.2 km	None	No	Low	None	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Noise constraints restrict land availability due to close proximity to housing.
ST 14	Land North of Clifton Moor	Y	Very High	Not within an airport safeguard area	None	None	Number cross site and with 150 m safeguarding buffer space remaining very limited	Has capacity and near to connection point, see figure B.3.	Approximate distance to Melrosegat substation - 0.8 km	None	No	Low	Close to local historic feature / area	1	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. No significant additional construction issues due to ground conditions. Site access adequate for construction components (via A1237).
ST 15	Whinthorpe	Y	Very High	Yes, edge of 15km safeguard zone	None	None	A number of links across site reduces available space.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to York Uni substation - 1.5 km	None	No	Low	Close to local historic feature / area	1	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. No significant additional construction issues due to ground conditions. Site access adequate for construction components (via A64).
ST 16	Terry's	Y	Very High	None	None	Beside a number of roads. Could significantly impact on available space.	4 links cross site.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Campleshon substation - 1.7 km	None	Yes	Low	Some listed buildings on site	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Within York Minster visual zone. Noise constraints restrict land availability due to close proximity to housing.
ST 17	Nestle South	Y	Very High	Yes, edge of 15km safeguard zone	None	Beside a number of roads. Could significantly impact on available space.	Five links cross site.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Campleshon substation - 0.02 km	None	Yes	Low	Within city so likely to have major impact.	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Within York Minster visual zone. Noise constraints restrict land availability due to close proximity to housing.
ST 18	Monks Cross	Y	Very High	Yes, edge of 15km safeguard zone	None	None	None	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to OSBA2 substation - 0.9 km	None	No	None	None	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Noise constraints restrict land availability due to close proximity to housing.
ST 19	North Minster Business Park	Y	Very High	Yes, edge of 5 km safeguard zone	None	None	1 link crosses site.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Huntington substation - 0.1 km	None	No	None	None	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Noise constraints restrict land availability due to close proximity to housing.
ST 20	Castle Piccadilly	Y	Very High	Yes, edge of 15km safeguard zone	None	Beside a number of roads. Could significantly impact on available space.	Numerous links cross the site.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Severus Hill substation - 0.5 km	None	Yes	Close to flood zone 3b	Within city so likely to have major impact. Next to castle.	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Within York Minster visual zone. Noise constraints restrict land availability due to close proximity to housing.

Ref	Site Name	Wind Resource > 6 ms-1	Radar Constraints	Aviation Constraints	MOD Constraints	Infrastructure (Roads, Railways, Power Lines, Airfields, Airports)	Communications Links	Grid Connection Issues	Distance to Closest Substation	Ecology issues	Within View area of Minster	Flood Risk	Other constraints	Estimated Energy Generating Capacity (MW)	Comments
ST 21	Naburn Designer Outlet	Y	Very High	Yes, edge of 15 km safeguard zone	High	Beside a number of roads. Could significantly impact on available space.	1 link crosses site.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Poppleton substation - 0.08 km	None	No	None	None	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Noise constraints restrict land availability due to close proximity to housing.
ST 22	Germany Beck	Y	Very High	Yes, edge of 15 km safeguard zone	High	Beside a number of roads. Could significantly impact on available space.	2 links cross site.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Poppleton substation - 0.2 km	None	Yes	Within flood zone 3b	Within city so likely to have major impact.	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Within York Minster visual zone. Noise constraints restrict land availability due to close proximity to housing.
ST 23	Derwenthorpe	Y	Very High	Yes, edge of 15 km safeguard zone	None	Beside a number of roads. Could significantly impact on available space.	2 links cross site.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to Haxby road substation - 1.4 km	None	Yes	Close to flood zone 3b	Within city so likely to have major impact.	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Noise constraints restrict land availability due to close proximity to housing.
ST 24	York College	Y	Very High	None	None	Beside a number of roads. Could significantly impact on available space.	11 links pass over site.	Has capacity, 33 kV LDN has over 20% capacity.	Approximate distance to OSBA1 substation - 0.2 km	None	Yes	Low	Within city so likely to have major impact.	0	Across all areas impact to radar potentially high risk as low as 20 m above ground level (a.g.l.) as it could be visible on the NERL and CAA systems. Noise constraints restrict land availability due to close proximity to housing.
	Total Estimated Energy Generating Capacity (MW) - All Sites													**2**	



Key

- Council boundary
- Strategic housing area
- Areas of development potential for medium to large scale wind turbines identified in 2010 study

Strategic Sites

ST 1 - British Sugar
ST 2 - Former Civil Service Sports Ground, Millfield Lane
ST 3 - The Grainstores, Water Lane
ST 4 - Land adjacent Hull Road and Grimon Bar
ST 5 - York Central
ST 6 - Land East of Grimston bar
ST 7 - Land East of Metcalf Lane
ST 8 - Land North of Monks Cross
ST 9 - Land North of Haxby
ST 10 - Land at Moor Lane, Woodthorpe
ST 11 - Land at New Lane, Huntington
ST 12 - Land at Manor Heath Road, Copmanthorpe
ST 13 - Land at Moor Lane, Copmanthorpe
ST 14 - Land North of Clifton Moor
ST 15 - Whinthorpe
ST 16 - Terry's
ST 17 - Nestle South
ST 18 - Monks Cross
ST 19 - North Minster Business Park
ST 20 - Castle Piccadilly
ST 21 - Naburn Designer Outlet
ST 22 - Germany Beck
ST 23 - Derwenthorpe
ST 24 - York College

0 km 4.5 km

Scale 1:75,000 @ A3

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Figure 4.2a

2010 Study Areas of Wind Development Potential

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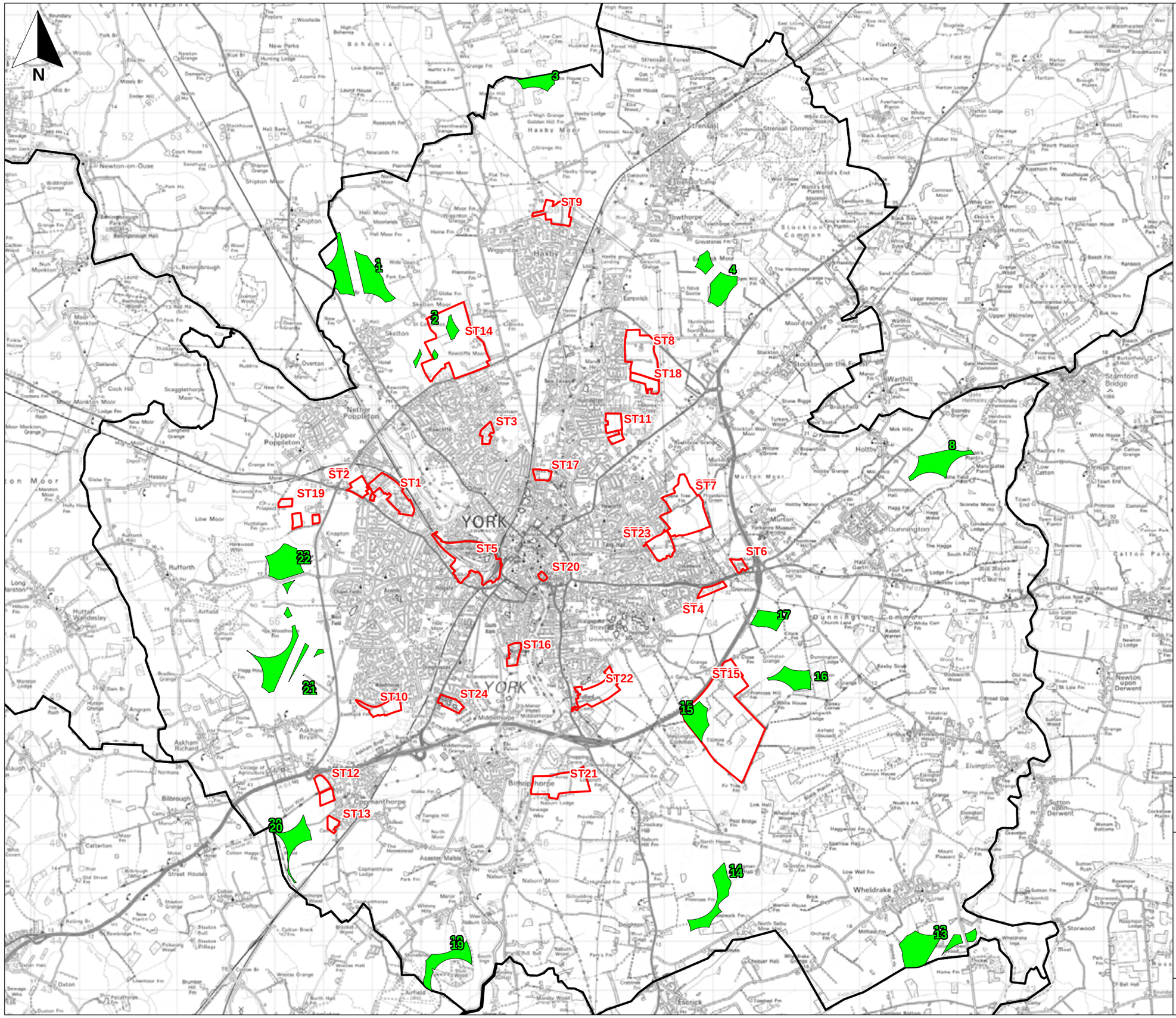

Key

- Council boundary
- Strategic housing area
- Remaining areas of development potential for medium to large scale wind turbines

Strategic Sites

ST 1 - British Sugar
ST 2 - Former Civil Service Sports Ground, Millfield Lane
ST 3 - The Grainstores, Water Lane
ST 4 - Land adjacent Hull Road and Grimon Bar
ST 5 - York Central
ST 6 - Land East of Grimston bar
ST 7 - Land East of Metcalf Lane
ST 8 - Land North of Monks Cross
ST 9 - Land North of Haxby
ST 10 - Land at Moor Lane, Woodthorpe
ST 11 - Land at New Lane, Huntington
ST 12 - Land at Manor Heath Road, Copmanthorpe
ST 13 - Land at Moor Lane, Copmanthorpe
ST 14 - Land North of Clifton Moor
ST 15 - Whinthorpe
ST 16 - Terry's
ST 17 - Nestle South
ST 18 - Monks Cross
ST 19 - North Minster Business Park
ST 20 - Castle Piccadilly
ST 21 - Naburn Designer Outlet
ST 22 - Germany Beck
ST 23 - Derwenthorpe
ST 24 - York College

0 km 4.5 km

Scale 1:75,000 @ A3

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Renewable and Low Carbon Energy Generation Options Update

Figure 4.2b

Refined Areas of Wind Development Potential

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4.5 Key findings

The present analysis suggests that there is potential for wind generation capacity of up to 24MW across the City of York. Assuming a capacity factor of 0.2[11] this would generate around 42,000 MWh of electricity per annum. This equates to around 5.2% of total existing electricity demand outlined in Section 2.

If all of this potential came forward, this could 'offset' 20,300 tonnes of CO_2 per annum (tCO_{2e} per annum), equivalent to the electricity consumption of around 11,100 households. Those sites with least overall constraints to wind development can be ranked according to the estimated annual energy generation capacity as per Table 4-5.

Table 4-5 Wind Development Potential Summary

Ref	Estimated Potential Wind Energy Generation Capacity (MW)	Estimated Annual Energy Output (MWh/yr)	Carbon Abatement Potential (tCO_{2e}/yr)
1	4	7,000	3,385
13	3	5,250	2,542
4	2	3,500	1,690
8	2	3,500	1,690
14	2	3,500	1,690
21	2	3,500	1,690
22	2	3,500	1,690
2	1	1,750	846
3	1	1,750	846
15	1	1,750	846
16	1	1,750	846
17	1	1,750	846
19	1	1,750	846
20	1	1,750	846
All Sites	**24**	**42,000**	**20,300**

Note: Abatement potential calculated using a carbon intensity of 0.48 $kgCO_{2e}$/kWh

In the event that proposed development opportunities at sites ST1 – ST26 inclusive are not implemented there would be limited opportunity for wind turbine development over and above the 24 MW identified here. This is

[11] https://restats.decc.gov.uk/cms/annual-variation-in-wind-load-factor/ (Accessed February 2014)

because the vast majority of sites ST1 – ST26 are too close to existing developments or lie within areas restricted by the views constraints of the Minster.

The key technical constraints to realising the wind potential identified in this Section include:

- Views Analysis: protection of views of the Minster will restrict potential wind turbine development across much of the West and South West of the area;
- Radar: the combination of safeguarded airfields and MOD operations in the area mean that there are significant potential issues with wind development even at low elevations; and
- Noise: suitable allowance for noise levels at both residential and non-domestic buildings restricts the available land area for turbine development.

Of course, it is important to note that AMEC is not recommending these sites as necessarily suitable for wind development in planning terms, which will be for York City Council to determine through the plan-making (or planning application) process, based on the application of wider considerations to the constraints identified above, not least:

- The views of local communities through consultation and engagement;
- Site specific environmental constraints informed by survey work (e.g. ecological, landscape, noise, heritage, air quality etc) formalised through an Environmental Impact Assessment (EIA) where required; and
- The wider views of key stakeholders, including MOD, NATS En Route Radar Ltd etc.

4.6 Implications for emerging Local Plan

Providing a positive policy framework for wind development

The information presented in this section is relevant to the emerging Local Plan and wider planning decisions because it shows that through a positive policy framework for wind development then there are significant benefits that can be delivered in terms of both renewable energy supply and CO_2 reductions. Indeed, the assessment shows that wind turbines could meet approximately 5% of the City's electricity demand and offset some 20,000 tonnes of CO_{2e} per annum.

For developers and landowners to understand where the potential exists

The assessment provided in this section can also be used by renewable energy developers, interested in developing in York, to understand what potential exists and where as a potential basis for further discussions with the Council. In addition, where the assessment identifies particular areas of land, this may help the relevant landowner to understand the potential of their site, if it is not pursued for alternative uses (be it farming or future aspirations for residential, employment of mixed use development).

Relationship with strategic site allocations

The potential for incorporating wind energy within strategic site allocations has been considered (Refer Appendix C) but is clearly limited. It is unlikely that any residential developer will want to include wind turbines as part of their masterplans given the impacts this could have on both noise and the marketability of the scheme. Building-integrated wind turbines are typically ineffective and expensive (circa £20-30k per dwelling, Appendix C, Table C-2) when compared to other solutions such as solar PV or low carbon options such as ground source heat pumps.

5. Renewable Resource: Solar

5.1 Solar Photovoltaics (PV)

Solar PV systems exploit the direct conversion of daylight into electricity in a semi-conductor device. The individual cells are interconnected to form a module (more commonly known as a panel). These modules can either be mounted on building roofs (a roof mounted array) or simply installed at ground level (a ground based array or solar farm). A typical domestic installation will cover a roof area of 7 – 14 m^2 with an output of 1 – 2 kW of electricity (referred to as kW peak output or kWp). Solar farms typically range in size from around 1ha -50 ha (depending upon land availability).

To maximise the electricity output from a solar PV system it needs to be:

- Orientated to be South facing; and
- Clear from any obstruction (overhanging trees or vegetation) or overshading from neighbouring buildings.

The electricity output from solar PV panels can be used directly in the home or business premises to which they are connected. During periods of the day when any surplus electricity is generated (i.e. more than is needed for use in the premises) then this can be exported to the national grid. Present feed-in tariffs offer owners of these systems a tariff payment for each kWh of electricity produced. Any exported electricity attracts an additional (lower) payment for each kWh supplied to the grid.

5.2 Assessment Methodology

Previous assessment work focused on building mounted solar photovoltaics (PV). The assessment methodology applied the following working assumptions:

- Domestic properties (including flats) – 25% will have suitable aspect features; will not have planning constraints and will not be subject to shading.
- Commercial properties – 40% will not have issues with shading
- Industrial premises – the majority (80%) will be suitable for installing solar.
- New developments - A higher percentage (50%) is proposed for new developments because PV, for example, can easily be incorporated into new buildings (Building Integrated Photovoltaics).[12]
- Wall mounted systems – excluded from assessment to avoid distortion of potential.

[12] These working assumptions are aligned with 'Renewable and Low Carbon Energy Capacity Methodology: Methodology for the English Regions', SQW on behalf of DECC/DCLG (2010)

In terms of solar irradiation and estimated energy outputs the Standard Assessment Protocol (SAP) methodology is used to determine output figures. Further details are provided in Appendix A.

The present study has extended the scope of assessment to include ground mounted solar PV arrays. Available land areas within the City of York boundary have been reviewed. Site boundaries of the areas assessed are shown in Figures A7-A11 provided in Appendix A. This includes:

- Council owned land areas;
- Council owned land areas unallocated in Local Plan; and
- Privately owned land areas unallocated in Local Plan

Key issues to address in the assessment of these land areas include:

- **Land area** – area of unconstrained land available for development, constraints include watercourses, waterbodies, pathways, trees, overhead lines etc.;
- **Land use** – high value agricultural land should be retained for agricultural use where possible, brownfield sites are the most desirable;
- **Topography** – flat land is most suitable for solar development, otherwise levelling of the land may be required which incurs additional costs and site works;
- **Sensitivity –** if the site has value in terms of local or national designations is it likely to be unsuitable for development;
- **Flood risk** – areas with significant risk of flooding could be problematic for developments;
- **Glint and Glare** - Glint and glare results from reflection of sunlight off solar panels, it is not likely to be a major issue but can present an issue for aviation/driver safety;
- **Landscape and Visual** –any nearby sensitive receptors increase the visual impact of the potential development

Table 5-1 outlines the criteria used to evaluate each of the key issues for each site; a grading of 1-3 has been applied with 1 being most suitable for a solar development and 3 being least suitable.

Table 5-1 Evaluation Criteria for Ground-Based Solar Arrays

Category	1	2	3	Description
Unconstrained area available	>10 ha	<10 ha	<2 ha	An area >10 ha would provide enough space for a solar farm >5MW
Land use	Brownfield land previously used for industrial/ commercial use	Low value land/ low grade agricultural	High value agricultural land/ecologically valuable or land of value to community	It is preferable to develop on non-agricultural land to retain valuable land for agricultural/ecological/community purposes. Value of land is based on gradin system in Natural England TIN049: Agricultural Land Classification as recommended by BRE planning guidance[13]
Topography	Flat	Some gradient	Undulating/slopes	Solar arrays require flat ground, gradients may require levelling prior to installation which adds to costs
Sensitivity	Low sensitivity/designations nearby	Medium sensitivity/ designations nearby	High sensitivity/designations nearby	Is the area valued by people, community, visitors? Is there any landscape, ecological, historic designations? Is it recognised locally, regionally or nationally?
Flood risk	Low/None	Moderate	Significant	As identified using Flood maps provided by Environment Agency[14] . Brief definitions are as follows None: No flood risk assessment information available as it is outside the floodplain or due to insufficient information. Low: unlikely to flood except in extreme conditions Moderate: Moderate chance of flooding, between 0.5%-1.3% chance of flooding each year Significant: Significant change of flooding >1.3% chance each year
Glint and Glare	Not likely to be an issue	Potential to effect some receptors	Sensitive receptors nearby, could be an issue	Glint and glare results from reflection of sunlight off solar panels. Solar panels are designed to absorb light however there is potential for visual impact and effects on aircraft safety. It is unlikely to inhibit a development but is a factor to be considered at planning stages; screening can be put in place to mitigate any likely effects.
Landscape and visual	Low visual impact	Medium visual impact	High visual impact likely	The visual impact is measured by how well screened the development could be and how many sensitive receptors are likely to be effected by the development

[13] 'Planning guidance for the development of large scale ground mounted solar PV systems' BRE National Solar Centre, October 2013

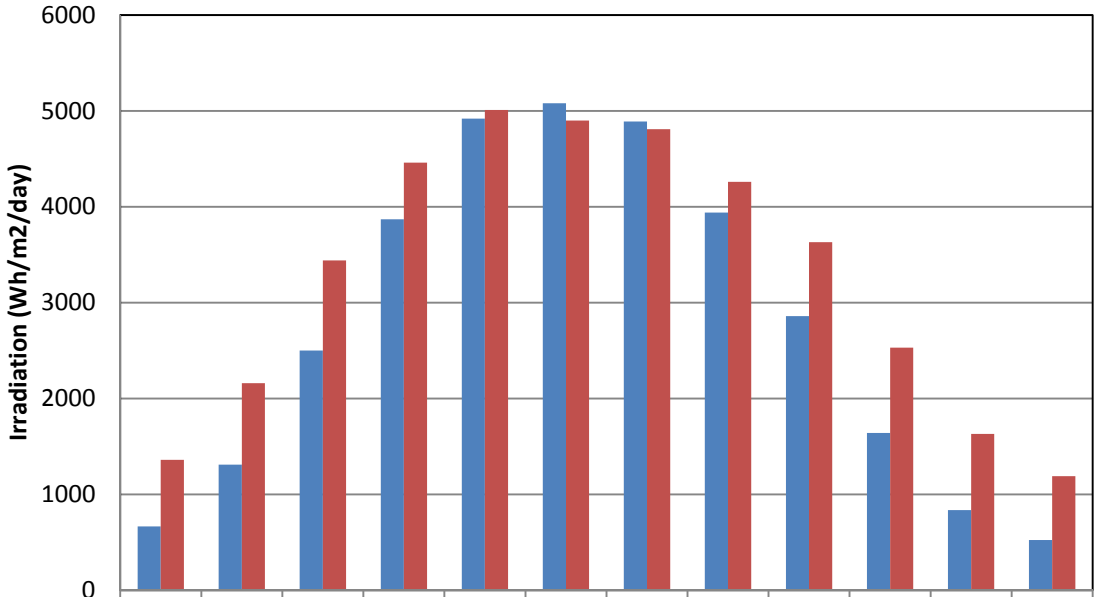
[14] http://maps.environment-agency.gov.uk/wiyby/wiybyController?ep=query&floodrisk=1&lang=_e&topic=floodmap&floodX=460806&floodY=455478

5.3 Technical Potential

5.3.1 Solar Resource

The average incident solar radiation in York is estimated to be 2,760 Wh/m^2/day for a horizontal plane (Hh) and 3,290 Wh/m^2/day on an optimally inclined plane (Ho), corresponding to an average annual solar radiation of 1,007 kWh/m^2 and 1,200 kWh/m^2 respectively[15]. The optimum inclination angle for solar panel installed in York is 40°. Figure 5-1 shows the local average monthly radiation based on long term averages.

Figure 5-1 Long Term Average Monthly Radiation in York



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hh	665	1310	2500	3870	4920	5080	4890	3940	2860	1640	836	524
Ho	1360	2160	3440	4460	5010	4900	4810	4260	3630	2530	1630	1190

PVGIS © European Communities, 2001-2012

5.3.2 Ground Based Solar PV Arrays

In addition to the key issues outlined in Section 5.1, there are general issues that need to be considered when looking at a ground-based solar PV development.

- **Security** of a solar farm is an important consideration. Sites are generally surrounded by security fencing with monitored CCTV cameras installed. Natural features such as hills, rivers etc. can assist in

[15] http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php PVGIS © European Communities, 2001-2012

securing a site. Ideally a site would have one secure entrance and be difficult to access from other locations. Isolated sites are vulnerable

- **Delivery** of solar panels and associated equipment is done by a standard vehicles with no abnormal loads required with the potential exception of the transformer. Some sites may be not have standard access

- **Grid capacity**: Should a development be considered beyond this assessment, there are two important factors to be considered: the nearest grid connection point and the capacity of the local network to accept the additional electricity generated by the solar farm. It is strongly recommended that the local Distribution Network Operator is contacted to establish the grid capacity and the cost of connecting to the local grid network. The point of any connection will depend upon existing local electrical loads and the scale of any proposed solar PV development. This level of detail isn't available at this stage of assessment. As a high level guide, two maps are available from Northern Powergrid: Extra High Voltage (EHV) Generation Capacity map provided by Northern Powergrid for large scale developments (33kV) and High voltage (HV) generation capacity map for small scale development (11kV)[16]. Both maps are provided in Appendix B.

- **Land Availability** – The size of land area will determine the energy generating potential of the proposed solar PV array. As an approximate rule of thumb 2 Ha of land is required for each 1 MW of generating capacity[17].

5.3.3 Energy yield calculation

The potential solar farm capacity for each site has been calculated based on a density of 1MWp per 1.5 hectare and the estimated annual energy output then calculated using the method outlined in the '*Guide to installation of Photovoltaic systems MCS 2012*'[18]. A kWh/kWp value of 871 has been used based on tilt angle of 20^{o} which is not optimal for this area but allows greater density of panels to fit into the available area. Orientation directly south and no shading has been assumed.

5.4 Site Level Analysis

An assessment of each of the potential sites has been completed. Table 5-2 outlines the characteristics of each site and the associated grading between 1 and 3 based on the criteria outlined in Table 5-1. It should be noted that the area available at each site accounts for land boundaries and avoidance of overshading or natural features. It therefore reflects the technical availability rather than the absolute size of any given site.

The sites assessed in Table 5-2 are ones which were previously proposed for residential/commercial development via the plan-making process, but they are sites which the Council has rejected for such uses. AMEC was therefore asked to consider the potential of these sites for renewable energy as an alternative use. It is therefore important to note that none of these sites have developer or landowner interest for renewable energy at this stage and indeed the site promoters may still be seeking to pursue residential or commercial development proposals. At this stage, the

[16] http://www.northernpowergrid.com/page/generation_over_16amps.cfm
[17] http://www.solar-trade.org.uk/solarFarms.cfm (Accessed February 2014)

only sites in the list where we know there is a landowner appetite for solar development are Knapton Moor 2 (owned by York City Council #55 in Table 5-2), Harewood Whin (owned by York City Council and #6 in Table 5-2) and Hermitage farmland (owned by Gem Holdings [York] Ltd #54 in Table 5-2).

Table 5-2 Site Level Analysis – Solar Ground-Based Array

#	Potential Site	Area available	Land use	Topography	Sensitivity	Flood risk	Glint and Glare	Landscape and visual	Overview	Distance to closest substation	Grid Connection Issues
1	Strensall Common	2 ha	Mostly forested land, many trees would need to be felled	Flat	Strensall common SSSI/SAC ~12m south of site boundary	Low- note extent of extreme flooding extends to southern area	Possible effect on passing drivers.	Located very close to many houses and is situated on local walkway	Site is located south of Strensall village very close to numerous residential properties. The majority of the site is forested which would require felling.	Approximate distance to Huntington substation -6 km	Has capacity, 33 kV LDN has over 20% capacity.
	Grading	3	3	1	3	1	2	3			
2	Moor Lane Roundabout	1.3 ha	Roundabout with tree plantations in areas and a pond	Flat	No designations apparent	None	Many receptors in busy traffic surrounding area	Many receptors due to passing traffic	Site is comprised of areas surrounding a large roundabout. There are areas of tree plantation that have been avoided. Glint and glare could be an issue with passing traffic; however, screening could be put in place. Also security likely to be an issue.	Approximate distance to Gale Lane substation - 1.8km	Has capacity, 33 kV LDN has over 20% capacity.
		3	2	1	1	1	3	3			

#	Potential Site	Area available	Land use	Topography	Sensitivity	Flood risk	Glint and Glare	Landscape and visual	Overview	Distance to closest substation	Grid Connection Issues
3	Fulford Ings Love Lane POS	1.9 ha	Site of local interest- with cycle lane running through- recreational use	Mostly flat with embankment areas	Area of local interest and recreational value	Significant	Not likely to be an issue	Sensitive receptors on opposite side of river and passing through on cycle lane	Site is located beside River Ouse, it is located within the Lovelane woodland an area of local interest, a cycle lane runs through it	Approximate distance to Campleshon substation - 0.3km	Has capacity, 33 kV LDN has over 20% capacity.
		3	3	2	3	3	1	3			
4	Tadcaster Road Land Rear YCFHE	0.02 ha	Small area of land behind college	Flat	No designations apparent	None	No sensitive receptors	College students	Land behind college, available area is very small	Approximate distance to Campleshon substation - 2.2km	Has capacity, 33 kV LDN has over 20% capacity.
		3	2	1	1	1	1	1			
5	Millfield Farm	34.5 ha	Agricultural land	Flat	No designations within site	Significant risk in eastern area	Possible effect on passing drivers	Residents of Nether Poppleton	Situated southeast of Nether Poppleton with river to the north, trainline to the east and road to the south. Land currently used for agricultural purposes.	Approximate distance to Poppleton substation - 0.6km	Has capacity, 33 kV LDN has over 20% capacity.
		1	3	1	1	3	2	2			

#	Potential Site	Area available	Land use	Topography	Sensitivity	Flood risk	Glint and Glare	Landscape and visual	Overview	Distance to closest substation	Grid Connection Issues
6	Harewood Whin	68 ha	Waste landfill site	Flat however some ground levelling works may be required due to previous use was waste facility	No designations apparent	Significant risk of flooding of watercourse (The Foss) which runs through centre of site. Flood area extends into northern area of site	View for drivers on B1224 is well screened.	Isolated area, no designations	Site is located on waste disposal facility Harewood Whin. Flood risk area has been excluded from developable area.	Approximate distance to Poppleton substation - 2.6km	Has capacity, 33 kV LDN has over 20% capacity.
		1	1	2	1	3	1	1			
7	Knapton Moor	9.8 ha	Agricultural land	Flat	No designations apparent	Low	Not likely to be an issue	Isolated area, no designations	Site is comprised of an agricultural field immediately Northwest of Knapton village	Approximate distance to Poppleton substation - 1.5km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	1	1	1	1			
8	Land at Hull Road Dunnington (site 43)	4.8 ha	Agricultural land	Flat	No designations apparent	None	None	Isolated area to south, residential properties to north, no designations	Agricultural site located along Hull road <1km from Dunnington. Watercourse runs through site.	Approximate distance to OSBA4 substation - 2.9km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	1	1	1	2			
9	Flaxton Road, Strensall (site53)	4.6 ha	Agricultural land	Flat	Strensall Common SSSI, SAC: heathland located 20 m south	None	No sensitive receptors	Strensall residents	Agricultural land located south of Strensall village adjacent to railway line.	Approximate distance to Huntington substation - 6.4km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	2	1	1	2			

#	Potential Site	Area available	Land use	Topography	Sensitivity	Flood risk	Glint and Glare	Landscape and visual	Overview	Distance to closest substation	Grid Connection Issues
10	York Road, Dunnington (site 74)	4.8 ha	Agricultural land	Flat	No designations apparent	None	Not likely to be an issue	Area on outskirts of Dunnington, no designations	Site is comprised of 3 agricultural fields immediately southwest of Dunnington	Approximate distance to OSBA4 substation - 1.6km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	1	1	1	1			
11	Duncombe Farm, Strensall (site 76)	27 ha	Agricultural land	Flat	Duncombe wood and pond of local interest, located beside and within site boundary	None	Possible effect on passing drivers but minor road so not considered significant	Caravan park located immediately to west	Agricultural land located ~400 m north of Strensall village. Duncombe pond located within site boundary, caravan site immediately west of site.	Approximate distance to Huntington substation - 7.6km	Has capacity, 33 kV LDN has over 20% capacity.
		1	3	1	2	1	1	3			
12	South of Airfield Business Park (site 97)	12 ha	Agricultural land	Flat	No designations apparent	None	No sensitive receptors	Isolated area south of business park, no designations	Agricultural fields south of Airfield business park and Elvington airfield	Approximate distance to Elvington substation - 0.7km	Has capacity, 33 kV LDN has over 20% capacity.
		1	3	1	1	1	1	1			
13	Land at Murton Lane Industrial Estate (site 161)	4 ha	Agricultural land	Flat	No designations apparent	None	Possible effect on passing drivers	Quite isolated area apart from industrial estate, no designations	Site comprises agricultural land beside Murton Lane Industrial estate	Approximate distance to OSBA4 substation - 1.2 km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	1	1	2	1			
14	Pond Field (site 170)	4.7 ha	Appears unused	Flat	No designations apparent	None	Possible effect on passing drivers	Located very close to many houses and on local walkway Church lane	Open field located next to school and residential area. Waterbody located in centre.	Approximate distance to York Uni substation - 0.03 km	Has capacity, 33 kV LDN has over 20% capacity.
		2	1	1	1	1	2	3			

#	Potential Site	Area available	Land use	Topography	Sensitivity	Flood risk	Glint and Glare	Landscape and visual	Overview	Distance to closest substation	Grid Connection Issues
15	Land to the North of Escrick (site 183)	7.6 ha	Agricultural land	Flat	No designations apparent	None	Possible effect on passing drivers	Close to residents of Escrick	Agricultural land located immediately north of Escrick village	Approximate distance to Campleshon substation - 7km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	1	1	2	2			
16	Land to the West of A19, Escrick (site 188)	18.8 ha	Agricultural land	Flat	No designations apparent	None	Possible effect on passing drivers	Close to residents of Escrick	Agricultural land located immediately east of Escrick village. Site spread across several field boundaries, watercourse runs though southern area.	Approximate distance to Campleshon substation - 7.2km	Has capacity, 33 kV LDN has over 20% capacity.
		1	3	1	1	1	2	2			
17	Land at Moor Lane, Copmanthorpe. Field No. 7222 (site 206)	10 ha	Agricultural land	Flat	Moor Lane Railway Verge SINC is located adjacent to site	None	No receptors	Residents of Copmanthorpe, no designations	Agricultural land immediately southeast of railway line east of Copmanthorpe village	Approximate distance to Gale Lane substation - 4.3km	Has capacity, 33 kV LDN has over 20% capacity.
		1	3	1	2	1	1	2			
18	Playing Fields and Village Fields off Askham Fields Lane (site 214)	8 ha	Playing fields and village fields	Flat	No designations apparent	None	Possible effect on passing drivers	Resident of Askham, no designations	Playing and village fields immediately south of Askham Bryan. Woodland in the southern area.	Approximate distance to Gale Lane substation - 3.1km	Has capacity, 33 kV LDN has over 20% capacity.
		2	2	1	1	1	2	2			

#	Potential Site	Area available	Land use	Topography	Sensitivity	Flood risk	Glint and Glare	Landscape and visual	Overview	Distance to closest substation	Grid Connection Issues
19	Land at Wetherby Road, Knapton (site 220)	7.6 ha	Agricultural land	Flat	No designations apparent	None	Possible effect on passing drivers	Residents of Knapton, no designations	Agricultural land located southeast of Knapton village	Approximate distance to Gale Lane substation - 1.5km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	1	1	2	2			
20	Amalgamated sites East of Earswick (site 296)	21.5 ha	Agricultural land	Flat	Earswick meadow SINC is beside	None	Roadway is screened by trees/hedges	Residents of Earswick, no designations	Site is comprised of agricultural land east of Earswick. A1237 runs to the southwest of the site boundary.	Approximate distance to Huntington substation - 2.6km	Has capacity, 33 kV LDN has over 20% capacity.
		1	3	1	2	1	1	2			
21	Amalgamated sites of main street Elvington (site 297)	6.5 ha	Part brownfield, part low value land	Flat	No designations apparent	None	Not likely to be an issue	Located close to numerous houses	Site located East of Elvington village along road to Water treatment works	Approximate distance to Elvington substation - 1km	Has capacity, 33 kV LDN has over 20% capacity.
		2	1	1	1	1	1	3			
22	Land south west of Heslington Playing Fields (site 311)	4.7 ha	Agricultural land	Flat	No designations apparent	Low	Possible effect on passing drivers	Located close to residential areas	Agricultural land located close to residential areas of Heslington	Approximate distance to York Uni substation - 0.5km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	1	1	2	2			
23	Amalgamated East of Monks Cross (site 691)	14.4 ha	Agricultural land	Flat	No designations apparent	None	Possible effect on passing drivers	Located close to shopping centre	Agricultural land north of Monks cross shopping centre. 2 overhead lines run through the site	Approximate distance to Huntington substation - 1.5km	Has capacity, 33 kV LDN has over 20% capacity.
		1	3	1	1	1	2	1			

#	Potential Site	Area available	Land use	Topography	Sensitivity	Flood risk	Glint and Glare	Landscape and visual	Overview	Distance to closest substation	Grid Connection Issues
24	Amalgamated site west of Chapelfields 1 (site 302)	42 ha	Agricultural land	Flat	No major designations; Westfield Marsh (local interest) located within and close to site	None	Possible effect on passing drivers	Would be visible to residents of Chapelfields and small caravan park Acomb grange	Agricultural land south of Chapelfields. A small caravan site is located within the site boundary	Approximate distance to Gale Lane substation - 0.9km	Has capacity, 33 kV LDN has over 20% capacity.
		1	3	1	2	1	2	2			
25	Amalgamated sites between Knapton and Westfield (327)	26 ha	Agricultural land	Flat	No designations	None	Possible effect on passing drivers	Would be visible to residents in Acomb	Agricultural land located 300 m North of Knapton	Approximate distance to Poppleton substation - 0.5km	Has capacity, 33 kV LDN has over 20% capacity.
		1	3	1	1	1	2	2			
26	North Carlton Farm, Stockton-on-the-forest (564)	32 ha	Agricultural land	Flat	No designations	None	No sensitive receptors	No sensitive receptors or designations	Agricultural land located northeast of Stockton on the forest. Commercial buildings adjacent to site.	Approximate distance to OSBA4 substation - 4.8km	Has capacity, 33 kV LDN has over 20% capacity.
		1	3	1	1	1	1	1			
27	Elvington Airfield (607)	17.5 ha	Land adjacent to airfield	Flat	No designations	None	If airfield is in use, panels are orientated such that no glint or glare would affect aircraft	Isolated area, no designations	Area next to airfield; would need to check for contaminated land, unexploded ordnance etc. Have assumed total area available is suitable for solar panels as there are no visible constraints	Approximate distance to Elvington substation - 1km	Has capacity, 33 kV LDN has over 20% capacity.
		1	1	1	1	1	1	1			

#	Potential Site	Area available	Land use	Topography	Sensitivity	Flood risk	Glint and Glare	Landscape and visual	Overview	Distance to closest substation	Grid Connection Issues
28	Pool Bridge Farm (623)	5.6 ha	Agricultural land	Flat	No designation. 700m north is Heslington Tillmire SSSI	None	Possible effect on passing drivers	Isolated area, no designations	Site is a large agricultural field located 1km east of Crockey Hill.	Approximate distance to York Uni substation - 4.2km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	1	1	2	1			
29	Land Adjacent to Grimston Bar and A1079 (623)	10.5 ha	Agricultural land	Flat	No designations apparent	Low	Possible effect on passing drivers	Isolated area, no designations	Site comprises two agricultural fields with overhead line passing through beside A62.	Approximate distance to OSBA4 substation - 0.3km	Has capacity, 33 kV LDN has over 20% capacity.
		1	3	1	1	1	2	1			
30	The Retreat, Heslington Road (629)	0.8 ha	Grounds of The Retreat a mental health care provider	Flat	Greenbelt	None	Patients in care home could be effected	Located on grounds of listed building in green belt	Grounds of The Retreat mental care provider. Many mature trees around land would cause shading	Approximate distance to Melrosegat substation - 0.8km	Has capacity, 33 kV LDN has over 20% capacity.
		3	3	1	2	1	2	3			
31	Land to the West of Knapton (688)	6.3 ha	Agricultural land	Flat	No designations apparent	None	Possible effect on passing drivers	Residents of Knapton	Agricultural land immediately east of Knapton village.	Approximate distance to Poppleton substation - 1.6km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	1	1	2	2			
32	Wheatlands (726)	3.5 ha	Half agricultural, half business park	Flat	No designations apparent but Wheatlands reserve is a woodland listed as local interest	None	Business park with few receptors located to south	Located close to business park, potential sensitivity due to woodland	Site is comprised of a business park and agricultural land. Business park has been excluded from developable area.	Approximate distance to Poppleton substation - 1km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	2	1	1	2			

#	Potential Site	Area available	Land use	Topography	Sensitivity	Flood risk	Glint and Glare	Landscape and visual	Overview	Distance to closest substation	Grid Connection Issues
33	Holgate Park Site	1.8 ha	Industrial site	Flat	Site of local interest 'Holgate park dr.'	Moderate	Some commercial buildings and train depot	No sensitive receptors	Industrial site located adjacent to railway in Holgate	Approximate distance to Severus Hi substation - 0.8km	Has capacity, 33 kV LDN has over 20% capacity.
		3	1	1	2	2	2	1			
34	Askham Lane Bachelor Hill POS	2.2 ha	Grassland, open space	Hilly	Batchelor hill SINC within site boundary	None	Surrounding residents	Surrounded by residents and SINC within site boundary	Site comprised of green area surrounded by residential properties in east of Askham lane.	Approximate distance to Gale Lane substation - 0.4km	Has capacity, 33 kV LDN has over 20% capacity.
		2	1	2	2	1	3	3			
35	Tadcaster Road Ashfield Estate Land	5.2 ha	Agricultural	Flat	No designations apparent	None	Passing drivers on A64.	Many receptors due to passing traffic	Site is comprised of agricultural fields at intersection of A64 and A1036. Fuel station ~1km south of the centre of Dringhouses.	Approximate distance to Gale Lane substation - 2.4km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	1	1	2	3			

#	Potential Site	Area available	Land use	Topography	Sensitivity	Flood risk	Glint and Glare	Landscape and visual	Overview	Distance to closest substation	Grid Connection Issues
36	Nelsons Lane/Mayfield Grove Land	1 ha	Nature conservation area	Flat	2 sites of local interest within site boundary: Mayfield clay pit, Mayfield open space and	None	Passing drivers on Nelsons lane	Users of the nature reserve	Site is comprised of two areas, area to the south is covered in woodland and contains a large water body therefore is unsuitable for any solar panels. The northern area has available land space but there is a playground and a pathway crosses the site.	Approximate distance to Campleshon substation - 1.2km	Has capacity, 33 kV LDN has over 20% capacity.
		3	3	1	3	1	3	3			
37	Swinerton Avenue Land POS 1	1.6 ha	Public open space by River Ouse	Flat	River Ouse and Clifton bridge SINCs nearby but site itself not designated	Significant	Residents and school students	Residents of Swinerton Avenue; users of public area and walkway	Site is located behind Swinerton Avenue beside the River Ouse.	Approximate distance to Severus Hi substation - 1km	Has capacity, 33 kV LDN has over 20% capacity.
		3	3	1	2	3	3	3			
38	Main Street/ Ousemoor Lane Recreation Ground	2.4 ha	Local playing fields	Flat	No designations. Local village playing fields	None	Receptors at primary school	School users and residents of Nether Poppleton	Site is playing fields in village of Nether Poppleton	Approximate distance to Poppleton substation - 1.8km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	2	1	3	3			
39	Acomb Wood	2.4 ha	Acomb wood local nature reserve (LNR) – woodland	Flat	Acomb wood local nature reserve	None	Surrounding residents and users of LNR	Surrounding residents and users of LNR	Entire site is comprised of designated woodland	Approximate distance to Gale Lane substation - 1.2km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	3	1	3	3			

#	Potential Site	Area available	Land use	Topography	Sensitivity	Flood risk	Glint and Glare	Landscape and visual	Overview	Distance to closest substation	Grid Connection Issues
40	Clifton (Aka Rawcliffe) Lake And Surrounds	2.4 ha	Public space surrounding lake	Flat	Local SINC Rawcliffe lake and grassland	Moderate	Surrounding residents and users of lake and public space	Surrounding residents and users of lake and public space	Public open space surrounding Rawcliffe lake	Approximate distance to Poppleton substation - 1.7km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	3	2	3	3			
41	Gale Lane Playing Field	2.9 ha	Playing fields	Flat	No designations but is valuable as recreational grounds	None	Surrounding residents and passing drivers	Surrounding residents	Large playing field in Acomb with pathway passing through	Approximate distance to Gale Lane substation - 0.3km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	2	1	3	3			
42	Crematorium Land	3.2 ha	Green land adjacent to Crematorium	Flat	SINC Middlethorpe crematorium. Naburn Marsh on other side of river	Significant	No sensitive receptors	No sensitive receptors in vicinity	Land adjacent to York crematorium, surrounded by trees which would reduce developable area due to shading. River Ouse immediately to the south. Drain and pond located within site boundary	Approximate distance to Campleshon substation - 1.7km	Has capacity, 33 kV LDN has over 20% capacity.
		2	2	1	2	3	1	1			
43	Esplanade Clifton Long Reach	3.2 ha	Flood plain area by Clifton long reach	Flat	No designations	Significant	Train line users/drivers	Residents and users of esplanade	Flood plain area beside Clifton long reach river, embankment and pathway within site.	Approximate distance to Skeldergat substation - 1km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	1	3	3	3			

#	Potential Site	Area available	Land use	Topography	Sensitivity	Flood risk	Glint and Glare	Landscape and visual	Overview	Distance to closest substation	Grid Connection Issues
44	Acres Farm Barn & Land	3.4 ha	Agricultural land	Flat	No designations	None	None	No sensitive receptors	Agricultural land in East riding of Yorkshire, very isolated.	Approximate distance to Campleshon substation - 1.5km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	1	1	1	1			
45	Bilsdale Close Land – Land to be leased to PC	3.4 ha	Local recreation ground	Flat	No designations	None	Local residents	Local residents and users of playing field	Site is comprised of 5 different areas of local recreation ground located within residential area	Approximate distance to Poppleton substation - 1.7km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	1	1	3	3			
46	Millfield Lane Poppleton Junior Football Club	3.6 ha	Football club pitches	Flat	No designations	None	Passing drivers	Local residents and users of football club	Sports fields used by Millfield Lane Junior football club	Approximate distance to Poppleton substation - 0.7km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	1	1	3	3			
47	Clifton Long Reach	3.7 ha	Flood plain along river Ouse	Flat	No designations	Significant	Passing drivers but on quiet road	Residents of Upper Poppleton but might not be too visible	Flood plain along Clifton reach liable to flooding	Approximate distance to Poppleton substation - 2km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	1	3	1	2			
48	Askham Bar Land 2	4 ha	Open land appears unused	Flat	Askham bog SSSI located on other side of railway	None	Passing drivers Tadcaster road	No sensitive receptors	Site located adjacent to railway south of Dringhouses. Land appears unused currently	Approximate distance to Gale Lane substation - 2.3km	Has capacity, 33 kV LDN has over 20% capacity.
		2	1	1	1	1	2	1			

#	Potential Site	Area available	Land use	Topography	Sensitivity	Flood risk	Glint and Glare	Landscape and visual	Overview	Distance to closest substation	Grid Connection Issues
49	Sim Hills Site (former household waste site)	4.8 ha	Brownfield site former tip	Flat	SINC: Askham bog SSSI located on other side of railway	None	Passing drivers Tadcaster road	No sensitive receptors	Site located adjacent to railway on former tip. Supermarket and Park & Ride located to north-east.	Approximate distance to Gale Lane substation - 1.9km	Has capacity, 33 kV LDN has over 20% capacity.
		2	1	1	1	1	2	1			
50	Rawcliffe Bar Country Park	10 ha	Country park	Flat	Rawcliffe bar country park. Cornfield local interest within site boundary	Moderate to significant	No sensitive receptors	Local users of Country park and residents of Rawcliffe	Site comprised of Rawcliffe Country park and cornfields to the south.	Approximate distance to Poppleton substation - 1km	Has capacity, 33 kV LDN has over 20% capacity.
		1	3	1	3	3	1	3			
51	Clifton Backies Nature Reserve	9 ha	Nature reserve, wooded area	Flat	Whole site is LNR and SINC. Sites of roman camps (not designated)	None	Residential properties in Clifton	Nature reserve and local residents	Local nature reserve with extensive woodland. Local group 'Friends of Clifton Backies' likely to strongly oppose	Approximate distance to Haxby road substation - 0.9km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	1	3	1	2	3			
52	Hob Moor Nature Reserve (2)	1.8 ha	Hob Moor Local nature reserve, unimproved pasture including archaeological features	Flat	Whole site is part of Hob Moor LNR and SINC	None	Receptors at primary school	Nature reserve and local residents	Local nature reserve Hob Moor with extensive nature reserve to east and residential properties to west. Pathway traverses site.	Approximate distance to Gale Lane substation - 0.6km	Has capacity, 33 kV LDN has over 20% capacity.
		3	3	1	3	1	3	3			

#	Potential Site	Area available	Land use	Topography	Sensitivity	Flood risk	Glint and Glare	Landscape and visual	Overview	Distance to closest substation	Grid Connection Issues
53	St Peters School Playing Field	3.1 ha	Playing field	Flat	No designations	Moderate	Local residents and receptors at primary school	Walkers along river, school students, local residents	Playing fields next to St. Peters school with River Ouse located to the south	Approximate distance to Skeldergat substation 0.9km	Has capacity, 33 kV LDN has over 20% capacity.
		2	2	1	1	2	3	3			
54	Hermitage Farmland Site (750)	8.8 ha	Agricultural	Mostly flat; small hill in Western area	Towthorpe Dam Hill, an area of local interest, is located directly South. Strensall Common Nature Reserve and SAC is located directly North.	None	No receptors	Quite isolated location; no designations within site boundary; passing traffic and nature reserve directly North.	Site is split into two parts: agricultural land in East, unknown land use in West. Forested area between both areas.	Approximate distance to Elvington substation - 5km	Has capacity, 33 kV LDN has over 20% capacity.
		2	3	2	2	1	1	2			
55	Knapton Moor 2	1.9 ha	Agricultural	Flat	No designations	Low	Passing drivers	Isolated area; no designations	Agricultural land located ~ 1 km South West of Knapton village	Approximate distance to Gale Lane substation - 2.4km	Has capacity, 33 kV LDN has over 20% capacity.
		3	3	1	1	1	2	2			
56	Askham Bryan (site 253)	3 ha	Greenfield site	Flat	No designations within site or nearby	None	Passing drivers	No designations	Site is located by A1237, north of a roundabout, a sewage works is located immediately north	Approximate distance to Gale Lane substation - 3.2km	Has capacity, 33 kV LDN has over 20% capacity.
		3	2	1	1	1	2	1			

5.5 Key Findings

Table 5-3 shows the solar sites ranked according to their grading in the assessment. Sites with a total grading between 7-10 are considered to have the most potential for development (green), those with between 11-13 have medium potential (orange) and sites with gradings greater than 13 are considered to have the least potential (red). The potential solar farm capacity for each site has been calculated based on a density of 1MWp per 1.5 hectare and the estimated annual energy output then calculated using the method outlined in the '*Guide to installation of Photovoltaic systems MCS 2012*'[19].

Table 5-3 Ranking of Individual Sites by Solar Farm Potential

#	Potential Site	Area available (ha)	Total grading	Potential solar farm capacity (MWp)	Estimated annual energy generation (MWh)	Carbon Abatement Potential (tCO_{2e}/yr)
27	Elvington Airfield	17.5	7	11.7	10,162	4,914
26	North Carlton Farm, Stockton-on-the-forest	32	9	21.3	18,581	8,985
12	South of Airfield Business Park (site 97)	12	9	8.0	6,968	3,370
49	Sim Hills Site (former household waste site)	4.8	9	3.2	2,787	1,348
48	Askham Bar Land 2	4	9	2.7	2,323	1,123
6	Harewood Whin	68	10	45.3	39,485	19,094
23	Amalgamated East of Monks Cross (site 691)	14.4	10	9.6	8,362	4,044
29	Land Adjacent to Grimston Bar and A1079	10.5	10	7.0	6,097	2,948
7	Knapton Moor	9.8	10	6.5	5,691	2,752
21	Amalgamated sites of main street Elvington (site 297)	6.5	10	4.3	3,774	1,825
10	York Road, Dunnington (site 74)	4.8	10	3.2	2,787	1,348
44	Acres Farm Barn & Land	3.4	10	2.3	1,974	955
35	Tadcaster Road Ashfield Estate Land 1	0.02	10	0.01	12	6
25	Amalgamated sites between Knapton and Westfield (327)	26	11	17.3	15,097	7,300
20	Amalgamated sites East of Earswick (site 296)	21.5	11	14.3	12,484	6,037

[19] kWh/kWp value of 871 has been used based on tilt angle of 20° which is not optimal for this area but allows greater density of panels to fit in the available area. Orientation directly south and no shading has been assumed.

#	Potential Site	Area available (ha)	Total grading	Potential solar farm capacity (MWp)	Estimated annual energy generation (MWh)	Carbon Abatement Potential (tCO_{2e}/yr)
16	Land to the West of A19, Escrick (site 188)	18.8	11	12.5	10,917	5,279
17	Land at Moor Lane, Copmanthorpe. Field No. 7222 (site 206)	10	11	6.7	5,807	2,808
18	Playing Fields and Village Fields off Askham Fields Lane (site 214)	8	11	5.3	4,645	2,246
29	Pool Bridge Farm	5.6	11	3.7	3,252	1,573
8	Land at Hull Road Dunnington (site 43)	4.8	11	3.2	2,787	1,348
14	Pond Field (site 170)	4.7	11	3.1	2,729	1,320
13	Land at Murton Lane Industrial Estate (site 161)	4	11	2.7	2,323	1,123
56	Askham Bryan (site 253)	3	11	2.0	1,742	842
24	Amalgamated site west of Chapelfields 1 (site 302)	42	12	28.0	24,388	11,793
11	Duncombe Farm, Strensall (site 76)	27	12	18.0	15,678	7,581
15	Land to the North of Escrick (site 183)	7.6	12	5.1	4,413	2,134
19	Land at Wetherby Road, Knapton (site 220)	7.6	12	5.1	4,413	2,134
31	Land to the west of Knapton	6.3	12	4.2	3,658	1,769
22	Land south west of Heslington Playing Fields	4.7	12	3.1	2,729	1,320
9	Flaxton Road, Strensall (site 53)	4.6	12	3.1	2,671	1,292
32	Wheatlands	3.5	12	2.3	2,032	983
42	Crematorium Land	3.2	12	2.1	1,858	898
33	Holgate Park Site	1.8	12	1.2	1,045	505
5	Millfield Farm	34.5	13	23.0	20,033	9,687
54	Land to NW of Hermitage Farmland (site 750)	8.8	13	5.9	5,110	2,471
4	Tadcaster Road Ashfield Estate Land	5.2	13	3.5	3,019	1,460
47	Clifton Long Reach	3.7	13	2.5	2,148	1,039
55	Knapton Moor 2	1.9	13	1.3	1,103	533
46	Millfield Lane Poppleton Junior Football Club	3.6	14	2.4	2,090	1,011
45	Bilsdale Close Land – Land to be leased to PC	3.4	14	2.3	1,974	955

#	Potential Site	Area available (ha)	Total grading	Potential solar farm capacity (MWp)	Estimated annual energy generation (MWh)	Carbon Abatement Potential (tCO_{2e}/yr)
53	St Peters School Playing Field	3.1	14	2.1	1,800	870
34	Askham Lane Bachelor Hill POS	2.2	14	1.5	1,277	618
2	Moor Lane Roundabout	1.3	14	0.9	755	365
50	Rawcliffe Bar Country Park	10	15	6.7	5,807	2,808
51	Clifton Backies Nature Reserve	9	15	6.0	5,226	2,527
41	Gale Lane Playing Field	2.9	15	1.9	1,684	814
38	Main Street/Ousemoor Lane Recreation Ground	2.4	15	1.6	1,394	674
30	The Retreat, Heslington Road	0.8	15	0.5	465	225
43	Esplanade Clifton Long Reach	3.2	16	2.1	1,858	898
39	Acomb Wood	2.4	16	1.6	1,394	674
1	Strensall Common	2	16	1.3	1,161	561
40	Clifton (Aka Rawcliffe) Lake And Surrounds	2.4	17	1.6	1,394	674
52	Hob Moor Nature Reserve (2)	1.8	17	1.2	1,045	505
36	Nelsons Lane/Mayfield Grove Land	1	17	0.7	581	281
3	Fulford Ings Love Lane POS	1.9	18	1.3	1,103	533
37	Swinerton Avenue Land POS 1	1.6	18	1.1	929	449
	TOTAL			**341**	**297,021**	**143,629**

Note: Abatement potential calculated using a carbon intensity of 0.48357 $kgCO_{2e}$/kWh

It can be seen that these sites offer a total technical potential of around 340 MWp with an annual energy output of 297,000 MWh and an associated carbon abatement potential of 144,000 tCO_{2e} (around 20% of present total energy related carbon emissions in the City of York).

While not precluding development at any of the sites assessed, if development was prioritised in terms of the first thirteen sites in the ranked list (i.e. those graded 7 – 10) then this would amount to around 142 MWp of capacity with an annual energy output of 124,000 MWh (an abatement potential of 60,000 tCO_{2e}). This is equivalent to the electricity demand of around 32,000 households (based on average domestic consumption figures for City of York in 2011 – Section 2).

5.6 Implications for emerging Local Plan

Providing a positive policy framework for solar development

The information presented in this section is relevant to the emerging Local Plan and wider planning decisions because it shows that through a positive policy framework for solar development then there are significant benefits that can be delivered in terms of both renewable energy supply and carbon emission reductions. Indeed, the assessment shows that ground-based solar capacity could meet approximately 20% of the City's electricity demand and offset some 144,000 tonnes of CO_{2e} per annum.

Allocating sites

For the sites where the is landowner/developer interest, such as Knapton Moor 2 and Hermitage Farmland, the Council could pursue these particular sites for allocation in the plan, subject to further technical work alongside public and stakeholder consultation.

Supporting developer and landowner understanding of wider potential

In addition, through the plan-making process and publication of this study, other landowners may also want to secure allocations in the plan. It is important to recognise however that for many of the sites considered, the developer or landowner may still want to pursue residential or commercial development on these sites rather than solar schemes – this will be for further discussion between the site promoters and City of York Council.

Relationship with strategic site allocations

Solar PV is likely to have an integral role in meeting national building regulations and local planning policies for energy efficiency on the strategic site allocations (Refer Appendix C). It is clear that it is by far the most popular technology currently in use in York (driven by financial incentives such as the FiT) and a number of models produced by Government and the Zero Carbon Hub show that solar PV alongside improvements to the fabric of a building will be the most cost effective way to achieve low and zero carbon development (the cost of a typical 4 kW solar PV system is circa £6,000-7,400 per dwelling at present, but the costs are continuing to fall – see also Appendix C-2).

Retrofitting

One further opportunity may be to continue to promote the benefits of retrofitting solar PV to existing homes and businesses, building on the significant level of deployment that has already occurred in York.

6. Renewable Resource: Biomass

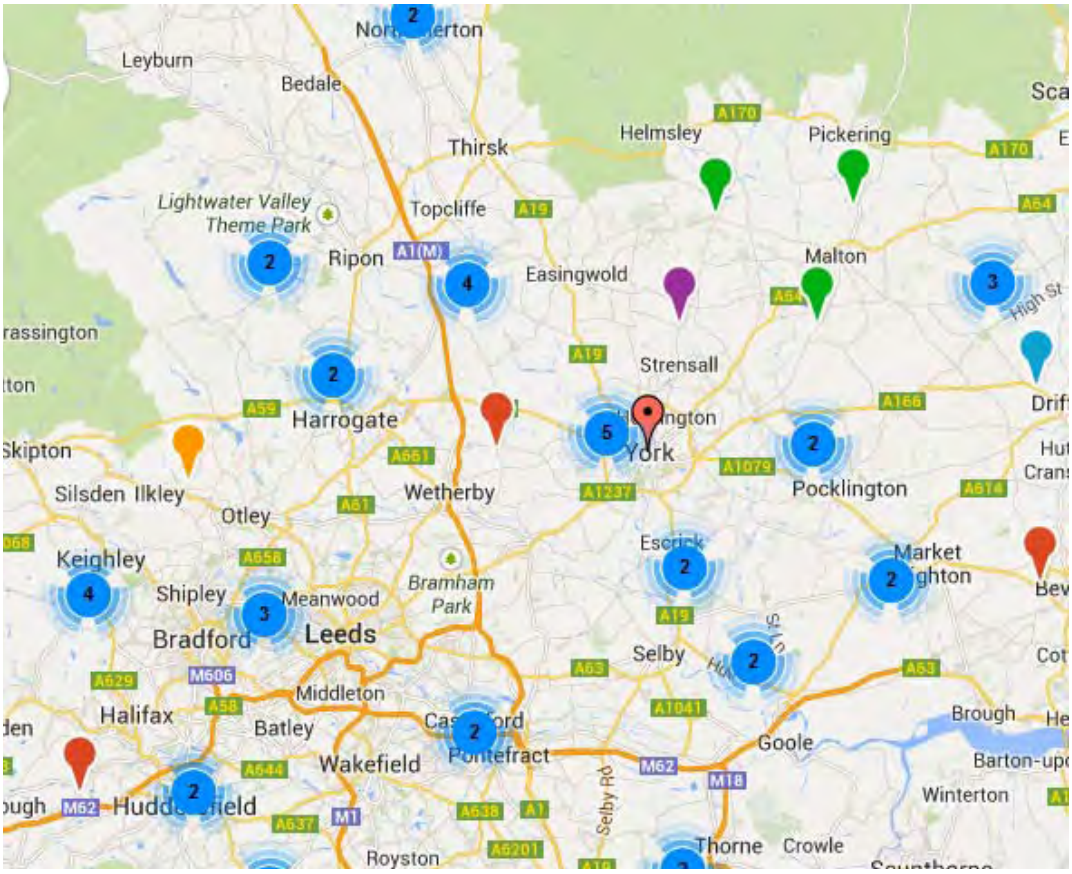
6.1 Sources of Biomass

There are a number of different potential sources of biomass material in the local area, summarised in this section.

6.1.1 Existing Supplier Network

There is a mature biomass supply chain operating within the Yorkshire region with a number of different suppliers in operation. A snapshot of the spatial extent of these suppliers is provided in Figure 6-1.

Figure 6-1 Biomass Suppliers in the York Area



Note: Reproduced from www.woodfueldirectory.org (Accessed November 2013)

These suppliers offer a range of products from logs, chips and pellets to briquettes.

6.1.2 Forestry Commission Data

The Forestry Commission provides data relating to the potential availability of woody resources across the UK[20]. These figures provide an initial estimate of an annual sustainable production level of biomass from within forest areas and regions of England and Wales. Figures for Yorkshire and the Humber are reproduced in Table 6-1.

Table 6-1 Estimated Annual Sustainable Production of Woodfuel in Yorkshire & The Humber

Region	Forest and Woodland (ODT)	Arboricultural Arisings (ODT)	Short Rotation Coppice (ODT)	Primary Processing Co-Products (ODT)
Yorkshire & The Humber	228,332	90,079	7,703	18,969

In the specific case of the North Yorks Moors forest an estimate of the sustainable production potential is provided in Table 6-2. These figures provide an estimate of the annual sustainable production that can be made available taking account of technical and environmental constraints. It accounts for all woodland area over 2 Ha in size. While the figures are stated in terms of oven-dry tonnes, in reality the fuel would be supplied with a moisture content of anything between 30% (conditioned woodchips) to 50% for harvested brash.

While this provides an extensive potential resource a number of power stations and large energy users in the Yorkshire & The Humber region have a growing demand for large quantities of biomass fuel. This is likely to put upward pressure on local resources since supply contracts are typically agreed with suppliers within a certain local radius of the point of use. It does not take into account any subsequent processing of wood fuel for supply to market. The value of wood fuel is higher when processed in the form of chips or pellets (and meeting national fuel standards) than in unprocessed form.

[20] http://www.forestry.gov.uk/pdf/niyorkshireandthehumber.pdf/$file/niyorkshireandthehumber.pdf (Accessed November 2013)

Table 6-2 North Yorks Moors: Forestry Commission and Private Sector Thinning and Felling Biomass Forecast(Oven Dried Tonnes) estimated average annual production

Period	Species	Stemwood				Poor Quality (odt)	Tips (odt)	Branches (odt)	Foliage (odt)	Total (odt)
		7 14 (odt)	14 – 16 (odt)	16 – 18 (odt)	18+ (odt)					
2012 - 2016	Pines	7,934	4,468	4,699	33,583	99	339	3,704	1,613	56,441
	Spruces	7,368	4,098	4,293	27,402	0	282	3,659	1,613	48,716
	Other Conifers	5,173	2,668	2,928	25,784	504	231	2,241	997	40,526
	Broad Leaves	4,531	3,086	3,925	45,881	4,106	272	11,330	0	73,130
2017 – 2021	Pines	6,303	3,713	4,090	34,157	374	272	3,476	1,501	53,886
	Spruces	8,040	4,530	4,806	29,564	0	308	3,873	1,709	52,829
	Other Conifers	4,021	2,357	2,708	22,642	1,305	178	1,909	843	35,963
	Broad Leaves	4,077	2,824	3,606	50,921	2,721	246	13,067	0	77,462
	Total (odt)	47,448	27,743	31,055	269,933	9,110	2,127	43,259	8,277	438,953

Note: Stemwood size ranges refer to the diameter in centimetres of the fuel produced.

6.1.3 Food Waste

Food waste provides a ready source of biodegradable material that can be used to generate energy. A process known as anaerobic digestion provides a way of breaking down the food waste and generating a combination of gas (known as biogas) and a solid residue that can, if processed correctly, be used as a soil conditioner or improver. Biogas can be used to generate electricity.

Anaerobic digestion can be carried out at a variety of scales of operation ranging from small scale units used by a small number of households or businesses to large scale processing plants that collect waste from large geographical areas (e.g. local authorities).

Experience from food waste collection schemes already set up in the UK suggests that the average amount of food waste generated by households (HH) is 1 kg/HH/week. Using this figure as a guide, then domestic food waste arisings within the City of York would amount to around 4,350 tonnes per year (based on 83,600 households[21]).

[21] http://www.york.gov.uk/info/200567/york_data_observatory/247/york_data_observatory/2 (Accessed November 2013)

Assuming that all of this waste was then used in anaerobic digestion it would provide a source of around 800 MWh of electricity per year.[22] This is equivalent to 210 households worth of annual electricity consumption (based on 2011 average domestic electricity consumption for City of York).

Non-domestic food waste arisings are more difficult to quantify, since there are typically a larger number of contractors involved in its collection. The number of different waste streams is also higher than the domestic equivalent.

6.1.4 Energy Crops

The increasing use of biomass as a fuel for energy generation plants has led to a rise in the growth of so called energy crops to meet this market demand. Species such as miscanthus or willow are grown on a short rotation coppice (SRC) basis in order to provide a sustained annual output.

The area around York benefits from having high grade agricultural land. As with the rest of the UK there is a balance to be struck between use of land for production of energy crops and other uses such as food production.

While any area of open land (brown or 53reenfield) is potentially available for the growth of energy crops the present study will focus on the land areas reviewed during the solar ground based array assessment. This provides for a total available land area of 500 Ha. At an indicative energy yield of 140 MWh/Ha/yr this suggests a total indicative energy yield of 70,000 MWh/yr. This is equivalent to the heat demand of 4,730 households in York based on 2011 average figures (see Section 2).

This does not take account for any assessment of site soil conditions and suitability for particular energy crops. It also assumes that no processing of energy crops are carried out on site, i.e. the site is used solely for cultivation and harvesting of crops rather than any further processing of chips or pellets prior to sale off site.

6.2 Practical Constraints

6.2.1 Environmental Permitting Legislation

Waste wood comes in a variety of different forms such as forestry management and offcuts from sawmills or other processing. When used as a fuel by non-domestic users it must meet certain criteria in order to avoid being classified as a waste stream. If it is classified as waste then the process of burning it is subject to environmental permitting and requires an application to the Environment Agency.

A summary of what forms of wood are classified as waste by the Environment Agency is provided in Table 6-3.

[22] This assumes a single facility operating for 8,000 hrs/yr with a 100 kWe gas reciprocating engine and a moisture content of waste of 70%.

Table 6-3 Classification of Waste Wood

Description	Non- Waste	Waste
Description	Virgin Timber	Non-virgin timber Mixed virgin and waste timber
Source of timber	Timber from whole trees/woody parts of trees Virgin wood processing	Untreated non-virgin timber Treated non-virgin timber (any chemical treatment such as oils, surface treatments and flame retardants)
Operations from which it arises	Forestry works Woodland management Tree surgery Timber product manufacture Sawmills (offcuts., shavings or sawdust)	Processing of non-virgin timber (offcuts, shavings, clippings and sawdust)
Purposes of use allowed	Woodchips in gardens/pathways Raw material for composting Animal bedding Fuel in an appliance Raw material for wood-based or paper products Natural cycle land management	

Source: AMEC

6.2.2 Air Quality Management Areas

In common with conventional combustion systems, biomass burning boilers can emit a number of pollutants including nitrogen dioxide (NO_2), particles (PM) and sulphur dioxide (SO_2). The mix and amounts of pollution produced will depend on the size and design of the boiler, the quality of the fuel used and any abatement (cleaning) measures installed locally to restrict the release of pollutants.

As a general rule of thumb, a well maintained biomass boiler will generate more local pollution than a similar gas fed system, but less than a conventional oil (or coal) fired boiler. As with all boilers, poor maintenance is likely to lead to higher pollutant emissions.

Batch fired appliances are fuelled by logs or lump wood. Continuously fired boilers on the other hand regulate the supply of fuel and combustion air to ensure continuous heat output at the desired level. In the latter case the fuel can be in the form of processed pellets or chips. Continuously fired boilers typically generate lower emissions than the batch fired equivalent.

For any proposed use of biomass boilers within the Air Quality Management Areas (AQMA) there would need to be consideration of both the local impact of the specific boiler and any cumulative impacts due to resulting clustering of boilers. This would centre around the specification of the boiler and its compliance with the Clean Air Act. Related to this would be sufficient provision for flues and chimneys to ensure dispersion of the resulting

particulate and waste gases. In the case of domestic installation the extent of chimney is determined via Building Regulations; for larger installations at non-domestic premises there may be a need for dispersion modelling to be undertaken to demonstrate how air quality management issues would be minimised.

6.2.3 Physical Sizing and Access

Biomass boilers are physically larger than the equivalent size of natural gas or oil fired boilers. This means that more physical space is required in a house or commercial premises to accommodate a boiler. Biomass boilers are typically floor rather than wall mounted so are better suited to larger domestic houses or non-domestic premises rather than smaller houses or flats.

Installation of a biomass boiler also means a need for a fuel storage area (typically wood chips or pellets) that can be directly accessed by delivery vehicles. This again typically restricts use of biomass boilers in high density development areas.

6.3 Key Findings

Wood Fuel

Estimated available annual sustainable wood fuel production within Yorkshire & The Humber amounts to 345,000 odt. However, in practical terms it is unlikely that more than 50% of this resource would be harvested (172,500 odt). The majority of this fuel is likely to be sold under contract to major industrial consumers in the Yorkshire and Humber region. Only larger households and commercial premises are capable of having biomass boilers installed due to their larger size and fuel storage requirements relative to gas boilers. It is therefore estimated that 5% of this fuel resource might be used for heat generation.

If all this fuel was used for energy generation it would produce something in the region of 91,425 MWh/yr (assuming a calorific value of 5,300 kWh/odt); this would meet around 5% of the existing heat energy demand in City of York.

Energy Crops

It is estimated that there is a land area of 500 Ha within the City of York region available for cultivating energy crops. At an indicative energy yield of 140 MWh/Ha/yr this suggests a total indicative energy yield of 70,000 MWh/yr. This is equivalent to the heat demand of 4,730 households in York based on 2011 average figures (see Section 2).

Food Waste

Experience from food waste collection schemes already set up in the UK suggests that the average amount of food waste generated by households (HH) is 1 kg/HH/week. Using this figure as a guide, then domestic food waste arisings within the City of York would amount to around 4,350 tonnes per year (based on 83,600 households[23]).

Assuming that all of this waste was then used in anaerobic digestion it would provide a source of around 800 MWh of electricity per year.[24] This is equivalent to 210 households worth of annual electricity consumption (based on 2011 average domestic electricity consumption for City of York).

Net technical potential for all three technologies is summarised here.

Table 6-4 Biomass: Technical Potential

Energy Source	Estimated Energy Generation Potential (MWh/yr)	Energy Output	Carbon Abatement Potential (tCO_{2e}/yr)	Equivalent Household Energy Consumption
Wood Fuel	91,425	Heat	16,800	6,180
Energy Crops	70,000	Heat	12,900	4,730
Food Waste	800	Electricity	400	210

Note: Equivalent Household Energy Consumption is based on 2011 figures for heat and electricity demand as presented in Section 2.

6.4 Implications for emerging Local Plan

Providing a positive policy framework for biomass

The information presented in this section is relevant to the emerging Local Plan and wider planning decisions because it shows that biomass could be used to supply energy, potentially supported by a positive planning framework which encourages anaerobic digestion and biomass boilers.

Relationship with strategic site allocations

The suitability of biomass to supply strategic site allocations has been considered (Refer Appendix C) and it could make a key contribution to both meeting energy demand and reducing CO_{2e} emissions on some of these sites.

[23] http://www.york.gov.uk/info/200567/york_data_observatory/247/york_data_observatory/2 (Accessed November 2013)
[24] This assumes a single facility operating for 8,000 hrs/yr with a 100 kWe gas reciprocating engine and a moisture content of waste of 70%.

7. Renewable Resource: Hydro

7.1 Hydro Energy Generation

Hydropower is a technology that is well established. Water flowing from a higher to a lower level is used to drive a turbine, which produces mechanical energy, which is usually turned into electrical energy by a generator. The energy produced is directly proportional to the flow volume of water and the head (distance from higher to lower level). There are high head–low volume applications and low head-high volume applications.

Larger scale projects involve a reservoir where a large body of water is stored (dammed) and then released to lower level enabling energy generation. The larger majority of schemes, however, are so called run-of-river schemes where water flow is diverted along a channel and through a turbine before being discharged back into the river at a lower point. A further design type, the Archimedes screw turbine, can be located directly in the flow of the river.

7.2 Assessment Methodology

The Environment Agency (EA) published a report looking at the opportunities for hydropower alongside the environmental sensitivity associated with exploiting hydropower opportunities to give a national overview[25]. This therefore provides a guide as to areas most likely to have potential to host a hydropower scheme. It is indicative only, and does not avoid the need for further analysis on a site by site basis to assess the viability of any given scheme.

The EA study suggests a number of potential sites within the City of York that may sustain a hydropower scheme. These have been reviewed with regard to:

- General location – proximity to built up areas
- Grid connection – availability of grid connection points
- Ecological – proximity to designated habitat areas and any specific species
- Landscape/Historic – proximity to conservation area or significant landscape features
- Flood risk – extent of flood risk zone

In terms of estimating the annual energy generation from potential hydro-power sites as similar methodology was utilised to that used in the Renewable Energy – Strategic Viability Study for York, Final Report (AEA, 2010).[26,27]

A summary of this assessment is provided in Table 7-1.

[25] http://www.environment-agency.gov.uk/shell/hydropowerswf.html (Accessed November 2013)
[26] For each hydro-power range, e.g. 0 – 10 kW, a mid-point in the range has been selected for available power output.
[27] A load factor of 50% for larger hydropower generators, and 37% for smaller potential sites.

7.3 Technical Potential

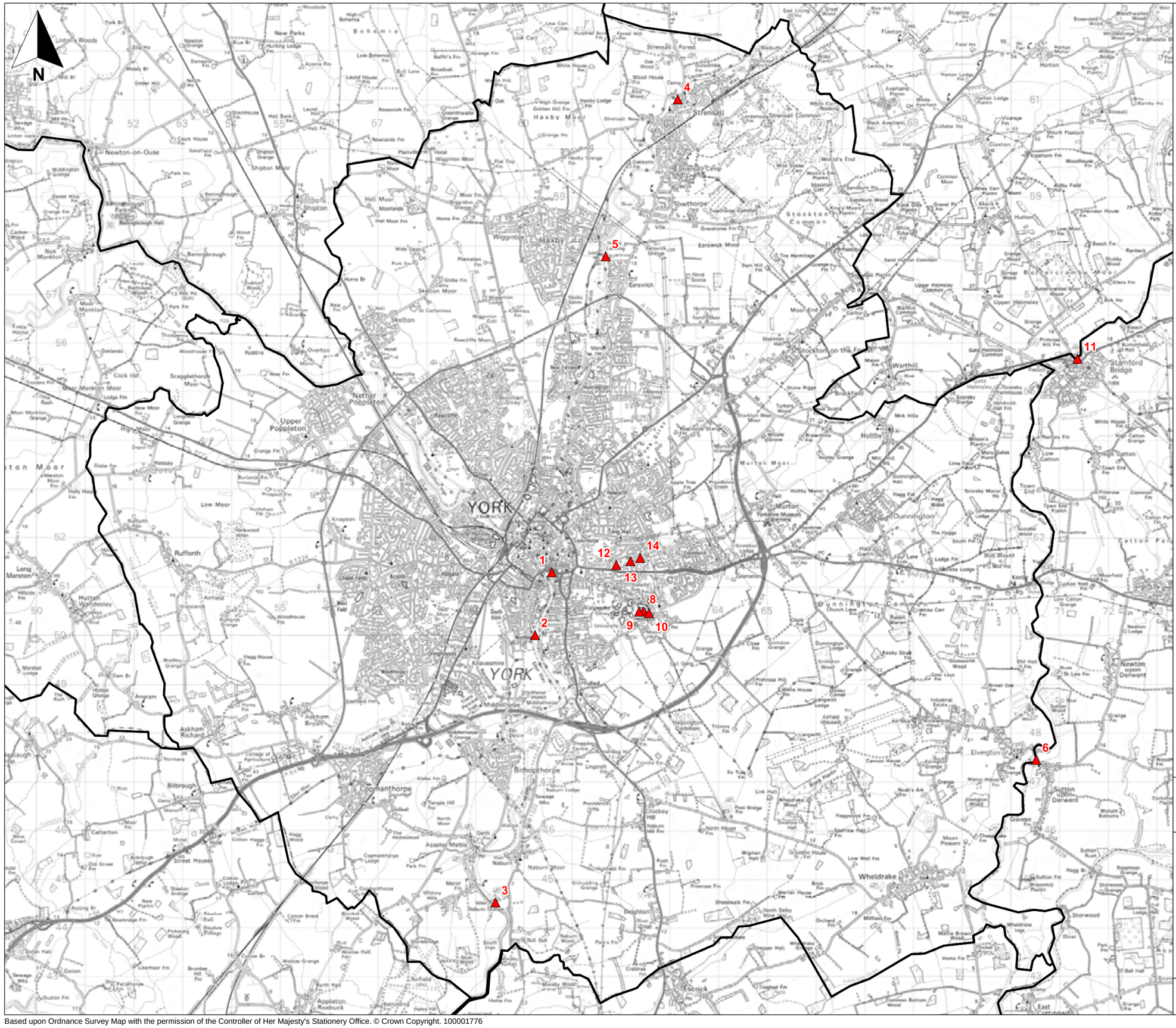
Table 7-1 Hydro Potential Summary

#	Site Name	River	Location	Predicted Power (kW)	Grid Connection	Distance to Closest Sub Station	Ecology	Landscape / Historic	Flood Risk	Comments	Potential hydro-power capacity (MW)	Estimated annual energy generation (MWh)
1	Foss Islands Weir	Ouse	City Centre	10 – 20	EHV(33 kV) has > 20% capacity; HV (11 kV) < 5% capacity	Skeldergat (0.4 km)	NA	City centre location, conservation area	Flood zone 3B, land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood.	Site appears to afford good potential head of water for hydropower development.	0.015	49
2	Nr. Fulford	Ouse	Nr. Fulford	10 – 20	EHV(33 kV) has > 20% capacity; HV (11 kV) < 5% capacity	NA	Near the SSSI Fulford ings	City centre location, conservation area	NA	Limited site viability	0	
3	Naburn Lock	Ouse	Naburn Lock	500 – 1,500	EHV(33 kV) has > 20% capacity; HV (11 kV) < 5% capacity	Camplesh on (5.6 km)	Two SSSI's close to the site, Church Ings and Acaster South Ings	Site on land that is a green corridor	Flood zone 3B	Large lock with large volume of water flow. Likely good resource.	1	4,380
4	The Tannery Weir Strensall	Foss	Near Haxby	10 – 20	EHV(33 kV) has > 20% capacity; HV (11 kV) < 5% capacity	Huntington (7.0 km)	Located on regional corridor in greenbelt	River Foss corridor, site of local interest		Lock / weir therefore possible enough flow and height difference.	0.015	49

#	Site Name	River	Location	Predicted Power (kW)	Grid Connection	Distance to Closest Sub Station	Ecology	Landscape / Historic	Flood Risk	Comments	Potential hydro-power capacity (MW)	Estimated annual energy generation (MWh)
5	Lock House Weir Earswick	Foss	Near New Earswick	10 – 20	EHV(33 kV) has > 20% capacity; HV (11 kV) < 5% capacity	Huntington (3.7 km)	Located on regional corridor in greenbelt	In a coalescent historical interest area? River Foss corridor, site of local interest		Lock / weir therefore possible enough flow and height difference.	0.015	49
6	Elvington Lock (Disused) & Elvington Weir	Derwent	Near Wheldrake	100 -500	EHV(33 kV) has > 20% capacity; HV (11 kV) < 5% capacity	Elvington (1.9 km)	Site within National Nature Reserve Wheldrake Ings, and near Important Bird Area, the lower derwent valley			Large weir with large volumes of water flowing, disused lock would also look promising. At edge of county boundary.	0.3	1,314
7	Nr. Thorganby	The Beck	Near Thorganby	0 -10	EHV(33 kV) has > 20% capacity; HV (11 kV) < 5% capacity	NA	Site within National Nature Reserve Derwent Ings, near Important Bird Area, the lower Derwent valley			Outside county boundary	0	-
8	Langwith College Weir	Germany Beck (feeding Ouse)	Near Hesington	0 – 10	EHV(33 kV) has > 20% capacity; HV (11 kV) < 5% capacity	York Uni (0.5 km)		University of York grounds		From aerial inspection appears to be limited head of water for viable hydropower scheme	0	-
9	Spring Wood Weir	Germany Beck (feeding Ouse)	Near Hesington	0 – 10	EHV(33 kV) has > 20% capacity; HV (11 kV) < 5% capacity	York Uni (0.5 km)		University of York grounds		From aerial inspection appears to be limited head of water for viable hydropower scheme	0	-

#	Site Name	River	Location	Predicted Power (kW)	Grid Connection	Distance to Closest Sub Station	Ecology	Landscape / Historic	Flood Risk	Comments	Potential hydro-power capacity (MW)	Estimated annual energy generation (MWh)
10	Derwent College Weir	Germany Beck (feeding Ouse)	Near Hesington	0 – 10	EHV(33 kV) has > 20% capacity; HV (11 kV) < 5% capacity	York Uni (0.4 km)		University of York grounds		From aerial inspection appears to be limited head of water for viable hydropower scheme	0	-
11	Stamford Bridge	Derwent	Stamford Bridge	20 – 50	EHV(33 kV) has > 20% capacity; HV (11 kV) < 5% capacity	Elvington (7.9 km)				Site looks to offer limited head of water but reasonable flow rates.	0.035	113
12	Osbaldwick Beck Weir Melrosegate	Derwent	On Osbaldwick Beck Weir	0 – 10	EHV(33 kV) has > 20% capacity; HV (11 kV) < 5% capacity	Melrosegat (0.4 km)			Flood zone 3B	Shallow weir suggests limited head of water for viable hydropower scheme.	0	-
13	Osbaldwick Beck Hull Weir Road Park	Derwent	On Osbaldwick beck weir	0 – 10	EHV(33 kV) has > 20% capacity; HV (11 kV) < 5% capacity	Melrosegat (0.5 km)			Flood zone 3B	Site offers potential head of water though shallow weirs either side may offer limited flow rates.	0.005	16
14	Osbaldwick Beck Weir Flaxman Avenue	Derwent	on osbaldwick beck weir	0 – 10	EHV(33 kV) has > 20% capacity; HV (11 kV) < 5% capacity	Melrosegat (0.6 km)			Flood zone 3B	Shallow weir suggests limited head of water for viable hydropower scheme.	0	-
	Total										1.4	5,969

The location of each site is shown in Figure 7.1.



Key

Council boundary

Hydropower site review location

Hydro-power Sites

1) Foss Islands Weir
2) River Ouse near Fulford
3) Naburn Lock
4) The Tannery Weir Strensall
5) Lock House Weir Earswick
6) Elvington Lock (Disused) & Elvington Weir
8) Langwith College Weir
9) Spring Wood Weir
10) Derwent College Weir
11) Stamford Bridge
12) Osbaldwick Beck Weir Melrosegate
13) Osbaldwick Beck Hull Weir Road Park
14) Osbaldwick Beck Weir Flaxman Avenue

0 km 4.5 km

Scale 1:75,000 @ A3

CITY OF YORK COUNCIL

City of York Council
Renewable and Low Carbon Energy Generation Options Update

Figure 7.1

Locations of Hydro-power Review

April 2014
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7.4 Key Findings

The estimated potential capacity for hydro scheme generation is 1.4 MW, which would produce something in the region of 5,970 MWh per annum of electricity. This is equivalent to meeting the annual electricity demands of 1,580 dwellings based on present average domestic electricity demand (see Section 2).

This potential assumes use of 'run-of-river' schemes, where water flow is diverted to power a turbine and then returned to the main river body.

Table 7-2 Hydro Potential Summary

#	Location	Potential Capacity (MW)	Estimated Annual Energy Generation (MWh/yr)	Carbon Abatement Potential (tCO_{2e}/yr)
1	Foss Island's Weir	0.015	49	24
3	Naburn Lock	1.0	4,380	2,118
4	The Tannery Weir Strensall	0.015	49	24
5	Lock House Weir Earswick	0.015	49	24
6	Elvington Lock (Disused) & Elvington Weir	0.3	1,314	635
11	Stamford Bridge	0.035	113	55
13	Osbaldwick Beck Hull Weir Road Park	0.005	16	8
All Sites		**1.4**	**5,969**	**2,887**

Note: Abatement potential calculated using a carbon intensity of 0.48357 $kgCO_{2e}$/kWh

This estimate does not preclude additional small scale (micro hydro) development in specific cases. This would be evaluated on a case-by-case basis. Any such developments would generate small quantities of electricity equivalent to demand from no more than a few households.

7.5 Implications for emerging Local Plan

Providing a positive policy framework for hydro

The information presented in this section is relevant to the emerging Local Plan and wider planning decisions because it shows that how hydro power could be used to supply some 6,000 MWh/yr and offset 2,887 tCO_{2e} per annum. The evidence presented in this section of the report could also be used to identify specific hydro projects, subject to further discussions with City of York Council.

Relationship with strategic site allocations

We have reviewed the potential for incorporating hydro as part of the strategic sites but in the main, potential is limited given the lack of watercourses/minimal flow rates to make hydro an attractive proposition.

8. Other Heat Sources

8.1 Solar Thermal

Solar thermal systems use solar energy to heat water which is stored in a hot water cylinder. A boiler or immersion heater is required to provide an additional source of heat over and above the energy available from the sun. Solar thermal panels (collectors) come in two designs:

- **Evacuated tube**: Water flows through a number of copper pipes, which in turn are sealed in a glass tube. This reduces heat losses and makes these systems very efficient at transferring the heat of the sun to the water;
- **Flat Plate**: Water flows through copper pipes that are encased with a glass covered plate.

Solar collectors are suitable for use in both domestic and light industrial premises as well as part of systems supplying swimming pools.

8.1.1 Installation Considerations

There are a number of factors to consider in relation to solar thermal system installation including:

a) As with solar PV systems the optimum roof space available to solar thermal systems is South facing areas with little or no immediate overshading;

b) The system must include a hot water cylinder to store the resulting hot water. It is therefore more costly to install a solar thermal system in properties with an existing combi boiler since there is no existing water tank;

c) The proposed installation area of the roof must be structurally capable of supporting the weighted of the water-filled collector;

d) Solar collectors are eligible for Renewable Heat Incentive (RHI) payments for each kWh of heat produced in a year;

e) Solar collectors are likely to be most cost effective when reducing water heating demand from electricity or oil/LPG fuelled systems, i.e. those not on the national gas grid.

8.1.2 Potential for York

As the existing statistics for York show in Section 3 there are a small number of solar collectors already installed, including two at School sites. The technical potential for further installation is limited by a number of factors:

- Not all buildings have suitable roof areas available (majority of existing flats ruled out and 30% of future development assuming a broadly 70:30 overall mix between houses and flats);
- For any given building only one of heat producing technologies would be installed (e.g. biomass boiler rather than solar thermal, or heat pump);
- For any given building only one of solar thermal or solar PV will be installed;
- Of remaining buildings not all will have South facing roofs (assumed at 50% in original AEA report)
- Properties that are off the national gas grid will benefit most from the introduction of solar thermal systems; and
- Solar thermal systems can be used as part of a design solution to achieve Code for Sustainable Homes Level 4; and
- In some instances built heritage designations may preclude installation of solar thermal systems.

8.2 Heat Pumps

There are three different forms of heat pump that can be used to provide space heating.

8.2.1 Ground Source Heat Pump

A ground source heat pump extracts heat from the ground, which can then be used to supply radiators, underfloor or war air heating systems and hot water systems. A mixture of water and antifreeze is circulated around the so called ground loop, which is a loop of pipe arranged either horizontally (in a trench) or vertically (in a borehole). The circulating water/antifreeze fluid absorbs heat from the ground and this is then passed through a heat exchanger and into the heating system.

8.2.2 Air Source Heat Pump

Air source heat pumps extract heat from the outside air using the same approach as a fridge uses to extract heat from its inside. Heat from the air is absorbed at low temperature into a fluid. This fluid then passes through a compressor where its temperature is increased, and transfers its higher temperature heat to the heating and hot water circuits of the house. The heat in the house can then be provided via an underfloor system, warm air circulated by fans or a wet radiator system using outsized radiators.

8.2.3 Water Source Heat Pumps

Water source heat pumps extract heat from water bodies. These can be lakes, ponds, rivers, springs, wells or boreholes. The heat transfer rate from water is higher than that from the ground or the air. So called ‘open loop’ designs circulate water via a heat exchanger and then discharge it back to the original source; a ‘closed loop’

system operates in a similar manner to a ground source heat pump with a water/antifreeze fluid mixture being circulated through pipes set within the water source.

An extraction licence is required from the Environment Agency when using open loop heat pumps that require more than 20 m^3/day of water to be abstracted from the water source (typically a 4 kW system and above). A discharge consent is also required for the cold water that has flowed through the heat pump.

Closed loop systems do not require any licensing from the Environment Agency.

8.2.4 Heat Pump Use

The heat output from heat pumps (whether ground, air or water) is lower than a typical wet radiator system fuelled via natural gas or oil. For this reason heat pumps are generally best used with underfloor heating, providing a larger surface area for supply. If used to supply a wet radiator system then these radiators need to be much bigger than conventional systems.

While the source of heat is renewable (ground, air or water), circulating fluid requires electricity to power the pumps. For this reason heat pumps are less economic to install in areas where natural gas fed heating systems already operate. In situations where heat pumps are replacing oil or electric heating systems the savings in terms of energy and cost will be more attractive.

The extent of the main natural gas network in York is shown in Figure 8-1. While the majority of properties have access to natural gas, there are a number of dwellings towards the extremities of the City boundary that don't. These dwellings are therefore likely to offer the best opportunities for heat pump installation.

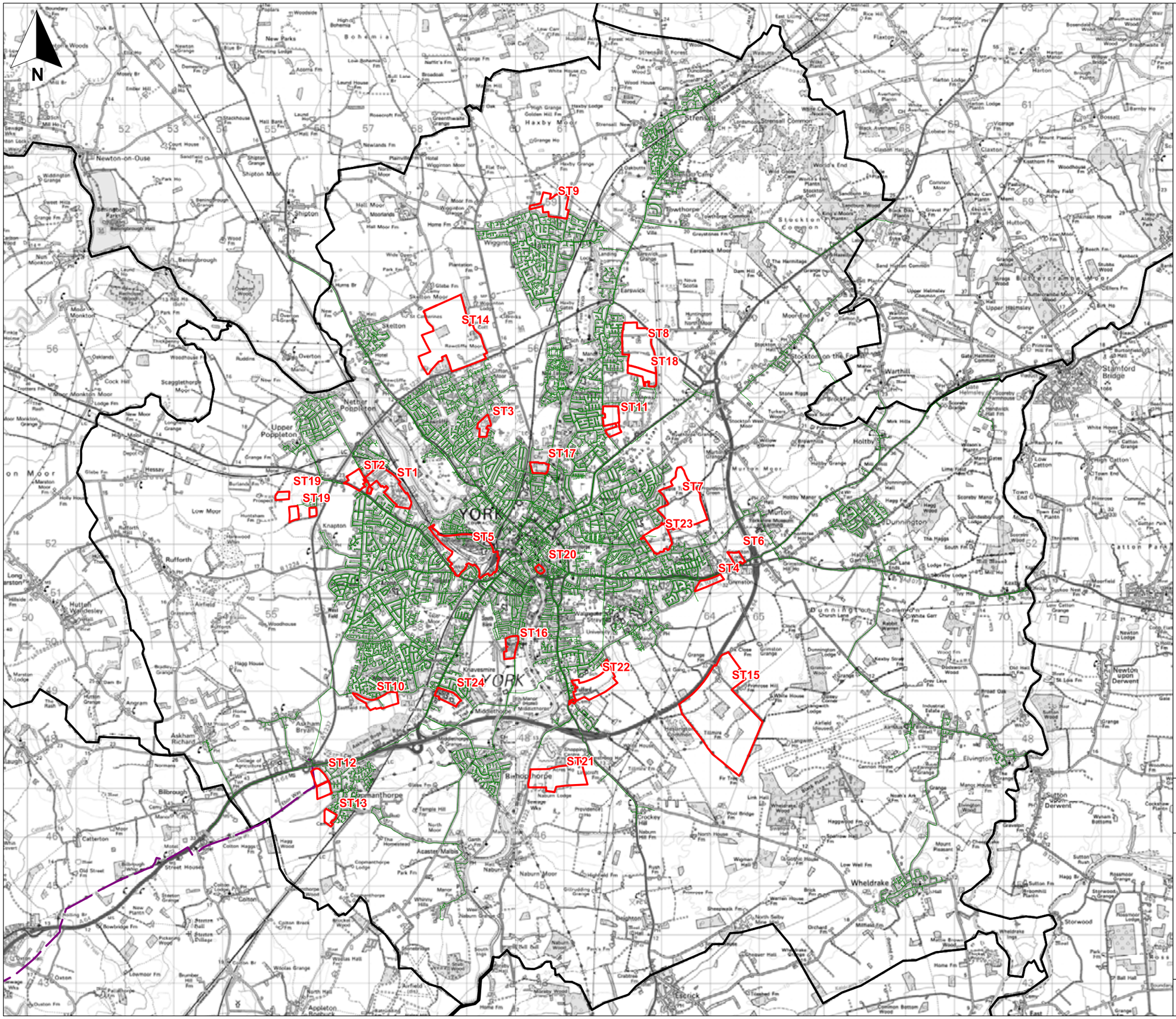
The majority of strategic sites outlined in the draft Local Plan are serviced by natural gas. The exception to this is the ST15 development site at Whinthorpe.

8.3 Micro-CHP

Micro-CHP, as the name suggests, are small scale combined heat and power (CHP) units designed for use in domestic premises. These units therefore feed space heating and hot water circuits in the dwelling just as a conventional boiler, but also provide additional energy output in the form of electricity. The electricity produced requires a single cable connection and can be readily integrated with existing electrical circuits.

Previous field trials conducted by the Carbon Trust suggest that micro CHP is best suited to larger houses[28]. There are a small number of commercially available units currently within the UK market, though this is anticipated to increase given the feed-in tariff support available to micro-CHP users.[29]

[28] http://www.carbontrust.com/media/77260/ctc788_micro-chp_accelerator.pdf (Accessed November 2013)
[29] http://www.ecuity.com/wp-content/uploads/2013/03/The-role-of-micro-CHP-in-a-smart-energy-world.pdf (Accessed November 2013)



Key

- Council boundary
- Strategic development area
- Local gas network
- Regional gas network

Strategic Sites

ST 1 - British Sugar
ST 2 - Former Civil Service Sports Ground, Millfield Lane
ST 3 - The Grainstores, Water Lane
ST 4 - Land adjacent Hull Road and Grimon Bar
ST 5 - York Central
ST 6 - Land East of Grimston bar
ST 7 - Land East of Metcalf Lane
ST 8 - Land North of Monks Cross
ST 9 - Land North of Haxby
ST 10 - Land at Moor Lane, Woodthorpe
ST 11 - Land at New Lane, Huntington
ST 12 - Land at Manor Heath Road, Copmanthorpe
ST 13 - Land at Moor Lane, Copmanthorpe
ST 14 - Land North of Clifton Moor
ST 15 - Whinthorpe
ST 16 - Terry's
ST 17 - Nestle South
ST 18 - Monks Cross
ST 19 - North Minster Business Park
ST 20 - Castle Piccadilly
ST 21 - Naburn Designer Outlet
ST 22 - Germany Beck
ST 23 - Derwenthorpe
ST 24 - York College

0 km 4.5 km

Scale 1:75,000 @ A3

CITY OF YORK COUNCIL

City of York Council
Renewable and Low Carbon Energy Generation Options Update

Figure 8.1

York Gas Network

April 2014
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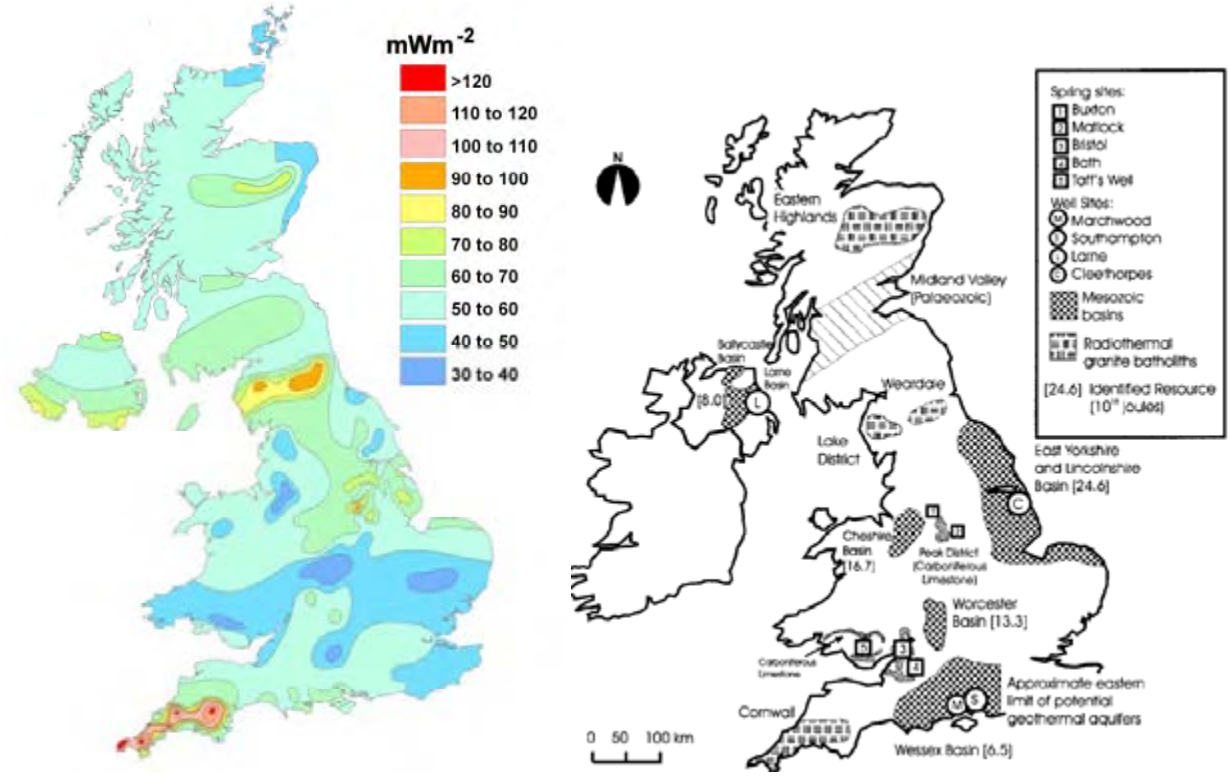
8.4 Geothermal

The potential for geothermal energy generation in the UK has been analysed as part of the Deep Geothermal Review study undertaken by DECC and summarised in a report released in October 2013[30]. The report used evidence from a number of previous studies examining the potential for geothermal energy generation in different areas of the UK.

The report identifies the key areas for UK geothermal resource which include granite outcrops in South West and northern England, and hot sedimentary aquifers in the Wessex and Cheshire basins (Figure 8-).

Figure 8-2 Heat Flow Map of the UK (Left); Location of Sedimentary Basins and Major Radiothermal Granites (Right)



Source: DECC

The report identifies key criteria for the viability of any geothermal power generation systems in terms of being able to access a thermal store of greater than 100 deg C at a depth of no greater than 5 km. On this basis, the report does not identify any significant potential for geothermal power production within the City of York region. The East Yorkshire and Lincolnshire Basin (which includes the City of York area) is mentioned in the report, (see figure 2). However, it is noted that the basin does not extend to a depth significantly below 2000 m. For this reason, temperatures above 100°C are unlikely to be found within the formation, which are required to make a geothermal power generation economically viable.

[30] Deep Geothermal Review Study Final Report Department of Energy & Climate Change (DECC) October 2013

8.5 Key Findings

Solar Thermal

It is difficult to provide a meaningful estimate of the potential capacity for this technology, given the factors outlined above. By definition, any such installations would be assessed on an individual basis. As an order of magnitude guide, based on previous estimates included in the 2010 report, there may be up to 1 MW of potential capacity, generating around 480 MWh/yr (an abatement potential of 100 tCO_{2e}).

Heat Pumps

Ongoing energy efficiency and fuel poverty initiatives may well encourage use of heat pumps in existing dwellings where these properties are off the natural gas network. There is considerable uncertainty therefore in what the potential installed capacity could be in the City of York region as a whole. There are a total of 58,900 households in North Yorkshire not connected to the gas network (16.5% of all households in the region)[31]. It is assumed that a small fraction of these households are within City of York; at 1% this would amount to 590 households. This would suggest an installed capacity of 3.8 MW generating 6,050 MWh/yr of heat[32] (an abatement potential of 1,100 tCO_{2e}).

Micro-CHP

Present feed-in tariff data suggests a total of 5 kW of capacity installed in the City of York region. This is unlikely to rise significantly in the period to 2030 and therefore will provide a very small contribution to renewable energy supply capacity in the region.

Geothermal

It is not anticipated that geothermal power production will feature in the future energy supply mix for City of York.

8.6 Implications for emerging Local Plan

Providing a positive policy framework for building-integrated renewables

The information presented in this section is relevant to the emerging Local Plan and wider planning decisions because it shows the important role that building-integrated renewables such as solar thermal and heat pumps could have. Both planning policy and building regulations will help to support the use of these technologies, where higher energy performance standards are required, particularly for new developments.

[31] http://www.northyorkshirestrategichousingpartnership.co.uk/index.php/private-sector-housing/energy-efficiency-and-fuel-poverty (Accessed February 2014)
[32] Assumption as per AEA 2010 report: average size of pump at 6.5 kW with a load factor of 18%.

Relationship with strategic site allocations

We have considered the role for the technologies reviewed in this section against the Council's strategic site allocations. It is clear that solar thermal will have by far the biggest potential, followed by heat pumps (Refer Appendix C-2 for cost information). The other technologies (micro-CHP and geothermal) are unlikely to have a significant role to play in the energy strategy for these allocations.

Retrofitting existing dwellings

In addition, the retrofitting of these technologies to existing properties in York, particularly solar thermal, could have a key role to play in addressing the high heat demand and reducing relation emissions. In Section 10 we consider how planning policies could help to support this, be it through an 'allowable solutions' fund (developers looking to offset residual emissions off-site through investing in retrofit programme) or wider measures that the Council could take – e.g. investing in its social housing stock.

9. Decentralised Energy Networks

9.1 Existing Supply Networks

As mentioned in Section 3, there are a small number of district heating schemes already operating in York:

- The University of York operates a district heating scheme across its main campus. This is presently supplied by two 1.5 MW Combined Heat and Power (CHP) units alongside a biomass boiler.
- The Joseph Rowntree Housing Trust provides heating for 540 dwellings at the Derwenthorpe site through the combination of two 320 kW biomass boilers and four 620 kW gas boilers.

In addition to these existing networks it is also of note that there are CHP units in operation at the Nestle company site and to be installed at the City Hospital. These are potential heat sources from which district heating networks can be built.

9.2 Assessment Methodology

Sites for potential district heating have been evaluated against a number of criteria:

- Base load demand – relative size of heat demand annually and likely diversity of this load across a 24 hour period
- Anchor loads – presence of large ‘anchor’ loads either within proposed development or in close proximity to the site
- Residential Potential – extent of residential demand on site available to a proposed network
- Ease of Access – How easily site can be accessed for installation of plant and maintenance visits/fuel delivery
- Expansion Potential – how easily could an initial network including the relevant site be expanded to other local users.

Each criterion has been allocated a score of between 1 – 3 (1 is low, 3 high) and the aggregate scores for each site ranked to develop an overall table listing sites with highest potential at the top and least potential at the bottom.

9.3 Strategic Sites

Table 9-1 District Heating Potential Assessment

Overall Development Potential	Strategic Site	Commentary
High Potential	ST5	Central site with large loads and demand diversity (residential, retail and office).
	ST7	Anchor loads to South of site on Industrial Estate. Potential link to ST23.
	ST15	DH could be incorporated in masterplan. CHP more viable if schools and retail included in masterplan.
	ST23	Potential to link with ST7 and Industrial Estate to East of site
Medium Potential	ST4	University DH scheme runs to buildings to South of site. Potential to explore connection to University network.
	ST8	School to SW of site provides potential load diversity
	ST11	Adjacent retail premises and Sports Stadium offer scope to develop heating network. Refurbishment of Monks Cross could incorporate CHP.
	ST12	Would need either small retail or Askham Bryan College to make DH viable. College is on other side of major road (A64)
	ST14	Retail Park is separated by major road. However, retail units may offer baseload potential – particularly supermarket (heating and chilling)
	ST17	CHP already installed at Nestle site and to be installed at City Hospital. Might be able to get these sites to supply heat to residential units.
	ST18	Link to ST8 and existing retail/proposed employment site
	ST20	Small scale opportunity unless retrofit is undertaken with adjacent premises
	ST22	Without other anchor loads this would be a small scheme.
Low Potential	ST1	Residential demand means low baseload. Limited scope to extend supply to other loads. Constrained by railway line in linking to E13.
	ST2	Residential demand means low baseload. Limited scope to extend supply to other loads. Constrained by railway line in linking to E13.
	ST3	Predominantly residential demand. Local expansion also predominantly retrofit for existing homes. Some light industrial but limited heating demand.
	ST6	No major base loads in proximity to site and constrained on East and South sides by major roads.
	ST9	Safeguarded land constrains site. Limited demand beyond residential therefore high degree of retrofit required for expansion.
	ST10	No anchor loads in vicinity. Reliant on retrofit to resident to grow network.
	ST13	No anchor loads surrounding site. Expansion potential limited to existing dwellings

Overall Development Potential	Strategic Site	Commentary
	ST16	No anchor loads in proximity.
	ST19	Light industrial load profile; no scope for expansion. Constrained by A59 road to North.
	ST21	Reliant on existing site energy solution
	ST24	Reliant on existing site energy solution

Further details are provided in Appendix A.

9.4 Key Findings

District heating schemes are considered an important element of UK Government's overall efforts to reduce energy related carbon emissions. The combination of national building standards and implementation of EU Directives are key drivers in encouraging greater uptake of decentralised energy systems.

Assessing the realistic potential for district heating in City of York is difficult since the business case for such schemes is highly sensitive to the scale of heat consumers that can be signed up. The prime energy generation plant (combined heat and power or stand-alone boiler) also directly impact the energy and carbon benefits available on any scheme.

By way of illustration, if district heating schemes using combined heat and power were implemented at the three sites considered of highest potential then this would amount to around 14 MW of capacity generating in the region of 85,000 MWh of heat per annum and 35,000 MWh/yr of electricity. This is a carbon abatement potential of around 32,600 tCO_{2e}/yr (based on present emission factors of 0.48357 $kgCO_{2e}$/kWh for grid electricity and 0.18404 $kgCO_{2e}$/kWh for mains natural gas).

9.5 Implications for emerging Local Plan

Providing a positive policy framework for district heating linked to the strategic site allocations

The information presented in this section is relevant to the emerging Local Plan and wider planning decisions because it shows the key role that district heating could play, particularly alongside the development of future strategic site allocations (specifically ST5, ST7, ST15 and ST23). Of course, feasibility and viability will ultimately depend on the mix of uses and densities proposed as part of these schemes, and whether or not the developer/landowner can bear the up front costs for installing such a network. One option may be to set up an energy services company (ESCO) who could take on the costs and risks associated with installing a network. At the very least, the Council could ask that the potential for district heating networks is explored as the strategic site allocations are progressed, drawing on the findings of this study.

10. Supporting the Local Plan

10.1 Why the Local Plan is Important

Responding to national policy and legislation

The 2008 Climate Change Act commits the UK Government to delivering an 80% reduction in carbon emissions by 2050 (against a 1990 baseline) in order to help mitigate future climate change. With energy use from the built environment accounting for a significant proportion of the UK's total carbon emissions[33] the Government has identified both the spatial planning system and building regulations as having key roles to play.

The role of the planning system in reducing emissions is affirmed in the National Planning Policy Framework (NPPF)[34] by encouraging local planning authorities to plan for new development in ways which reduce emissions (linked to wider policies on reducing the need to travel by car), actively supporting energy efficiency improvements to buildings and linking with the government's policy for zero carbon buildings (zero carbon homes from 2016 and for all other development from 2019 – see Glossary for further details). The NPPF also requires local planning authorities to have a positive strategy to promote energy from renewable and low carbon sources, design policies to maximise renewable and low carbon energy development, consider identifying suitable locations for such developments, support community-led initiatives and identify opportunities where development can draw its energy supply from decentralised, renewable or low carbon sources[35].

In order to meet the 2016 zero carbon target for homes, incremental changes have been made to Part L (Conservation of Fuel and Power) of the original 2006 Building Regulations: 2010 regulations represented a 25% improvement in carbon performance against 2006, with 2013 regulations representing a further 6% improvement. Wider measures relating to reducing emissions from the built environment include the introduction of the Green Deal[36], retention of Energy Performance Certificates[37] and supporting use of the Code for Sustainable Homes (CSH) and Building Research Establishment Environmental Assessment Methodology (BREEAM). In parallel, financial incentives such as the Feed-in-Tariff[38] are encouraging property owners to retrofit technologies such as solar PV on their buildings (see Glossary for further details).

[33] In 2009 buildings accounted for about 43% of all the UK's carbon emissions - source: Department for Communities and Local Government, https://www.gov.uk/government/policies/improving-the-energy-efficiency-of-buildings-and-using-planning-to-protect-the-environment (accessed February 2014)

[34] Department for Communities and Local Government, March 2012

[35] Refer Paragraphs 95-97, NPPF

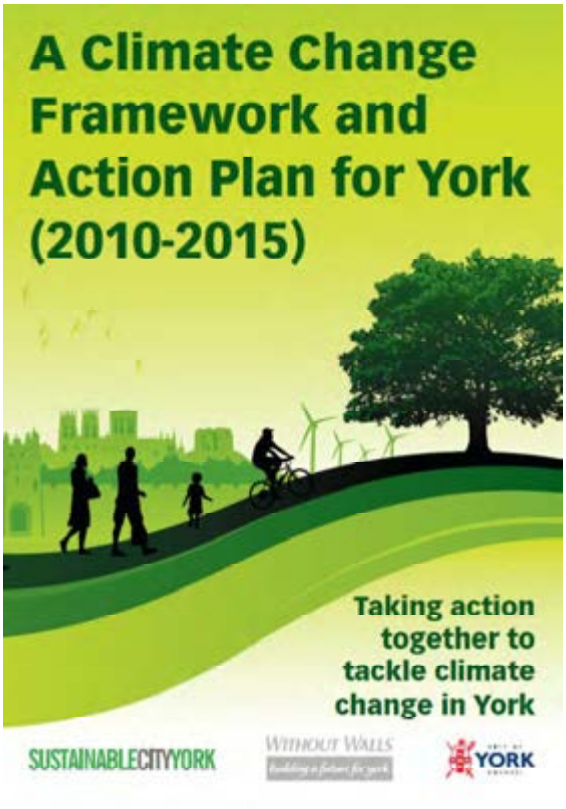
[36] https://www.gov.uk/green-deal-energy-saving-measures (accessed February 2014)

[37] https://www.gov.uk/buy-sell-your-home/energy-performance-certificates (accessed February 2014)

[38] http://www.energysavingtrust.org.uk/Generating-energy/Getting-money-back/Feed-In-Tariffs-scheme-FITs (accessed February 2014)

Realising local commitments in response to climate change

It is within the national context of reducing emissions and responding to climate change that City of York Council published its *Climate Change Framework and Action Plan for York.*



The Action Plan commits the city to a 40% reduction in CO_2 emissions by 2020 (2005 baseline) and an 80% reduction by 2050 (1990 baseline). It also commits the city to making full use of the potential for low carbon, renewable and local sources of energy generation across York. Ten key areas are identified for the city to focus on and progress now and in the future:

1. Sustainable Homes
2. Sustainable Buildings
3. Sustainable Energy
4. Sustainable Waste Management
5. Sustainable Transport
6. Sustainable Low Carbon Economy
7. Sustainable Low Carbon Lifestyles
8. Sustainable Planning, Agriculture and Land Use
9. Sustainable Without Walls Partnership
10. Preparing for Climate Change

The new Local Plan will have an influence across all ten of these areas but the aim of this report is to help identify how policies in the plan can influence the first three areas – sustainable homes, buildings and energy. At present, the Council's draft policies in response to these topic areas are set out in the 2013 Preferred Options draft of the Local Plan (see Box 10.1 for current policies as drafted). Planning policies adopted in the City of York Local Plan will of course form *part* of an overall package of measures in the City's response to climate change and achieving an 80% reduction in emissions by 2050 alongside a range of other factors including:

- Wider policies in the Local Plan in terms of influencing the location and mix of uses within new development in terms of reducing the need to travel by car and promoting walking, cycling and use of public transport.
- Council-led strategies and initiatives to reduce emissions as a signatory to the 10:10 Campaign and Nottingham Declaration on Climate Change, such as ensuring energy efficiency and using renewable energy on Council properties.
- The impact of national policies and strategies at the local level, for example efforts to decarbonise the grid, zero carbon building agenda, Green Deal, Feed-in-Tariffs etc.

- Changes in technology through to 2050, including smart cities[39], greater use of alternative fuel sources (e.g. hydrogen fuel cells) and social and economic changes associated with the move to a low carbon economy.

Box 10-1 City of York Local Plan Policies, 2013 Preferred Options Consultation as Drafted

Policy CC1: Supporting Renewable and Low Carbon Energy Generation

The Local Plan will support and encourage the generation of renewable and low carbon energy through proposals that meet all of the following requirements:

3. *respond positively to the opportunities identified in The Renewable Energy Strategic Viability Study for York (2010) and as shown as potential areas of search for renewable electricity generation on the proposals map; and*

ii. are in accordance with the Plan's Spatial Strategy; and

iii. demonstrate that there will be no significant adverse impacts on landscape character, setting, views, heritage assets and Green Belt objectives; and

iv. demonstrate benefits for local communities.

Policy CC2: Sustainable Design and Construction

All new development will be expected to make carbon savings through reducing energy demand, using energy and other resources efficiently and by generating low carbon / renewable energy in accordance with the energy hierarchy. The key areas the Council will seek to address this through the Local Plan are:

A. Sustainable Design and Construction of New Development

i. All new development will be required to produce a Sustainability and Sustainable Energy Statement to demonstrate that the following minimum standards of construction (or other equivalent standard) are achieved, unless it can be demonstrated that it is not feasible or viable:

*- New Build Residential Developments: Code for Sustainable Homes Level 4****;*

- Conversions of existing buildings and changes of use to residential, to achieve BREEAM Eco-Homes 'Very Good';

- Minor Non-residential Developments: BREEAM "Very Good"; and

- Major Non-residential Developments: BREEAM "Excellent".

ii. All major development shall make provision of and connection of infrastructure to a network for an existing or proposed Combined Heat and Power Station or District Heating Network unless it is demonstrated that a better alternative for reducing carbon emissions for the development can be achieved or it is not technically possible.

iii. If "Allowable Solutions" are introduced, the Council will require developers to achieve zero carbon standards through energy efficiency and carbon compliance on site. Where this is not feasible, developers will be expected to explore with the Council local off-site solutions to meet zero carbon standards.

B. Consequential Improvements to Existing dwellings.

When applications are made to extend dwellings the Council will seek to secure reasonable and proportionate improvements to the energy performance of the dwelling. This will be in addition to the requirements under Part L of the Building Regulations for the changes for which planning permission is sought.

C. District Heating and Combined Heat and Power Networks

For all allocated new development and residential development of 10 dwellings or more, and non residential development (of 1000m2 or more) gross external floor space the Sustainable Energy Statement will also be required to integrate Combined Heat and Power and district/block heating networks or cooling infrastructure, and uses reasonable endeavours to provide the necessary infrastructure to:

i. Establish and provide a new network on site; and

ii. Connect to existing networks where available; and

iv. Provide development designed to provide for future connection.

Unless it is technically not feasible or viable.

[39] https://www.gov.uk/government/news/uk-set-to-lead-the-way-for-smart-cities (accessed February 2014)

10.2 Key considerations for future policy development

Reflecting on feedback in response to CC1 and CC2

Through the 2013 Preferred Options consultation a significant number of responses were received regarding Policy CC1. Whilst some consultees were generally supportive of a positive policy approach to renewable energy generation, concerns were raised regarding the environmental impacts of renewable energy developments on York's environmental assets particularly in relation the potential areas of search for wind development identified on the proposals map (Policy CC1 infers that proposals for these areas of search will be considered favourably). Particular concerns relating to wind energy included:

- The effectiveness of wind turbines in terms of energy generation
- Impacts on heritage, landscape, ecology and Green Belt
- Proximity to existing communities in terms of amenity and property values

In terms of CC2 the focus of representations included:

- Concerns from developers regarding the impacts on viability of seeking higher Code for Sustainable Homes and BREEAM levels.
- Concerns from developers regarding the 10 dwelling threshold for district heating networks.
- Concerns from others that the policy does not go far enough in terms of seeking truly sustainable buildings (e.g. a need to be delivering Code for Sustainable Homes Level 6 as soon as possible).

This feedback needs to be addressed in the development of policies for the next version of the Local Plan.

The implications of AMEC's evidence base

Renewable and Low Carbon Energy Policy (CC1)

Within the context of Policy CC1, AMEC's evidence base is helpful because:

- It shows that there is a widespread renewable and low carbon energy resource which can help York go beyond its existing renewable energy capacity, to exceed the equivalent proportion that renewables currently make towards City-wide energy consumption (currently approx. 1.6%).
- It identifies likely development costs per MW of installed capacity for each of the different renewable energy technologies (Appendix E).
- It demonstrates that wind and solar technologies have by far the biggest potential in terms of driving forward additional renewable energy capacity, also highlighting the planning and environmental criteria that would need to be taken into account in response to previous consultation responses:
    - Anticipated effects resulting from development, construction and operation such as air quality, atmospheric emissions, noise, odour, water pollution and the disposal of waste

- Acceptability of the location, and the scale of the proposal and its visual impact in relation to the character and sensitivity of the surrounding landscape.
- Effect on national and internationally designated heritage sites or landscape areas, including the impact of proposals close to their boundaries.
- Effect of development on nature conservation sites and features, biodiversity and geodiveristy, including internationally designated and other sites of nature conservation importance, and potential effects on settings, habitats, species and the water supply and hydrology of such sites.
- Accessibility by road and public transport.
- Effect on agriculture and other land based industries.
- Visual impact of new grid connection lines.
- Cumulative impact of the development in relation to other similar development.
- Proximity to the renewable fuel source such as wood-fuel biomass processing plants within or close to major woodlands and forests.
- Impacts on Green Belt purposes and need to demonstrate 'exceptional circumstances' (for plan-making) or 'very special circumstances' (for decision-taking on planning applications).

- It shows that particular sites could be allocated for renewable energy uses, particularly solar, where there is landowner/developer interest to do so and for further testing and consultation via the plan-making process (Table 10.1). In addition, the evidence base provides the framework to test the allocation of further sites via the plan-making process, e.g. the solar sites tested in section 5 of this report. Whilst these particular sites were proposed for alternative uses (e.g. housing and employment), the Council has rejected them for such uses at this stage and so the landowners/developers could be approached to assess their willingness to bring forward a solar or other renewable energy project, subject to community consultation, planning and environmental constraints.

Table 10-1 Sites Proposed by York City Council to consider as potential allocations for renewable energy in the Local Plan

Site proposed	Planning and Environmental Considerations
1. Knapton Moor 2, Wetherby Road 2.4 ha	The site's location within the Green Belt means that regard would need to be had to the findings of the Green Belt review to justify the allocation of the site in the plan (as inappropriate development that could impact on Green Belt openness). If the site were not allocated, any planning application would need to demonstrate the very special circumstances for such inappropriate development in the Green Belt as per NPPF policy (e.g. environmental benefits from renewable energy generation, responding to climate change and the temporary nature of the development). As with any solar scheme key environmental issues to consider will include landscape and visual impact, ecology, archaeology and heritage, hydrology and flood risk. The need for ancillary works such as access roads and fences/security would also need to be considered. Recommendation: this site has clear potential for solar PV, with no overriding technical or environmental constraints identified at this stage. The main constraint concerns planning policy with regard to the site's location within the Green Belt. Via the plan-making process the case would need to be made for the site's allocation, reflecting the findings of York's Green Belt review. If a draft allocation were to be taken forward then this would need to be tested further through wider consultation with key stakeholders and the local community.

Site proposed	Planning and Environmental Considerations
2. Land to NW of Hermitage (Gem Holdings (York) Ltd) 9.7 ha	The site's location within the Green Belt means that regard would need to be had to the findings of the Green Belt review to justify the allocation of the site in the plan (as inappropriate development that could impact on Green Belt openness). If the site were not allocated, any planning application would need to demonstrate the very special circumstances for such inappropriate development in the Green Belt as per NPPF policy (e.g. environmental benefits from renewable energy generation, responding to climate change and the temporary nature of the development). As with any solar scheme key environmental issues to consider will include landscape and visual impact, ecology, archaeology and heritage, hydrology and flood risk. In this case, the site is located directly north of Strensall Common Nature Reserve and Special Area of Conservation (SAC). The need for ancillary works such as access roads and fences/security would also need to be considered. The loss of Grade 2 agricultural land would need to be balanced against the site's potential for renewable energy generation, albeit that the proposed land use would only be temporary (solar PV has a typical lifetime of up to 25 years) Recommendation: this site has clear potential for solar PV, with no overriding technical constraints identified at this stage. The main constraints concern potential environmental effects which would need to be understood in more detail, as well as planning policy with regard to the site's location within the Green Belt. Via the plan-making process the case would need to be made for the site's allocation, reflecting the findings of York's Green Belt review. If a draft allocation were to be taken forward then this would need to be tested further through wider consultation with key stakeholders and the local community.
3. Harewood Whin (City of York Council) 17 ha	This site is located at a waste disposal facility. It is in an isolated area without environmental designations in its immediate surroundings and the view for drivers on the B1224 is well screened.
4. North Selby Mine Site (Peel Environmental and North Selby Waste Ltd) 23.3 ha Former coal mine	Former Coal Mine proposed for 60,000 tonnes per year anaerobic digestion (AD) and horticultural glasshouse facility. The Council has resolved to grant planning consent for this scheme at Planning Committee on 23rd January 2014 (ref. 12/03385/FULM)[40], however as inappropriate development in the Green Belt the decision has had to be referred to the Secretary of State before a formal decision can be issued. The technical, planning and environmental constraints presented by this proposal are rehearsed at length within the Officer's Report to planning committee, reflecting the EIA submitted by the developer and views of statutory consultees and others. As inappropriate development in the Green Belt, the Council needed to consider the very special circumstances for the proposed scheme, including the environmental benefits associated with the increased production of energy from renewable sources in accordance with NPPF policy. On balance, the Council decided that this is a suitable site for development when considered against Green Belt policy and wider environmental impacts. The Council may choose to allocate this site in the emerging plan given that its committee decision and Officer's report confirm it is a suitable site and proposal, albeit that this may need reviewing pending the Secretary of State's response which is now awaited.
5. Askham Bryan (Lindum York) 4.5 ha	In terms of the proposal's relationship to this study, a compressed natural gas facility is not strictly considered as a renewable or low carbon source of energy. Whilst the site may be also suited to renewable energy type uses (e.g. solar), we are not currently aware of the developer interest to do so, interest which would be essential in order to propose a site for allocation in the emerging plan. If a solar scheme were to be pursued, then the environmental constraints would be similar to Knapton Moor 2 and the Gem Holdings site, albeit that the site may not be as constrained in planning policy and Green Belt terms since it is already identified as a Major Developed Site.
Note: In order to allocate either the above sites or others, the Council will need to provide further evidence in terms of site availability (developer and landowner interest) and proportionate level of evidence relevant to the development which is proposed, including an understanding of environmental effects and necessary mitigation. For example, the Government's national practice guidance for plan-making notes that: *"Where sites are proposed for allocation, sufficient detail should be given to provide clarity to developers, local communities and other interests about the nature and scale of development (addressing the 'what, where, when and how' questions)."*[41] The potential for allocating the above sites could be tested further through the plan-making process. Preliminary assessment of the suitability for the specific technologies noted here is provided in Appendix D.	

[40] http://planningaccess.york.gov.uk/online-applications/files/9BD56E4925FD1459E808EB0D8BBD435D/pdf/12_03385_FULM--1475468.pdf (accessed March 2014)
[41] http://planningguidance.planningportal.gov.uk/blog/guidance/local-plans/preparing-a-local-plan/

Site proposed	Planning and Environmental Considerations
In terms of the approach to site allocations, to some extent this depends on the nature of the technology proposed: • Few authorities have specifically allocated sites for wind turbines given the extent of evidence which is likely to be required, although some LPAs have identified areas of search/broad locations based on landscape capacity work and a consideration of cumulative impacts (e.g. Durham). • Few authorities have allocated sites for solar or hydro schemes since it comes down to the merits of particular sites. However, and depending on scale, it may be possible to allocate sites for solar technology through the Local Plan subject to further discussions with the landowners and assessment of site suitability in planning and environmental terms. • Some authorities do identify sites for Energy from Waste although this is more related to strategic-scale/County-wide needs and linked to Minerals and Waste Plans rather than local plans/core strategies • Some authorities identify sites/development areas as suitable for district heating and CHP where heat mapping suggests that this is likely to be technically feasible or where it is known that a significant mix of new development is proposed which is likely to make such development an attractive option.	

Adding the key planning and environmental criteria to the policy, as highlighted in this report, could help to alleviate some of the concerns regarding the impacts of renewable energy schemes on York's environmental assets. However, in response to peoples' concerns regarding property prices, it is important to note that it is not the role of the planning system to protect individual property interests. Whilst there are also concerns raised regarding the effectiveness of wind turbines, they are a recognised source of renewable energy.

In taking forward a revised or new version of Policy CC1 it is recommended that, based on the evidence prepared in this report, the broad framework for a policy could be as follows:

I. Overarching support for renewable and low carbon energy schemes to provide a positive policy 'hook' for the developer.

II. A set of criteria against which proposals will need to be considered (see above) to ensure that environmental effects can be managed and mitigated.

III. The allocation of sites/ broad locations where the evidence exists to do so, including demonstration of 'exceptional circumstances' where sites lie in the Green Belt and also other key evidence including: landowner/developer interest, appraisal against criteria above and community consultation via the plan-making process).

IV. That new developments will be encouraged to incorporate renewable and low carbon sources of energy and energy efficiency measures, linked to policy CC2.

Sustainability requirements for new developments, energy efficiency and renewable energy (CC2)

In terms of CC2, AMEC's evidence base is helpful because:

- It shows what technologies may/may not be feasible for strategic sites, including an estimation of costs. This will help in two ways:
  - It can be used as an initial guide for developers in understanding what technologies may work in response to national targets (e.g. Building Regulations and zero carbon homes) and new locally set standards; and

- The Council can use this as evidence, linked to the plan-wide viability assessment, in support of target setting and standards for strategic sites.

- It identifies the cost implications of higher sustainability standards for testing, including building regulations, government target for zero carbon homes, Code for Sustainable Homes and BREEAM. This can inform viability testing and the approach to target setting in the policy (see Feasibility & Viability below).

- It shows the need for flexibility given ever-changing national policy and the on-going Housing Standards Review. There are a number of changes on the horizon, not least the potential scaling back in use of the Code for Sustainable Homes as elements of this are subsumed within national building regulations (see 2014 Ministerial Statement[42]) as well as introduction of the zero carbon homes standard in 2016. In this regard there are two main scenarios for policy preparation:

  - **Housing Standards Review & Zero Carbon Target come into force by 2016:** if introduced it is likely that these national standards will supersede policies in the Local Plan, as a nationally consistent standard to which all developers will have to build to. There will still be scope for the Local Plan to go further, however the evidence would need to be refreshed at this point to consider both costs and feasibility implications.

  - **Housing Standards Review & Zero Carbon Target delayed:** if there are delays in these standards coming into force, or if it is a lower standard than that adopted in the Local Plan, then the Local Plan policy will still have weight, provided it is justified in viability terms linked to the evidence provided in this report.

- It shows that demand for energy to heat the City's existing homes is one of the biggest contributors to emissions. To some extent the role of plan-making is limited in its role to affect change in the existing built environment, except in the case of refurbishments and, perhaps more significantly, if 'allowable solutions' are introduced (this could be in the form of a carbon offset fund which developers pay into to fund energy efficiency or renewable energy retrofit projects). This is something that can be explored in more detail as the plan progresses.

This evidence, alongside the plan-wide viability testing which the Council is undertaking, will help the Council to find a balance between the development industry concerned that standards are too high (impact on build costs) and the wider view that standards should be pushed higher, e.g. to Code for Sustainable Homes Level 6.

In taking forward a revised or new version of Policy CC2 it is our view that the broad approach to the existing policy is sound, subject to viability testing of the Code Level 4 and BREEAM excellent targets (see Feasibility and Viability section which follows) plus further revisions once the government firms up its Housing Standards Review, approach to Code for Sustainable Homes and zero carbon development. As an additional element, the Council would also like to request that developers of the strategic site allocations undertake a BREEAM Communities Assessment[43] (a scheme wide sustainability test) (or equivalent/similar assessment methods), with the costs set out in the following section. The following framework could therefore be used to take forward a policy, subject to viability testing:

[42] https://www.gov.uk/government/news/stephen-williams-announces-plans-to-raise-housing-standards (accessed July 2014)
[43] http://www.breeam.org/page.jsp?id=372 (accessed July 2014)

I. Requiring that all new developments consider the principles of sustainable design and construction and how carbon emissions will be reduced through energy efficiency and use of renewable and low carbon energy generation. This part of the policy could also require climate change adaptation to be taken into account (either as part of this policy or separate policy) to ensure that communities are resilient to climate change impacts that are already faced (hotter, drier summers with increased incidences of storm events and wetter milder winters).

II. Developers of all sites would be required to submit a sustainable design and construction statement, and for strategic site allocations a BREEAM Communities Assessment (or equivalent) would need to be undertaken.

III. Developers will need to meet key standards, including:

a. CSH Level 4 / BREEAM Excellent (or equivalents) for all new developments

b. Strategic site allocations to meet the minimum above standards, but also set out how they have factored in the government target for zero carbon developments, including allowable solutions

c. In progressing strategic site allocations, the use of CHP and District Heating networks needs to be considered at outline planning stage, with feasibility and viability tested

Feasibility & Viability

In developing the policies outlined above, the Council will need to consider the costs outline in Table 10-2 as part of its plan-wide viability assessment which is currently being progressed.

Table 10-2 Feasibility and costs associated with policy approaches

Policy approach	Core Elements to policy	Technical feasibility/key considerations	Cost and viability implications for the plan (against 2013 baseline)
A. Positive policy hook for renewable and low carbon energy generation	The Council will "support"/"encourage" renewable or low carbon energy projects	This study shows that a range of technologies are technically feasible in York	No real cost or viability constraints associated with this element of the policy
	Criteria against which projects will be assessed from a social, economic and environmental perspective	NA	No real cost or viability constraints associated with this element of the policy
	The Council will "support"/"encourage" development of district	The viability of district heating networks will depend upon the	£2,400 - £2,800 pd

Policy approach	Core Elements to policy	Technical feasibility/key considerations	Cost and viability implications for the plan (against 2013 baseline)
	heating networks	specific development and factors such as potential heat demand density, number and size of dwellings and density of development.	
			Source: City of York Local Plan Area Wide Viability Study, PBA, June 2013 (based on figures from the Potential and Costs for District Heating Networks, A Report to DECC, POYRY and Faber Maunsell, April 2009)
B. Providing a policy which allocates sites for renewable and low carbon energy generation		Landowner/developer willingness to allocate sites will need to be demonstrated The allocation of sites will also need to be tested through the plan-making process, including community and stakeholder consultation (planning, green belt and environmental constraints will also need to be taken into account	No real cost or viability constraints associated with this element of the policy
C. Provides a policy which encourages/requires specific energy efficiency standards	Residential building standards		
	Compliance with current Building Regulations (Part L) 2013	All new homes should be built to this standard therefore no issues in terms of technical feasibility need to be highlighted here	No E/O cost
	2016 Building Regulations (Zero Carbon standard)	Challenging at present, but will become commonplace	£6,700-7,500 per dwelling (pd) for detached houses £4,100-5,100 pd for semi-detached/mid-terraced £2,300-2,500 pd for apartments
			Source: Cost Analysis: Meeting the Zero Carbon Standard, Zero Carbon Hub, February 2014
	CSH Level 4	Relatively straightforward, going slightly beyond current 2013 Building Regulations	Up to £2,500 pd
	CSH Level 5	Both Code Levels 5&6	£6,000-9,000 pd

Policy approach	Core Elements to policy	Technical feasibility/key considerations	Cost and viability implications for the plan (against 2013 baseline)
	CSH Level 6	seen as technically challenging given the additional improvements to building fabric plus on-site renewable energy. In addition, the need to incorporate greywater recycling systems to achieve mandatory water credits is technically challenging, with no widespread update of these systems currently in place in the UK.	£15,000-20,000 pd
			Source: Cost of Building to the Code for Sustainable Homes, Element Energy & Davis Langdon, 2013
	BREEAM Domestic Refurbishment 'Very Good'	Standard equivalent to Eco Homes 'Very Good'. No significant technical constraints envisaged in order to reach these levels of performance.	Applies to refurbishment work or conversion work to existing buildings. Viability will depend on the specific characteristics of the baseline building and the nature of the refurbishment.
			Source: Comparison of BREEAM Domestic Refurbishment 2012 with EcoHomes 2006, BREEAM, 2013
	Energy Efficiency	No significant technical constraints envisaged in order to reach these levels of performance.	Applies to consequential improvements in the context of extensions to existing dwellings. Householders may be eligible for grant funding to contribute to any agreed energy efficiency measures. The cost of consequential improvements will therefore vary according to the nature of the existing building and proposed extension works. Any measures proposed will be reasonable and proportionate to the cost of the extension to the existing building.
			How Local Authorities can reduce emissions and manage climate risk, Committee on Climate Change, 2012
	Non-residential		
	BREEAM 'Very Good'	No significant technical constraints envisaged in order to reach these levels of performance.	Up to 0.2% increase in capital cost for a building (0.2% uplift for school, 0.04% for warehouse, 0.24% for supermarket, 0.17% for office and 0.14% for mixed use)
	BREEAM 'Excellent'		Up to 1.8% increase in capital cost for a building (0.7% uplift for school, 0.4% for warehouse, 1.76% for supermarket, 0.77% for office and

Policy approach	Core Elements to policy	Technical feasibility/key considerations	Cost and viability implications for the plan (against 2013 baseline)
			1.58% for mixed use) In the case of conversion of existing buildings (or change of use) viability will depend on the specific characteristics of the baseline building and the nature of the refurbishment
	BREEAM 'Outstanding'	Technical challenging as the highest level of BREEAM and only a small number of schemes have achieved this.	Up to 10% increase in capital cost for a building (5.8% uplift for school, 4.8% for warehouse, 10.1% for supermarket, 9.8% for office and 4,96% for mixed use)
			Source: Table 3: Capital cost uplift for a range of building (their source Target Zero), The Value of BREEAM, A BSRIA Report by James Parker, 2012
	Site/wide standards		
	BREEAM Communities or equivalent	BREEAM Communities is a relatively straightforward assessment method and the approach is similar to the CSH/BREEAM certification methods which many developers will already be familiar with. Of course, a developer may still want to assess their scheme against other 'nationally recognised' standards.	There is no cost information available in terms of achieving a particular level of BREEAM Communities, but at this stage the Council is simply considering a request to undertake a BREEAM Communities Assessment. In this regard, the Assessment Fee for a large scheme, defined as up to 5,999 units, is £5,000. For schemes between 10-499 units the fee is £2,500[44]

10.3 Conclusions

This report shows York's current energy demand and related carbon ($CO_{2e)}$ emissions as well as the current contribution that renewable and low carbon energy scheme's make. It is clear that the City has potential to deliver much more in the way of renewable energy projects, with this study setting out the range of opportunities to do so. The new City of York Local Plan can have a key role to play, with this report helping to support the development of planning policies which encourage renewable energy projects, allocate specific sites and seek higher sustainability standards for the City's new developments and strategic site allocations. The study also presents the

[44] http://www.breeam.org/filelibrary/BREEAM%20Communities/FS5065__-_BREEAM_Communities_Fee_Sheet.pdf (accessed July 2014)

key cost implications for different policy approaches to inform the plan-wide viability assessment which is currently underway.

Glossary

Units

Gigwatt hour (GWh): 1,000 megawatt hours

Megawatt hour (MWh): 1,000 kilowatt hours

Kilowatt hour (kWh): 1,000 watt-hours

Wider definitions

Allowable Solutions: mechanism to allow developers to 'offset' residual CO_2 emission via a financial contribution (£ per tonne CO_2) which is central to meeting the government's target for zero carbon homes

Anaerobic digestion: produces renewable energy in the form of biogas from organic materials such as manures and slurries, food waste and sewage sludge

BREEAM (BRE Environmental Assessment Method): BREEAM is a widely used environmental assessment method for buildings, typically used for non-residential buildings following the introduction of the Code for Sustainable Homes

BREEAM Communities: an environmental assessment method for assessing the performance of a whole new development, not just its individual dwellings

CHP: Combined Heat and Power. The supply of both heat and power from a single generating facility. Differs from traditional generators where heat produced during the generation of power is released without deriving any benefit from it

Code for Sustainable Homes: the national standard for sustainable design and construction of homes, using a 1 to 6 star rating against 9 key categories.

Decentralised energy supply: refers to that which is part of or near to a development site and is locally connected (i.e. rather than connection to the national grid)

DECC: Department for Energy and Climate Change

DEFRA: Department for Environment and Rural Affairs

DHN: District Heating Network

ESCO: Energy Services Company is a commercial business supplying energy to a community (instead of a national energy supplier), typically associated with district heating networks and other decentralised energy supply

Environmental Impact Assessment (EIA): assessing the significance of a projects environmental effects

Feed-in-Tariff (FiT): a government scheme to promote the take-up of small to medium scale renewable energy production by guaranteeing a rate of payment for the energy over a fixed term (different levels depending on the technology and its size)

Green Deal: a government scheme for reducing emissions and fuel poverty by providing financial support for efficiency measures to low income households

Ground source heat pumps (GSHP): low carbon energy technology which utilises the stable temperature found in the ground to provide heat to properties

HCA: Homes and Communites Agency

Housing Standards Review: the government's on-going review of housing standards to remove regulation and the number of standards to which housing developers need to comply with

Installed capacity: this is the theoretical annual production capacity of an energy plant/system

MUSCO: multi-utilities services company, similar to an ESCO but also supplies wider utilities (e.g. water etc)

Renewable and low carbon energy: includes energy for heating and cooling as well as electricity. Renewable energy covers those energy flows that occur naturally and repeatedly in the environment, from the wind, the fall of water, the movement of the oceans, from the sun and from biomass. Low carbon technologies are those that can help reduce emissions. Renewable and low carbon energy supplies include, but not exclusively, those from biomass and energy crops, CHP, waste heat that would otherwise be generated directly or indirectly from fossil fuels, energy from waste, ground source heating and cooling, hydro, solar thermal and photovoltaic and wind generation.

Renewable Heat Incentive (RHI): a government scheme to help promote the takeup of small to medium scale renewable heat production by guaranteeing a rate of payment over a fixed term.

Renewables Obligation Certificates (ROC): a ROC is issued for every MWh of renewable electricity produced by licensed suppliers so that they can prove that they are supplying the amout of renewable energy they are required to.

Zero carbon buildings: the government's target for all new homes to be zero carbon from 2016 and for non-residential development by 2019. *"The Government would set a minimum energy performance standard through the building regulations. The remainder of the zero carbon target can be met through cost effective off-site carbon abatement measures - known as 'allowable solutions'. These provide an optional, cost-effective and flexible means for house builders to meet the zero carbon homes standard, as an alternative to increased on-site energy efficiency measures or renewable energy (such as solar panels). Small sites, which are most commonly developed by small scale house builders, will be exempt. The definition of a small site will be consulted on shortly, and set out in regulation... The Zero Carbon Home standard will be set at Level 5 of the Code for Sustainable Homes, but the*

legislation will allow developers to build to Level 4 as long as they offset through the allowable solutions scheme to achieve Code 5."[45]

[45] The Queen's Speech, HM Government, June 2014

Appendix A
Resource Assessment Details

A.1 Wind Resource Assessment Constraints

Figure A-1 Environmental Constraints

Figure A-2 Land Designation Constraints

Figure A-3 Infrastructure Constraints

Figure A-4 Airport, Radar and Communications Constraints

Figure A-5 Rural and Urban Buildings and Noise Buffer Constraints

Figure A-6 Views Analysis Constraints

A.2 Solar Resource Assessment

Figure A-7 Solar Site Map Divisions

Figure A-8 Solar Sites Map 1

Figure A-9 Solar Sites Map 2

Figure A-10 Solar Sites Map 3

Figure A-11 Solar Sites Map 4

A.3 District Heating Assessment

A.1 Wind Resource Assessment Constraints

Table A-1 Buffers Applied to Site Constraints

Constraint	Minimum Buffer Requirement[46]	Minimum Buffer Justification	Maximum Buffer Requirement[47]	Maximum Buffer Justification
Motorway	Blade Tip fall over (125m) measured to edge of highway boundary – normally post and rail fence.	National Planning Policy Guidance Note 22 (Companion Guide[48]) defines fall over distance as being "the height of the turbine to the tip of the blade" (p.171, para 51) and states in para 52 that: "it may be advisable to achieve a set-back from roads and railways of at least fall over distance". When commenting on the Reading the turbine the Highways Agency in 2002 required a separation distance of 2 blade lengths from the tower to the motorway fence i.e. 70m, whereas the total height of the turbine is 120m. The Reading Turbine is actually 149m from MW boundary. NB If the maximum separation buffer cannot be achieved, the Highways Agency, as statutory consultee, should be consulted in DP1.	Blade Tip fall over + 50m (175m for 125m N90) measured to edge of highway boundary – normally post and rail fence.	Highways Agency: SPATIAL PLANNING ADVICE NOTE: SP 02/06 States: "Assessment of the risk associated with structural failure suggests that a reasonable offset would be to site the wind turbines at a distance of not less than (H + 50) metres where H is the maximum height to the tip of blade. The offset should be measured from the highway boundary fence rather than the edge of carriageway so as to ensure the safety of our roadside equipment and our workforce. However, analysis of the risk posed by 'icing' suggests that it would be wise to adopt a minimum offset of 100 metres. Therefore, no turbine should be sited closer to the trunk road boundary than the greater of (H + 50) or 100 metres." The later edition Spatial Planning Advice Note

[46] The minimum separation distance considered reasonable to expect the Local Planning Authority and the consultee to accept. There is a probability that negotiation and discussion will be required. **It is important to note that:**

1. The results of the Feasibility Study, in terms of turbine numbers, predicted annual energy production and costs are based on the minimum separation distances to identified constraints, unless the maximum separation distance can be achieved without reducing the installed capacity of the site and
2. These buffers are to be treated as guidance only, since it is not possible to stipulate separation distances for every site specific eventuality.

[47] Considered the failsafe separation distance, where no negotiation with consultees/LPA will be required and no material planning objections will be put forward once the planning application has been submitted.

[48] In England this is the national planning advice on wind energy, which all local planning authorities will use as guidance when assessing planning applications.

Constraint	Minimum Buffer Requirement[46]	Minimum Buffer Justification	Maximum Buffer Requirement[47]	Maximum Buffer Justification
				04/07 "Planning Applications for Wind Turbines sited near to Trunk Roads" advises that commercial wind turbines should be set back from the trunk road boundary by their height + 50m, which is widely understood to mean blade tip + 50m.
Trunk Road	Blade Tip fall over measured to edge of highway boundary – normally post and rail fence.	The 2nd Swaffham Turbine (120m blade tip) is 150m from the Trunk road. The Swaffham Ecotech turbine (100m blade tip) is 125m. Not aware of any turbines within fall over distance to Trunk Roads. Consider this is an appropriate minimum separation distance for reasons set out for motorways. NB If the maximum separation buffer cannot be achieved, the Highways Agency, as statutory consultee, should be consulted in DP1.	Blade Tip fall over + 50m measured to edge of highway boundary – normally post and rail fence.	Consider this is an appropriate maximum separation distance for reasons set out for motorways.
A Road	Blade tip fall over measured to the edge of the highway boundary.	Consider this is an appropriate minimum separation distance for reasons set out for motorways, given the likely traffic flows on main roads. Aware of one example of a 120m blade tip turbine being approved 82m from an A road (Manchester City Football Club). NB If the maximum separation buffer cannot be achieved, the Highways Authority, as statutory consultee, should be consulted in DP1.	Blade tip fall over measured to the edge of the highway boundary +10%.	Precautionary principle, considered best practice approach.
B Road	50m (assumed max blade length) from center point of turbine tower i.e. no part of blade should be overhanging the highway boundary.	Arguably, contrary to advice contained with in PPS22, but there are examples of turbines within fall over distance to minor roads. NB If the maximum separation buffer cannot be achieved, the Highways Authority, as statutory consultee, should be consulted in DP1.	Blade tip fall over measured to the edge of the highway boundary.	Precautionary principle, based upon guidance in PPS22: "it may be advisable to achieve a set-back from roads and railways of at least fall over distance". Discussions with planning officers has shown that adherence to this guidance is expected.
Minor Road	50m from center point of turbine tower i.e. no part of blade should be overhanging the highway	Arguably, contrary to advice contained with in PPS22. BUT: 2nd Swaffham Turbine is within fall over distance of a minor road (c.35m). The Reading turbine is 48m from a minor road.	Blade tip fall over measured to the edge of the highway boundary.	Precautionary principle, based upon guidance in PPS22: "it may be advisable to achieve a set-back from roads and railways of at least fall over distance".

Constraint	Minimum Buffer Requirement[46]	Minimum Buffer Justification	Maximum Buffer Requirement[47]	Maximum Buffer Justification
	boundary.	A turbine in Dagenham (Ford) is over sailing a road with public access – although there have been incidents of ice fall… There are other examples of operational wind turbines within fall over distance to minor roads. i.e. Royd Moor turbines (0.5mw bonus) operating since 1993 within fall over distance to minor road. B If the maximum separation buffer cannot be achieved, the Highways Authority, as statutory consultee, should be consulted in DP1.		Discussions with planning officers has shown that adherence to this guidance is expected.
Unclassified Road, but adopted public highway.	50m from center point of turbine tower i.e. no part of blade should be overhanging the highway boundary.	As for Minor Road above.	50m from center point of turbine tower i.e. no part of blade should be overhanging the highway boundary.	As per Map A: Justification for minor roads.
Railway (all)	Blade tip fall over measured to the edge of the railway track.	Companion Guide to PPS22 states: "it may be advisable to achieve a set-back from roads and railways of at least fall over distance". NB If the maximum or minimum separation buffes cannot be achieved, Network Rail, as statutory consultee, should be consulted in DP1.	Blade tip fall over +10% measured to the edge of the railway track.	Network Rail, objected to a planning application for 5 turbines in Sedgemoor District Council in 2006, where a turbine was exactly fall over distance to track. The objection was only removed when the scheme was amended and a fall over +10% separation distance was achieved.
Permanent Structures which are not buildings i.e. water tanks; communications towers.	If there is no public access, no buffer should be applied. However, account needs to be taken of construction activities which may require that a 15m buffer is applied for the foundation. For structures used for the storage of "hazardous materials" blade tip fall over distance.	These are essentially plant and machinery not on public land. There do not appear to be any insurance restrictions for these non occupied buildings. The PSB would though need to undertake an appropriate Risk Assessment to ensure that Personnel accessing the plant are adequately protected i.e. wearing a hard hat in the area swept by the turbine blades.	50m from center point of turbine tower i.e. no part of blade should be overhanging the structure. For structures used for the storage of "hazardous materials" blade tip fall over +10% separation distance.	Precautionary approach based on tone of PPS22. It is arguable that nearby sites covered by the Control of Major Accident Hazards (COMAH) Regulations and Nuclear Installations will require consultation and/or site specific risk assessments in DP1.
Public Car Parks and Public Open Space	50m buffer from center of turbine i.e. not over hanging.	Public Car Parks and public open spaces are in effect public rights of way (PROW). PPS22 states that: "and the minimum distance is often taken to	Blade tip fall over distance.	Companion Guide to PPS22.

Constraint	Minimum Buffer Requirement[46]	Minimum Buffer Justification	Maximum Buffer Requirement[47]	Maximum Buffer Justification
		be that the turbine blades should not be permitted to over sail a public right of way."		
Private/Staff car parks	No Buffer, but ideally 50m buffer from center of turbine i.e. not over hanging.	The option to lease should specify that it may be necessary for health and safety reasons to exclude access under the swept area of the turbine – should, for example, insurance be problematic and/or a planning condition on health and safety is attached.	Blade tip fall over distance (125m) from center point of turbine tower.	Minimises any potential safety risk, in terms of ice and component/blade failure.
Commercial Buildings	No over sailing of building by blades i.e. 45m buffer for N90.	Contrary to PPS22 Companion Guide, which states: "Fall over distance (i.e. the height of the turbine to the tip of the blade) plus 10% is often used as a safe separation distance". However: The Reading turbine (120m blade tip) is 68m from an office building; A turbine (120m blade tip) at Dagenham is 77m from a commercial building; Business Development are aware of 2 turbines with blades oversailing a factory by upto 8m i.e towers 27m from factory. But due to a reported component failure incident and risk of ice, the blade swept area ie circle of 35m radius is fenced off to prevent access and walkways/fire escapes within swept area have been roofed. At Manchester City Football Club, a 120m to blade tip turbine was approved within a car park, 52m from an athletic stadium and 110m from main football stadium. However, due to concerns from the Health and Safety Executive the turbine is no longer being built. NB There are potentially public liability and safety issues which need addressing regarding public access beneath the swept area of the turbine blades e.g. some turbine manufactures require all personnel to wear hard hats under the turbine and explicitly state that manufacturers are not liable for public injury caused by mechanical failure/ice through.	137.5m (fall over +10% for a 125m tip turbine)	Complies with recommendations set out in the Companion Guide to PPS22 (Blade tip fall over distance +10% "often used as a safe separation distance"). However, Nordex have restrictions over the maximum height of buildings and proximity to turbines. Advice from Nordex being that no part of the swept area should be affected by turbulence of

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		INSURANCE Ace confirmed that having a building within the topple zone is material information; however, in the context of clients portfolio, advised that it wouldn't impact the overall premium. Aon's advice was to apply commonsense and consider each site on a case-by-case basis. The following flags increase the level of concern on insurance terms: Occupied buildings; High value buildings and infrastructure (eg electricity pylons, pipelines, bridges etc); Large congregations of people; and Proximity of the building to the turbine (particularly if it approaches the oversail area).		
Third party Residential Building[49]	Site layout design should be based on the 40dB contour which will typically result in a separation distance of 500m. Where predicted turbine noise levels exceed 40dB there needs to be evidence that prevailing back ground noise will be no more than 5dB below predicted turbine noise i.e. if turbine noise	Based on known planning conditions it is assumed that the LPA will require a daytime limit of between 35-40dB or background +5dB, normally whichever is the greater. A more conservative approach is taken by applying the 40dB contour, in recognition of parliamentary pressure to revise noise guidance and review permissible separation distances between turbines and properties. The use of the 40dB contour also takes account of the fact that PfR sites have emerged to be often in rural areas, where background noise levels are low. At Feasibility, the issue of visual dominance/over bearing on residential properties should be taken	35dB contour which will typically result in a separation distance of 750m .	750m is arguably the minimum optimum separation distance to ensure that visual and noise effects do not significantly affect residential amenity, and takes account of backbench MP calls for set separation distances between turbines and housing. It should be noted that each site should be considered on its merits and planning appeals have been dismissed on residential amenity grounds even where separation distances considerably in excess of 450m have been achieved. The 35dB noise contour represents the definitive safeguard beyond which currently no noise monitoring or assessment is required.

[49] For all noise sensitive constraints in Feasibility Studies, the noise contour derived separation distance should in the first instance be based on the 80m hub Nordex N90 High Speed 2.5MW turbine. If the relevant noise contour cannot be achieved the 80m N90 Low Speed 2.5MW turbine should be used. Judgement is required for sites where existing background noise levels may allow the minimum 43dB buffer to be exceeded. The Feasibility Study should be based upon the turbine selected for achieving compliance with the minimum buffer requirement.

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	predicted to be 42dB background needs to be 37dB. For sites in Scotland with 10 or more turbines, the Feasibility Study should include three layout designs: 1. No properties within 35dB contour; 2. No properties within 750m of any turbine; 3. No properties within 40dbB contour. Layout design 2 (750m) should be used as the basis for the MW capacity of the site. Caravan Parks and campsites are classed as noise sensitive land uses and should be treated as third party residential buildings. Although a degree of judgment is required for campsites.	into account i.e. if 500m achieved but property is at the bottom of a hill with uninterrupted principal views to the turbine on top of the hill, this is unlikely to achieve planning permission. 40dB is the upper daytime level and assumes that background noise levels are no more than 35dB. (taking into account the reduction of 2dB from LAeq – LA90 and use of 4m receiver height and use of mixed ground and reflect published guidance: (2009) Prediction and Assessment of Wind Turbine Noise. Acoustics Bulletin, Volume 34 Issue 2.) Bowdler, D., Bullmore, A., Davis, B., Hayes, M., Jiggins, M., Leventhall, G. & McKenzie, A. Companion Guide to PPS22 states (p.171 para 51). "The minimum desirable distance between wind turbines and occupied buildings calculated on the basis of expected noise levels and visual impact will often be greater than that necessary to meet safety requirements. Fall over distance (i.e. the height of the turbine to the tip of the blade plus 10% is often used as a safe separation distance." Examples of minimum separation distances to turbines include: Due to high background noise levels Manchester approved turbine (120m blade tip): Nearest 3rd party residential property is 125m. The Swaffham Ecotech turbine is 360m from nearest 3rd party house. An ecotricity turbine at the B&Q warehouse in Worksop, is believed to be <200m from housing. Dundee Turbines: Closest property is 330m from a turbine, however, noise (monitoring found no excedence of permitted levels) shadow flicker		Important to note the 2009 Shipdham Appeal decision, in which the Inspector found (broadly) that background monitoring must be undertaken at the Noise Sensitive Property, since otherwise there is significant doubt about the representativeness of the data – if a resident therefore denies access, it could be problematic. Secondly the Inspector, found that planning conditions alone were not sufficient to protect NSP's. Therefore advice from the HMP is that all developments should comply with ETSU without mitigation being required, since conditions requiring/enforcing mitigation are open to legal challenge on the basis of failing some of the 6 tests for conditions set out in Planning Circular 11/95. So, if turbines need to be powered down to meet noise limits, significant risk that EHO not accept mitigation (since not enforceable) and an open invitation to objectors to challenge the decision.

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		complaints - turbines programmed to shut down. Again there are safety concerns regarding residential properties if located within c.300m of turbines – some reports indicate that ice is thrown upto 250m from turbines and that the max distance debris could be thrown is ~600m. Nordex guidance (Precautions for Icing Conditions, 2007) on ice through states "Objects, which are closer to a wind turbine than 1.5 x the sum of hub height and rotor diameter, can be endangered from falling ice." Noise levels from microwind maybe limited to 45dB (DCLG News release 13/3/08).		
Residential property owned by the PSB (ie within PSB property Boundary and confirmed as being in residential use)	No residential property within blade tip fall over distance +10%. In addition, where possible, the turbine layout should be configured to ensure that predicted noise levels do not exceed 55dB.	As for third party residential (fall over +10% to occupied buildings requirement in PPS22) and ETSU (summary, para 24) advises that lower noise levels can be increased from 35-40 to 45dB and that the level above background can be increased beyond the permitted 5dB level. As ETSU states that it is the lower day and night limits which can be increased to 45dB it may be (this is an untested theory) possible to increase the maximum permissible day time level to 50dB (as there is a difference of 10dB between the lower limits for third parties and those with a financial involvement). A 5 dB increase in the ETSU-R-97 stakeholder limit may also be permissible, as this would then result in a minimum buffer justification sound level which would be broadly comparable to the lower of the WHO's guidance levels for gardens or balconies, generally applicable to daytime, and would not be seen as being too dissimilar to the ETSU-R-97 guidance. However, this would still result in higher than acceptable noise levels at night, which would require the provision of secondary glazing at the property and alternative ventilation, unless windows (existing/new) in the same room could open onto non-noise affected facades. Worth noting that although the Noise Exposure Criteria set out in PPG24 Noise apply to new	300m. 45dB noise contour	ETSU-R-97 stipulates that the fixed lower day and night time limits can be 45dB where the occupier has a financial . In areas where background levels are above 45dB it would be possible to decrease the separation distance until the background + 5 has been complied with. NB This is dependent upon changes to the tenancy agreement or financially involving the occupier (not the owner) of the property.

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		housing and existing noise levels (i.e. new housing adjacent to motorways) a noise level of 55dB is deemed acceptable, although mitigation maybe required. Legal agreement can be negotiated with PSB to agree acceptable noise. Although at the limits of acceptability, negotiation/legal agreement may be possible with PSB to remove residential use of building. NB This is dependant upon financially directly involving the resident (not the owner) of the property (as set out on p66 of ETSU-R-97, through for example, rent reduction.		
Staff Accommodation i.e. at hospitals.	Not within the blade tip fall over distance +10%. In addition, where possible, the turbine layout should be configured to ensure that predicted noise levels do not exceed the 53dB (LA90) noise contour.	Distance based on fall over +10% to occupied buildings requirement in PPS22. Using the 53dB(LA90) noise contour assumes a 20dB attenuation for closed windows with 2dB subtracted to allow for conversion from LAeq to LA90, resulting in internal noise levels of 35dB – in compliance with ETSU-R-97. This approach is based on the accommodation being either closed ventilation (windows do not open) and/or the EHO/PSB accepting that it is sufficient mitigation for the windows to be shut if noise is disturbing occupiers. It also assumes that outside space for these receptors is not considered to be noise sensitive. Government guidance available in “Health Technical Memorandum 08-01: Acoustics” does not consider permanent staff accommodation and therefore the most appropriate UK design guidance is BS 8233:1999 “Sound insulation and noise reduction for buildings - Code of practice”. The protection of staff outdoors is not relevant and hence only internal levels require consideration. The 53 dB level may cause an exceedance of the desirable internal level of 35 dB (BS 8233:1999) by 3 dB, if an assumed maximum of 15 dB and not 20 dB attenuation through the window. However, in modern healthcare facilities closed windows even this may be acceptable as HVAC systems	Not within the blade tip fall over distance +10%. In addition, where possible, the turbine layout should be configured to ensure that predicted noise levels do not exceed the 43dB (LA90) noise contour.	This assumes that windows are opening and that the EHO/PSB considers that noise levels should take this into account. Based on principal of ETSU-R-97 that there is a 10dB(A) allowance for attenuation through an open window and that 2dB is subtracted to allow for the use of LA90 rather than LAeq. This approach achieves the 35dB sleep disturbance noise level with an open window. If existing background (night-time) noise levels exceed 43dB at the external façade of the accommodation, likely that noise levels from the turbines could be increased to match but not exceed background levels.

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		should provide acceptable levels of ventilation. If existing background (night-time) noise levels exceed 53dB at the external façade of the accommodation, likely that noise levels from the turbines could be increased to match but not exceed background levels. There may though be a requirement to ensure that the frequency distribution of noise is taken into account. i.e. that lower frequency noise from turbines does not exceed the lower frequency background noise.		
Hospital Wards (measured to external façade)	Not within the blade tip fall over distance +10%. In addition, where possible, the turbine layout should be configured to ensure that predicted noise levels do not exceed the 48dB (LA90) noise contour.	Distance based on fall over +10% to occupied buildings requirement in PPS22. The World Health Organisation 1999 Guidelines for Community Noise recommends that the guideline values indoors on wardrooms are 30dBLAeq. Using the 48dB(LA90) noise contour assumes a 20dB attenuation for closed windows with 2dB subtracted to allow for conversion from LAeq to LA90. This approach is based on the accommodation being either closed ventilation (windows do not open) and/or the EHO/PSB accepting that it is sufficient mitigation for the windows to be shut if noise is disturbing occupiers. It also assumes that outside space for these receptors is not considered to be noise sensitive. The HTM-08-01 (for new healthcare buildings) recommends that internal sound levels during the night are 35 dB LAeq,T, there may therefore be some latitude in increasing the minium buffer to 53dB where the windows do not open. The Hayes McKenzie Partnership adopted this approach when conducting a noise assessment for a 2008 planning application for a wind turbine at the QEH Hospital in King's Lynn. If existing background (night-time) noise levels exceed 48dB at the external façade of the ward, likely that noise levels from the turbines could be increased to match but not exceed background levels.	Not within the blade tip fall over distance +10%. In addition, where possible, the turbine layout should be configured to ensure that predicted noise levels do not exceed the 38dB (LA90) noise contour.	This assumes that windows are opening and that the EHO/PSB considers that noise levels should take this into account. Based on principal of ETSU-R-97 that there is a 10dB(A) allowance for attenuation through an open window and that 2dB is subtracted to allow for the use of LA90 rather than LAeq. If existing background (night-time) noise levels exceed 38dB at the external façade of the ward, likely that noise levels from the turbines could be increased to match but not exceed background levels. The HTM-08-01 (for new healthcare buildings) recommends that internal sound levels during the night are 35 dB LAeq,T, there may therefore be some latitude in increasing the maximum buffer to 43dB where the windows open.
Prison accommodation Blocks	Not within the blade tip	Using the 53dB(LA90) noise contour assumes a	Not within the blade tip	This assumes that windows are opening and

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(measured to external façade)	fall over distance +10% In addition, where possible, the turbine layout should be configured to ensure that predicted noise levels do not exceed the 53dB (LA90) noise contour.	20dB attenuation for closed windows with 2dB subtracted to allow for conversion from LAeq to LA90, resulting in internal noise levels of 35dB – in compliance with ETSU-R-97. This approach is based on the accommodation being either closed ventilation (windows do not open) and/or the EHO/PSB accepting that it is sufficient mitigation for the windows to be shut if noise is disturbing occupiers. It also assumes that outside space for these receptors is not considered to be noise sensitive. If existing background (night-time) noise levels exceed 53dB at the external façade of the cell block, likely that noise levels from the turbines could be increased to match but not exceed background levels. There is no known design guidance for acceptable noise levels at prisons.	fall over distance +10%. In addition, where possible, the turbine layout should be configured to ensure that predicted noise levels do not exceed the 43dB (LA90) noise contour.	that the EHO/PSB considers that noise levels should take this into account. Based on principal of ETSU-R-97 that there is a 10dB(A) allowance for attenuation through an open window and that 2dB is subtracted to allow for the use of LA90 rather than LAeq. This approach achieves the 35dB sleep disturbance noise level with an open window. If existing background (night-time) noise levels exceed 43dB at the external façade of the cells, likely that noise levels from the turbines could be increased to match but not exceed background levels.
Halls of Residence	Not within the blade tip fall over distance +10% In addition, where possible, the turbine layout should be configured to ensure that predicted noise levels do not exceed the 53dB (LA90) noise contour.	Using the 53dB(LA90) noise contour assumes a 20dB attenuation for closed windows with 2dB subtracted to allow for conversion from LAeq to LA90, resulting in internal noise levels of 35dB – in compliance with ETSU-R-97. This approach is based on the accommodation being either closed ventilation (windows do not open) and/or the EHO/PSB accepting that it is sufficient mitigation for the windows to be shut if noise is disturbing occupiers. It also assumes that outside space for these receptors is not considered to be noise sensitive. If existing background (night-time) noise levels exceed 53dB at the external façade of the Hall, likely that noise levels from the turbines could be increased to match but not exceed background levels.	Not within the blade tip fall over distance +10% In addition, where possible, the turbine layout should be configured to ensure that predicted noise levels do not exceed the 43dB (LA90) noise contour.	This assumes that windows are opening and that the EHO/PSB considers that noise levels should take this into account. Based on principal of ETSU-R-97 that there is a 10dB(A) allowance for attenuation through an open window and that 2dB is subtracted to allow for the use of LA90 rather than LAeq. This approach achieves the 35dB sleep disturbance noise level with an open window. If existing background (night-time) noise levels exceed 43dB at the external façade of the hall, likely that noise levels from the turbines could be increased to match but not exceed background levels.
Public Building ie Schools	Not within the blade tip fall over distance +10% In addition, where possible, the turbine layout should be	Public buildings have a much greater sensitivity than commercial/industrial buildings. PPS22 Companion guide p171, para 51: “Fall over distance…. Plus 10% is often used as a safe	Not with in 450m. In addition, where possible, the turbine layout should be configured to ensure	Minimises any potential safety risk, in terms of ice and component/blade failure and minimises power loss from turbine shut down due to noise and shadow flicker. 43dB standard ETSU night time level allowing

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	configured to ensure that predicted noise levels do not exceed the 53dB (LA90) noise contour. No playing field should be within the 53dB(LA90) noise contour	separation distance". The World Health Organisation 1999 Guidelines for Community Noise recommends that the background sound pressure level in classrooms does not exceed 35dB (55dBLAeq – 20 dB subtracted for attenuation through a closed window and an allowance of 2dB for LAeq – LA90 conversion). The 53dB LA90 contour should be measured at the nearest classroom façade. "Building Bulletin 93 - Acoustic Design of Schools. A Design Guide" provides design guidance for new schools. Internal targets range from 30 to 40 dB LAeq, 30min and when corrected for the LA90, 10min metric and the temporal variation, the levels are comparable to those stated within the WHO guidance. The WHO guidance also recommends that for outdoor playgrounds the SPL from external noise sources should not exceed 55dB (53 = -2dB for LAeq-LA90). Increasing the minimum buffer requirement to 48dB would reduce the risk of community concerns unless the school has some direct involvement with the proposals, i.e. an interactive science project. 48 dB would be comparable to the lower WHO guidance level. Achieving these levels is dependant on the ventilation in the school not being dependant on opening windows.	that predicted noise levels do not exceed the 43dB (LA90) noise contour (to classroom façade) and/or 53dB(LA90) noise contour to playing field.	for attenuation through open window.
PSB Property Boundary	5m from maximum horizontal length of blade tip. So 55m if max blade length assumed to be 50m.	Ensures that there is no possibility turbine will oversail 3rd party land and provides some degree of micro—sighting should it be required.	-	-
Public Right of Way	50m from centre point of turbine tower i.e. no part of blade should be overhanging the public right of way.	Companion Guide to PPS 22 states (p172 para 57) "Similarly, there is no statutory separation distance between a wind turbine and a public right of way. Often, fall over distance is considered an acceptable separation, and the minimum distance is often taken to be that the turbine blades should	Blade tip fall over distance.	Companion Guide to PPS22.

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		not be permitted to oversail a public right of way." At a Public Inquiry in August 2007, no challenge was raised to turbines located just overhang separation distance from public footpaths. Industry wide premise that turbines should not oversail public rights of way.		
Bridleway	50m from center point of turbine tower i.e. no part of blade should be overhanging the public right of way.	Para 56 p. 172 of the Companion guide sets out that the British Horse Society has suggested a 200m separation distance. The BHS November 2008 policy note on turbines reiterates the 200m distance, but with a maximum separation to national trails of 4 x tip height i.e. 500m. BUT tested at appeal (Cemmaes Wind Farm) the inspector concluded: "What cannot be concluded from the evidence is that there is a generic proven difficulty (I.e. with wind turbines and horses). What can be concluded is that the 1995 BHS policy, which may influence many riders, riding schools and clubs is overtly alarmist in a way which is not supported by evidence. It is not accepted that wind turbines necessarily or even more than occasionally alarm horses. The evidence is not there". A presentation at a BHS conference has also recently concluded that wind turbines pose no discernable risk to horse riding.	200m from center point of turbine tower.	To appease and minimize any cause for objection from horse riding community, in line with PPS22 companion guide.
Woodland	Non classified woodland no buffer. However, where there is sufficient space on site, after all other constraints have been taken into account, turbine locations should avoid over sailing all woodland i.e. 45m buffer. A 70m buffer for a 125m tip turbine should be applied to any Ancient	No specific statutory guidance recommending separation distances. However, ecological importance of woodlands for birds and bats increases with the age and species diversity of the woodland. To prevent unnecessary loss of habitat through construction of foundations. Natural England Feb 2009 guidance on Bats and Wind Turbines identifies that some bat species have a high sensitivity to wind turbines and as a result a minimum separation distance of 50m between the habitat and the blade tip is required. This equates, broadly, to a separation distance of 70m between turbine tower and the edge of the	70m from center point of turbine for all woodland (as shown on a 1:25,000 map/site visit). This distance should be maximised where other site specific constraints allow.	Ecological surveys may identify bat populations within woodland, for which Natural England are likely to require a separation distance. Natural England Feb 2009 guidance on Bats and Wind Turbines identifies that some bat species have a high sensitivity to wind turbines and as a result a minimum separation distance of 50m between the habitat and the blade tip is required. This equates, broadly, to a separation distance of 70m between turbine tower and the edge of the habitat.

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	Woodland.	habitat. In some instances the removal of sufficient woodland to achieve a 70m or less separation distance and additional net replanting elsewhere, may be an acceptable mitigation option. Also, bat roosts can be moved under license in cases of over-riding public interest in order to enable development - need to demonstrate though that there was no alternative and that the works are necessary for reasons of overriding public interest (not economic gain) – considered unlikely NE would want to set a precedent that the need for turbines overrides the protection in situ of bats.		
Field Boundaries and non-protected hedgerows	Non designated hedgerows and/or field boundaries no buffer. However, where there is sufficient space on site, after all other constraints have been taken into account, turbine bases should be 70m from field boundaries. In addition any removal of hedgerows should be avoided wherever possible.	Field margins and hedgerows are important wildlife corridors and are often managed for biodiversity under the DEFRA Environmental Stewardship Scheme. These features are known movement corridors for some bat species and therefore NE may request a c.70m buffer if high risk bat species are present. Removal of hedgerows requires the LPA to approve a hedgerow removal notice under the Schedule 4 of the Hedgerow Regulations (1997) and the 1995 Environment Act.	70m from turbine tower and in accordance with NE 2009 bats and wind turbines guidance.	Field margins and hedgerows are important wildlife corridors and are often managed for biodiversity under the DEFRA Environmental Stewardship Scheme. These features are known movement corridors for some bat species and therefore NE may request a c.70m buffer if high risk bat species are present. Application 1/1386/2007 refused by Torridge DC (29/2/08), due to objection from NE as turbines oversailing hedgerows used by bats commuting and foraging.
Hedgerows (protected)	70m. Can only be applied when local information and/or surveys are available to confirm that the hedge is/qualifies for protection.	Hedgerows are wildlife corridors, utilised by, for example, bats. Protected hedgerows species rich and established. Likely to be used as bat movement corridors, especially in low land/sheltered sites. Any woodland/hedgerow will need to be surveyed for breeding birds/protected species before removal.	70m	Natural England Feb 2009 guidance on Bats and Wind Turbines identifies that some bat species have a high sensitivity to wind turbines and as a result a minimum separation distance of 50m between the habitat and the blade tip is required. This equates, broadly, to a separation distance of 70m between turbine tower and the edge of the habitat.
Water Courses Adopted by local	15m from turbine centre	Drainage Boards normally require that no part of	70m.	Likely minimum separation distance required by

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Drainage Board **and/or** those identified on a 1:50,000 map[50], including reservoirs.	point.	development within c.10m of an adopted drainage water course. With an assumed foundation radius of 15m, the minimum separation distance is therefore taken to be 15m. On a site by site basis this could be reviewed and an engineering solution negotiated with the Env. Agency/Drainage Board. The Environment Agency requires an 8m separation to main rivers, inclusive of foundations.		Natural England to protect the use of water courses as movement corridors by birds/bats. 70m increase for N100 - BATS
Navigable Waterways i.e. canals	20m to allow for construction of turbine foundations (see water courses above).	Applied in the absence of any specific guidance or known best practice.	50m (not over sailing) to water way and any moorings or public rights of way adjoining the waterway i.e. towpaths.	Companion Guide to PPS 22 states (p172 para 57) "Similarly, there is no statutory separation distance between a wind turbine and a public right of way. Often, fall over distance is considered an acceptable separation, and the minimum distance is often taken to be that the turbine blades should not be permitted to oversail a public right of way." An assessment of whether house boats are noise sensitive receptors will need to be undertaken. This may be dependant on whether or not the boats are independently powered and can therefore relocate.
11,33kV lines (Poles)	No Buffer.[51]	Operation: Based on assumption that should the DNO (National Grid do not have responsibility for 11/33/132kV network) require a 1.5 x the blade tip height (187.5m for 125m tip turbines) fall over separation distance, the section of line could be placed underground or re-routed. Construction: Consideration could also be given to covering lines with "sheath insulation" and or fencing to protect construction activities within c.12m and that micro sighting will enable construction activities to not conflict with safety criteria. In addition to trenching the cable, it may be cost effective to de-energise	1.5 x the blade tip height (187.5m for 125m tip turbines)	Companion Guide to PPS para 55 on p.172 states that "wind turbines should be separated from overhead power lines in accordance with the Electricity Council Standard 44-8 "Overhead Line Clearances". This reference should in fact be to ECS 43-8. The EC has now been abolished and DNO's/NGrid do not appear to be applying these separation distances (fall-over+ maximum swing of overhead wires), instead are stipulating 1.5 x the blade tip height (187.5m for 125m tip turbines). Scottish and Southern have requested (Rushy

[50] Local Drainage Board provides site specific maps of adopted waterways.
[51] The Feasibility Study should specify the indicative costs of trenching the 11/33kV cables through the 1.5 x blade tip fall over zone.

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		the line, in order to comply with HSE requirements during construction, should the DNO raise no concerns with separation distance between the line and the operating turbine. NB. HSE guidance note GS6 and Energy Networks Association Tehnical Specification 43-8 setout that within 15 meters of any overhead line supported on steel towers or 9 meters of any overhead line supported on wood poles, the relevant network operator must be consulted. i.e. DNO for 11/33kV lines.		Mead site) that: "The clearance between any overhead line and a wind turbine shall not be less than 1.5 times the height of the turbine, taken to the top of the turbine blade" (PR-PS-340 APPLICATION OF CLEARANCES TO OVERHEAD LINES AT LV TO 400kV).
11,33,66 and 132kV electricity lines	Not over sailing, for 11 and 33kV poled lines and tip height plus 10% for 33, 66 and 132kV lines on pylons.	11,33 and 132kV (Not 132 in Scotland) lines are the responsibility of the DNO. If the maximum buffer cannot be achieved consultation with DNO to be undertaken. Tip height + 10% for 33-132kV based on National Grid's minimum requirement for 275kV and above lines. Notwithstanding this, if the installed capacity of the site would be likely to support the cabling of over head lines this should be taken into account.	1.5 x blade tip height.	Scottish and Southern DNO have advised (September 2009): "The clearance between any overhead line and a wind turbine shall not be less than 1.5 times the height of the turbine, taken to the top of the turbine blade" (Ref.PR-PS-340 APPLICATION OF CLEARANCES TO OVERHEAD LINES AT LV TO 400kV) Note that this reference has not been validated.
275 – 400kV in UK and 132kV in Scotland	Tip height plus 10%[52]	In England and Wales National Grid are responsible for 275kV and above. In Scotland National Grid are responsible for 132kV and above. In October 2009, National Grid issued PS(T)087 – Issue 2 – Overhead line separation from wind turbines. It establishes that there is no impact on transmission lines by turbines that are sited more than 3 rotor diameters away from the line. In	3 rotor diameters (c.300m).	In some instances National Grid have requested a separation distance much greater than blade tip height +10%, due to extra strain/wear and tear placed on the HVLines caused by turbulence and wake effects from the turbines. This issue has yet to be tested at Public Inquiry. Current guidance from National Grid (PS(T)087 – Issue 2 – Overhead line separation from wind turbines) is that there is no impact on

[52] Assumes that cost of trenching HV line is not economic.

Constraint	Minimum Buffer Requirement[46]	Minimum Buffer Justification	Maximum Buffer Requirement[47]	Maximum Buffer Justification
		addition it does not prohibit closer sitting (provided that separation is greater than topple distance) but instead encourages early communication with NGET. The definition of topple distance has changed from tip height plus 20m to tip height plus 10%. National Grid, when consulted by Local Planning Authorities on planning applications (e.g. Ford Turbines, Dagenham) have requested that separation distances are based on the blade tip fall over distance + the maximum calculated swing of the HV cable. Fall over +10% would be a minimum allowing for a 12m cable swing. This is broadly in line with Electricity Association Standard 43-8 Overhead Line Clearances (2004) – which is referenced in National Grid guidance "Sense of Place" these Design Guidelines have been developed by National Grid to address the issues associated with developing sites crossed by, or in the vicinity of, pylons and high voltage overhead lines.		transmission lines by turbines that are sited more than 3 rotor diameters away from the line.
High pressure fuel pipelines (ie those identified through linesearch.org.uk)	125 – Blade Tip Fall Over. NB Separation distances for other fuel lines (medium, local high pressure and lower pressure gas pipelines and gas mains) should be determined by the standard separation distance required by the operator for construction activities. Local gas network operator should be consulted for information on the network in the vicinity of the site.	National Grid (Transco) has prepared a confidential internal report on separation distances between wind turbines and high pressure gas pipelines. This risk assessment concluded that blade tip fall over distance is required. Responding to consultations Transco have stated that an objection will be raised to any turbine within this distance. Experience to date is that Transco do not impose weight restrictions on plant crossing pipelines ie access tracks can cross pipelines. Clarification should be sought from pipe operator. Some turbine manufactures recommend fall over separation distances to "sour" gas pipe lines.	150m	Precautionary principle separation distance, to allow for micro-sighting of turbines. The National Grid risk table for development near high pressure gas pipelines http://www.nationalgrid.com/NR/rdonlyres/325B83B7-096C-4599-BBE2-D944E9307509/19056/aptdstmay07.pdf identifies as negligible the risk from pilling at 150m+ to a high pressure gas pipeline.

Constraint	Minimum Buffer Requirement[46]	Minimum Buffer Justification	Maximum Buffer Requirement[47]	Maximum Buffer Justification
Sewage and Water Pipes	No buffer	Not considered sensitive	No buffer	Not considered sensitive
Fixed Links (Microwave/Scanning Telemetry)	100m[53] Fixed links: 2nd and 8th Fresnel Zone (where frequency of link is available) and/or operator defined (if achievable) Scanning Telemetry links: 8th Fresnel zone.	Default separation distance requested by majority of fixed link operators. Bacon Report/Ofcom and majority of fixed link operators will accept a separation distance of the 2nd Freznel zone in most instances. 25m PAGER POWER additional buffer to 2nd Fresnel – LOOK AT PPower smaple report…	100m (Fixed Links) 1km + Blade length to Scanning Telemetry links.	Default separation distance request by majority of fixed link operators Basically scanning telemetry links operate at a lower frequency and so are liable to increased disruption to the signal path from turbines: http://www.jrc.co.uk/windfarms/
Turbine Warranty	-	Different manufacturers put in place different warranty restrictions and/or these maybe negotiable.	There should be no buildings taller than 15m within 300-400m of turbines and there should be no buildings within blade tip fall over distance.	Nordex advised in meeting of 8.5.08 with commercial director that they have recently turned down some single turbine sites because of their proximity to buildings. Nordex advised keeping the topple distance completely free of buildings (also driven by insurance) and restricting building heights to less than 15 feet within an approximate area of 300/400 meters of the base of the turbine.
Turbine Optimisation	5 rotor diameters down wind (SW assumed prevailing direction for turbine orientation) x 3 rotor diameters cross wind.	Minimum required to ensure turbulence and wake effects do not significantly reduced output/affect performance.	6 rotor diameters down wind (SW assumed prevailing direction for turbine orientation) x 4 rotor diameters cross wind.	More conservative separations.

[53] Distance between blade tip (when at 90 degrees from vertical) and the centre of fixed link.

N

Key

- Council boundary
- Sites of Importance for Nature Conservation (SINC)
- Sites of Special Scientific Interest (SSSI)
- Special Protection Area (SPA)
- Ramsar
- Special Areas of Conservation (SAC)
- National Nature Reserve (NNR)
- Local Nature Reserve (NNR)
- Important Bird Areas (IBA)

0 km 4.5 km

Scale 1:75,000 @ A3

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Figure A.1

Environmental Constraints

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N

Key

- Council boundary
- Scheduled monument
- Historic battlefield
- Country park
- Registered Parks & Gardens
- Ancient woodland

Listed Buildings

- Grade I
- Grade II*
- Grade II

0 km 4.5 km

Scale 1:75,000 @ A3

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Figure A.2

City of York Council Area with cultural designation constraints applied

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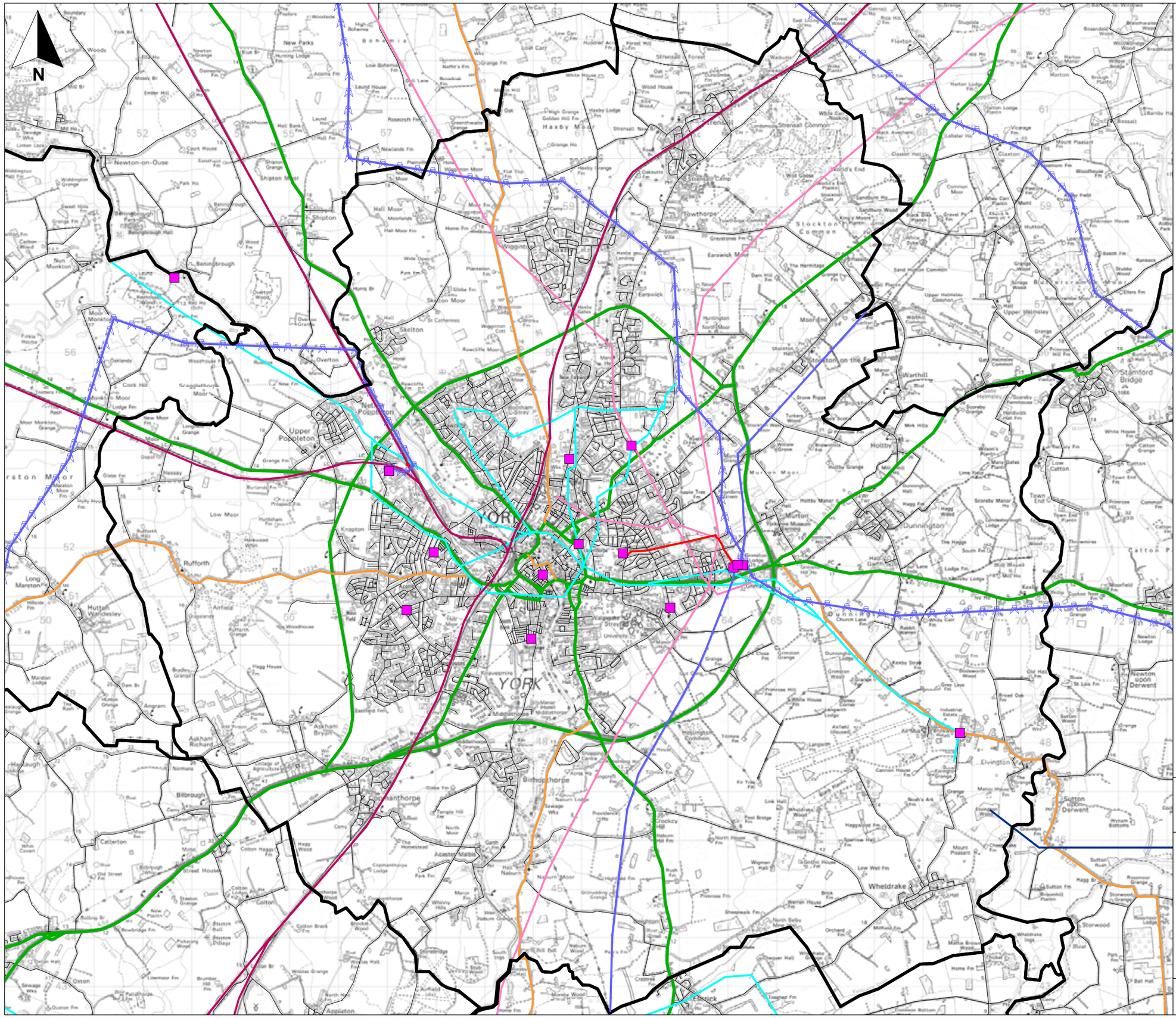

Key

- Council boundary
- Minor road
- B road
- A road
- Rail line
- Gas transmission pipeline
- CE Electric 33 kV overhead power line
- CE Electric 66 kV overhead power line
- CE Electric 132 kV overhead power line
- Substation site
- Electrical transmission overhead power line
- Electrical cable

0 km — 4.5 km

Scale 1:75,000 @ A3

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Figure A.3

City of York Council Area infrastructure

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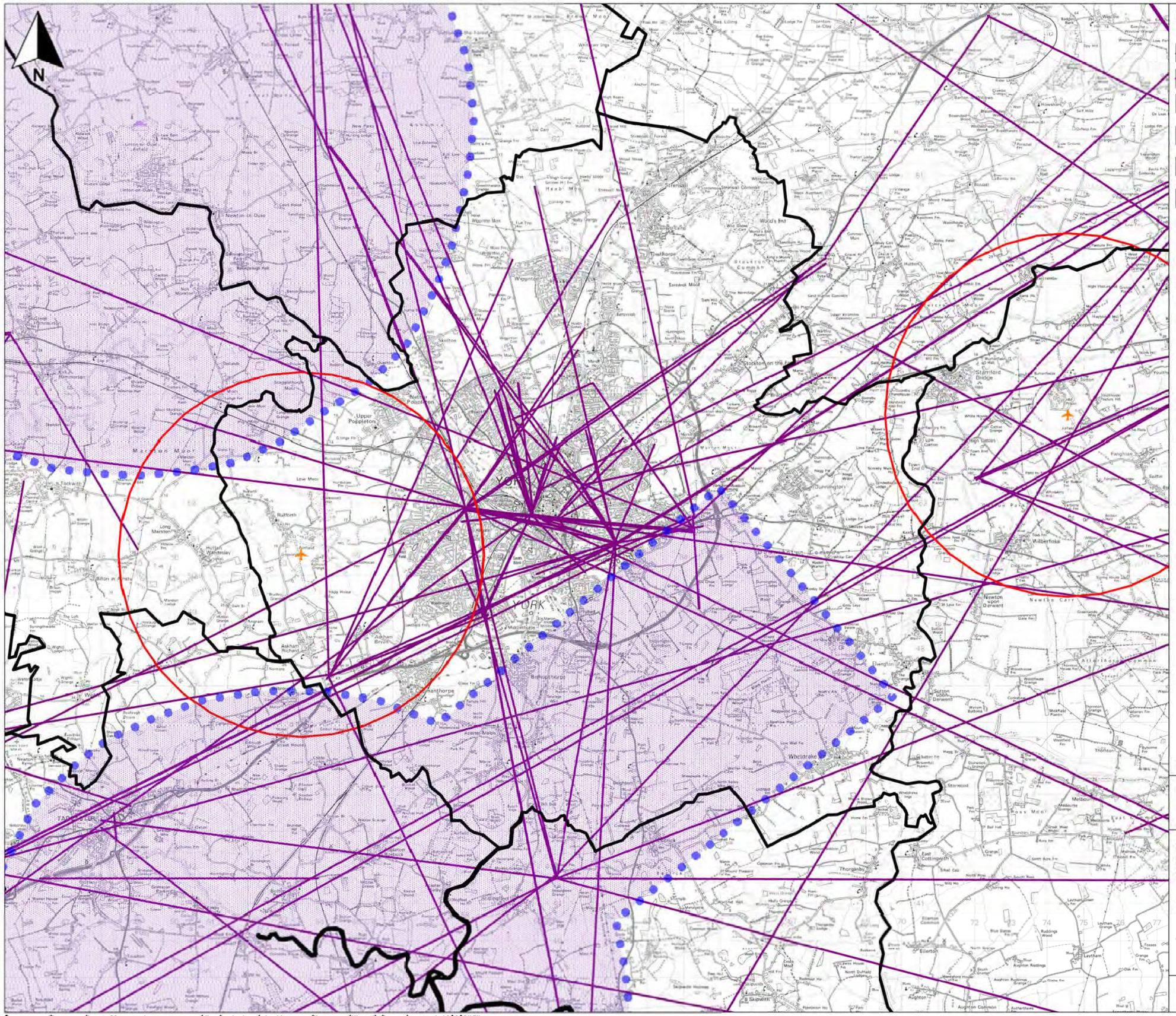

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Figure A.4

Airports, Radar and Communications

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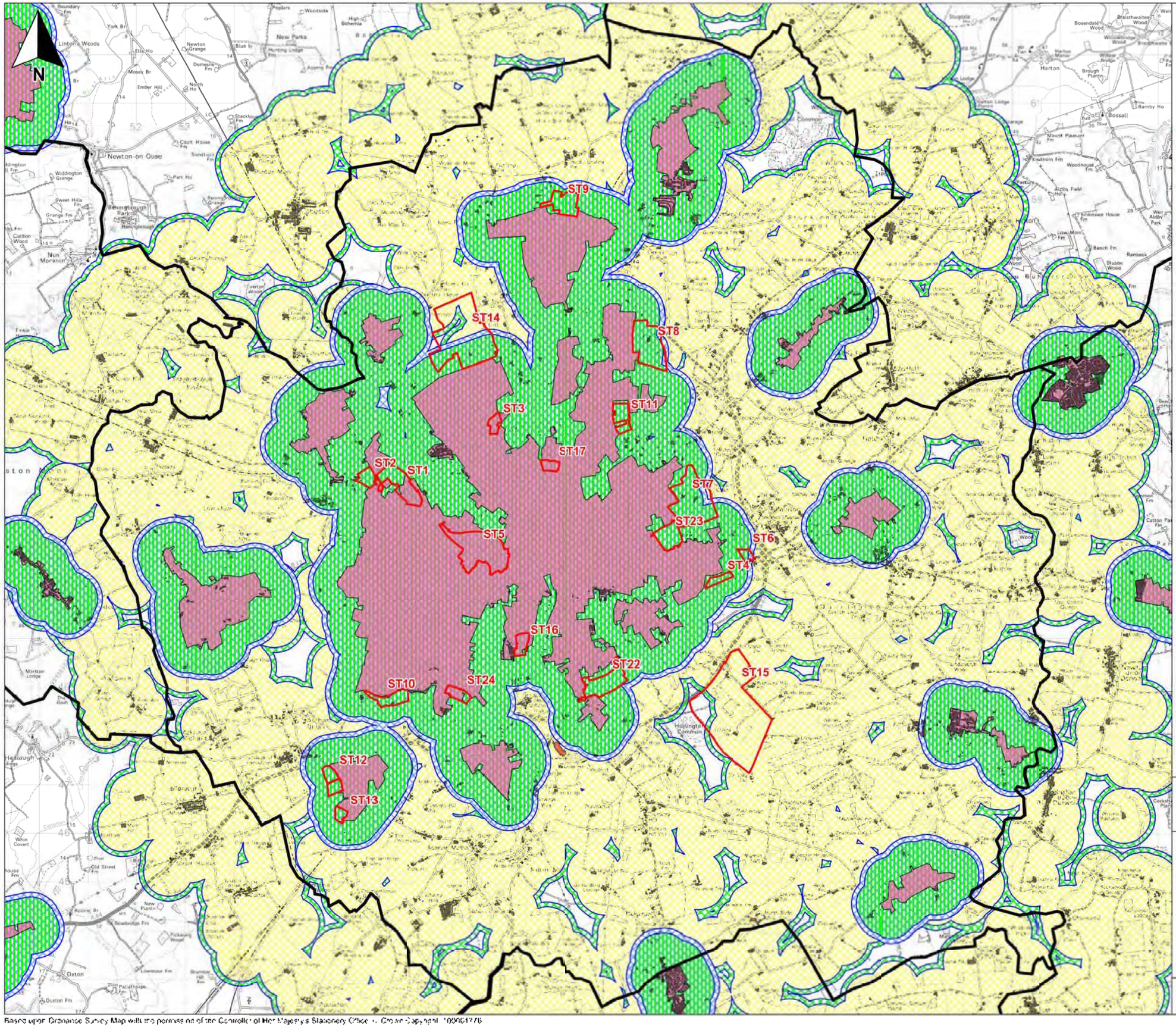

Key

- Council boundary
- Rural buildings
- Urban areas
- Urban areas
- Rural buildings 500 m noise buffer
- Urban areas 500 m noise buffer
- Rural buildings 600 m noise buffer
- Urban areas 600 m noise buffer

Strategic Sites

ST 1 - British Sugar
ST 2 - Former Civil Service Sports Ground, Millfield Lane
ST 3 - The Grainstores, Water Lane
ST 4 - Land adjacent Hull Road and Grimon Bar
ST 5 - York Central
ST 6 - Land East of Grimston Bar
ST 7 - Land East of Metcalf Lane
ST 8 - Land North of Monks Cross
ST 9 - Land North of Haxby
ST 10 - Land at Moor Lane, Woodthorpe
ST 11 - Land at New Lane, Huntington
ST 12 - Land at Manor Heath Road, Copmanthorpe
ST 13 - Land at Moor Lane, Copmanthorpe
ST 14 - Land North of Clifton Moor
ST 15 - Whinthorpe
ST 16 - Terry's
ST 17 - Nestle South
ST 18 - Monks Cross
ST 19 - North Minster Business Park
ST 20 - Castle Piccadilly
ST 21 - Naburn Designer Outlet
ST 22 - Germany Beck
ST 23 - Derwenthorpe
ST 24 - York College

0 km 4.5 km

Scale 1:75,000 @ A3

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Figure A.5

Rural Buildings and Urban Areas with Noise Buffers

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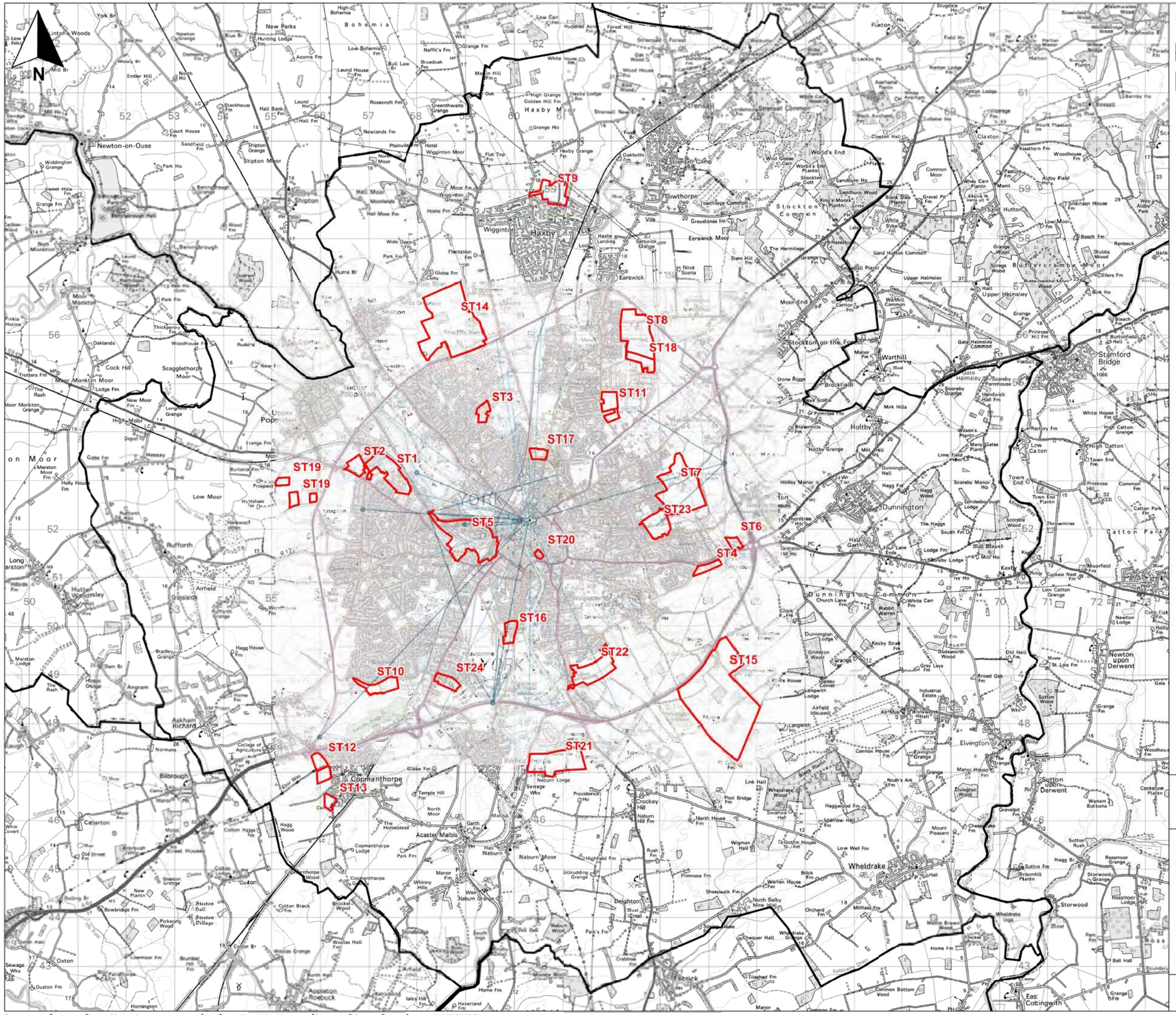

Key

Council boundary

Strategic housing area

Strategic Sites

- ST 1 - British Sugar
- ST 2 - Former Civil Service Sports Ground, Millfield Lane
- ST 3 - The Grainstores, Water Lane
- ST 4 - Land adjacent Hull Road and Grimon Bar
- ST 5 - York Central
- ST 6 - Land East of Grimston bar
- ST 7 - Land East of Metcalf Lane
- ST 8 - Land North of Monks Cross
- ST 9 - Land North of Haxby
- ST 10 - Land at Moor Lane, Woodthorpe
- ST 11 - Land at New Lane, Huntington
- ST 12 - Land at Manor Heath Road, Copmanthorpe
- ST 13 - Land at Moor Lane, Copmanthorpe
- ST 14 - Land North of Clifton Moor
- ST 15 - Whinthorpe
- ST 16 - Terry's
- ST 17 - Nestle South
- ST 18 - Monks Cross
- ST 19 - North Minster Business Park
- ST 20 - Castle Piccadilly
- ST 21 - Naburn Designer Outlet
- ST 22 - Germany Beck
- ST 23 - Derwenthorpe
- ST 24 - York College

0 km 4.5 km

Scale 1:75,000 @ A3

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Figure A.6

Minster Views Analysis and Strategic Sites

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A.2 Solar Resource Assessment

A.2.1 SAP Methodology

Annual Energy Yield (kWh/yr) = 0.8 x kWp x S x Z_{PV}

Where:

S = Annual Solar Radiation (kWh/m^2) as determined from Table A-2.

kWp = Size of Solar PV output (kW)

Z_{PV} = Overshading factor determined from Table A-3.

Table A-2 Solar Radiation (As per SAP v9.90)

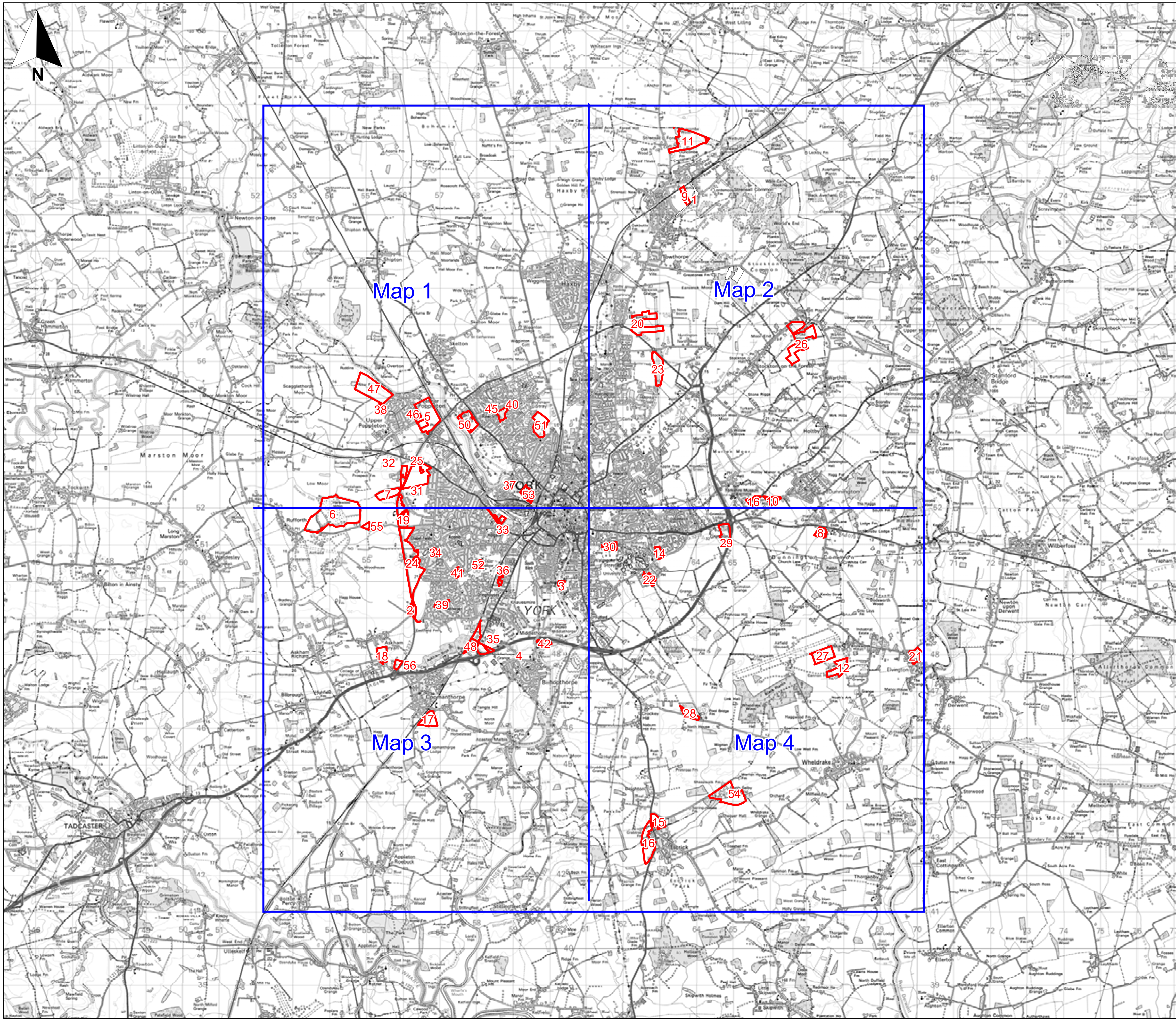
Tilt of Collector	Orientation of Collector				
	South	SE/SW	E/W	NE/NW	North
Horizontal	961				
30	1073	1027	913	785	730
45	1054	997	854	686	640
60	989	927	776	597	500
Vertical	746	705	582	440	371

Table H2 Annual Solar Radiation kWh/m^2

Table A-3 Overshading Factor

Overshading	% of sky blocked by obstacles	Overshading Factor
Heavy	> 80%	0.5
Significant	> 60% - 80%	0.65
Modest	20 – 60%	0.8
None or very little	< 20%	1.0

Table H4 Overshading Factor



Key

Site boundary

Map area

1 Site number

0 km — 6 km

Scale 1:100,000 @ A3

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Figure A.7
Solar Sites Map Divisions

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Key

Site boundary

Site number

Legend

5 Millfield Farm
6 Harewood Whin
7 Knapton Moor
20 Amalgamated Sites East of Earswick
23 Amalgamated East of Monks Cross
25 Amalgamated Sites between Knapton and Westfield
30 The Retreat, Heslington Road
31 Land to the West of Knapton
32 Wheatlands
37 Swinerton Avenue Land POS 1
38 Main St./Ousemoor Land Recreation Ground
40 Clifton (AKA Rawcliffe) Lake and Surrounds
43 Esplanade Clifton Long reach
45 Bilsdale Close Land
47 Clifton Long Reach
50 Rawcliffe Bar Country Park
51 Clifton Backies Nature Reserve
53 St Peters School Playing Field
55 Knapton Moor 2

0 km — 2.4 km

Scale 1:40,000 @ A3

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Figure A.8
Solar Sites Map 1

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Key

Site boundary

1 Site number

Legend

1 Strensall Common
9 Flaxton Road Strensall
10 York Road, Dunnington
11 Duncombe Farm, Strensall
16 Land to the West of A19, Escrick
20 Amalgamated sites East of Earswick
23 Amalgamated East of Monks Cross
26 North Carlton Farm, Stockton-on-the-forest
37 Swinerton Avenue Land POS 1
40 Clifton (AKA Rawcliffe) Lake and Surrounds
43 Esplanade Clifton Long reach
45 Bilsdale Close Land
50 Rawcliffe Bar Country Park
51 Clifton Backies Nature Reserve
53 St. Peters School Playing Field

0 km 2.4 km

Scale 1:40,000 @ A3

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Figure A.9
Solar Sites Map 2

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34848-Edi018 parkb

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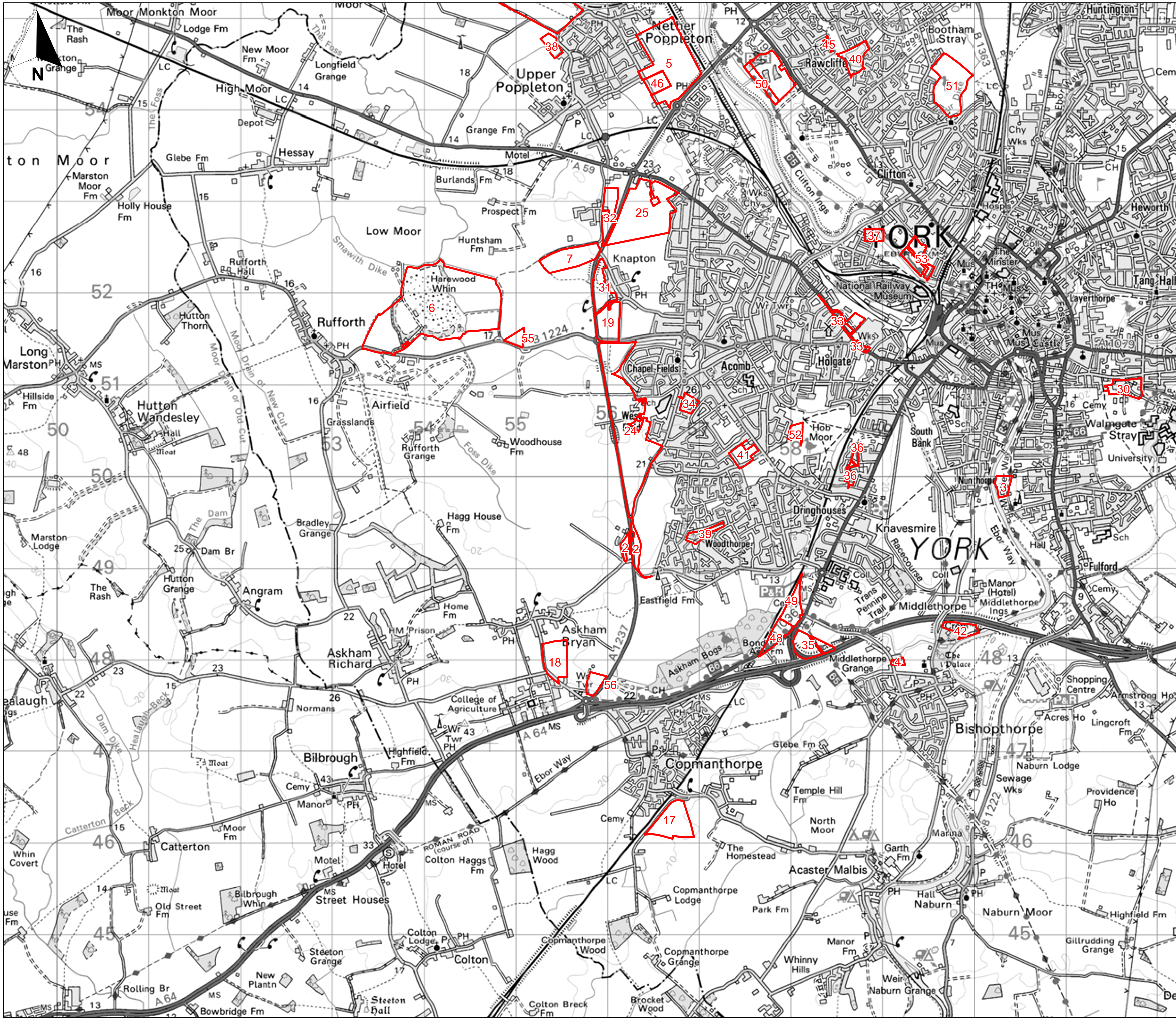

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Key

Site boundary

1 Site number

Legend

2 Moor Lane roundabout
3 Fulford Ing Love Lane POS
4 Tadcaster Road Land Rear YCFHE
5 Millfield Farm
6 Harewood Whin
7 Knapton Moor
11 Duncombe Farm, Strensall
13 Land at Murton Lane Industrial Estate
17 Land at Moor Lane, Copmanthorpe
18 Playing Fields and Village Fields off Askham Fields Lane
19 Land at Wetherby Road, Knapton
24 Amalgamated Site west of Chapelfields
25 Amalgamated Sites between Knapton and Westfield
28 Pool Bridge Farm
30 The Retreat, Heslington Road
31 Land to the West of Knapton
32 Wheatlands
33 Holgate Park site
34 Askham Lane Bachelor Hill POS
35 Tadcaster Road Ashfield Estate Land 1
36 Nelsons Lane/Mayfield Grove Land
37 Swinerton Avenue Land POS 1
38 Main St./Ousemoor Land Recreation Ground
39 Acomb Wood
40 Clifton (AKA Rawcliffe) Lake and Surrounds
41 Gale Lane Playing Field
42 Crematorium Land
43 Esplanade Clifton Long reach
44 Acres Farm Barn & Land
45 Bilsdale Close Land
46 Millfield Land Poppleton Junior Football Club
47 Clifton Long Reach
48 Askham Bar Land 2
49 Sim Hills Site
50 Rawcliffe Bar Country Park
51 Clifton Backies Nature Reserve
52 Hob Moor Nature Reserve
53 St Peters School Playing Field
56 Askam Bryan

0 km — 3 km

Scale 1:50,000 @ A3

City of York Council
Renewable and Low Carbon Energy Generation Options Update

Figure A.10
Solar Sites Map 3

February 2014
34848-Edi018 parkb

Key

Site boundary

1 Site number

Legend

3 Fulford Ing Love Lane POS
8 Land at Hull Road Dunnington
12 South of Airfield Buisness Park
14 Pond Field
15 Land to the North of Escrick
16 Land to the West of A19, Escrick
21 Amalgamated Sites of Main street Elvington
22 Land South West of Heslington Playing Fields
27 Elvington Airfield
28 Pool Bridge Farm
29 Land Adjacent to Grimston Bar and A1079
30 The Retreat, Heslington Road
36 Nelsons Lane/Mayfield Grove Land
42 Crematorium Land
54 Hermitage Farmland site (no. 750)

0 km 2.4 km

Scale 1:40,000 @ A3

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Figure A.11
Solar Sites Map 4

April 2014
34848-Edi020 parkb

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A.3 District Heating Assessment

Table A-4 Site Assessment of District heating Potential

Site Ref	Name	Proposed Development	Large Heat Loads	High Base Loads	Other Loads	Residential Potential	Land Availability	Ease of Access	Expansion Potential	Commentary
ST1	British Sugar	Residential	L	L		M	H	H	L	Residential demand means low baseload. Limited scope to extend supply to other loads. Constrained by railway line in linking to E13.
ST2	Former Civil Service Sports Ground, Millfield Lane	Residential	L	L	Millfield Academy School	M	H	H	L	Residential demand means low baseload. Limited scope to extend supply to other loads. Constrained by railway line in linking to E13.
ST3	The Grainstores, Water Lane	Residential	L	L	Light Industrial	L	H	H	L	Predominantly residential demand. Local expansion also predominantly retrofit for existing homes. Some light industrial but limited heating demand.
ST4	Land adjacent Hull Road and Grimon Bar	Residential	L	L	Adjacent to University	L	H	H	L	University DH scheme runs to buildings to South of site. Potential to explore connection to University network.
ST5	York Central	Residential / Office								Central site with large loads and demand diversity (residential, retail and office).
ST6	Land East of Grimston Bar	Residential	L	L	NA	L	L	H	L	No major base loads in proximity to site and constrained on East and South sides by major roads.
ST7	Land East of Metcalf Lane	Residential	M	M	Adjacent to ST23. Industrial Estate to South of site	M	H	H	M	Anchor loads to South of site on Industrial Estate. Potential link to ST23.
ST8	Land North of Monks Cross	Residential	L	L	School on SW edge of site	M	H	H	L	School to SW of site provides potential load diversity
ST9	Land North of Haxby	Residential	L	L		L	H	H	L	Safeguarded land constrains site. Limited demand beyond residential therefore high degree of retrofit required for expansion.)
ST10	Land at Moor Lane, Woodthorpe	Residential	L	L	NA	L	H	M	L	No anchor loads in vicinity. Reliant on retrofit to resident to grow network.
ST11	Land at New Lane, Huntington	Residential	M	M	Light industrial, supermarket and retail park	L	H	H	M	Adjacent retail premises and Sports Stadium offer scope to develop heating network. Refurbishment of Monks Cross could incorporate CHP.
ST12	Land at Manor Heath Road, Copmanthorpe	Residential	L	L	Small retail on Main St to East of site	L	H	H	L	Would need either small retail or Askham Bryan College to make DH viable. College is on other side of major road (A64)
ST13	Land at Moor Lane, Copmanthorpe	Residential	L	L	NA	L	H	H	L	No anchor loads surrounding site. Expansion potential limited to existing dwellings
ST14	Land North of Clifton Moor	Residential	L	L	Clifton Moor Retail Park	L	H	H	M	Retail Park is separated by major road. However, retail units may offer baseload potential - particularly supermarket (heating and chilling
ST15	Whinthorpe	Residential	M	M	Schools and retail potentially included in development site masterplan	M	H	H	M	DH could be incorporated in masterplan. CHP more viable if schools and retail included in masterplan.
ST16	Terry's	Office	L	L	NA	L	M	H	L	No anchor loads in proximity.
ST17	Nestle South	Residential	H	H	Nestle Site; Hospital	L	H	H	M	CHP already installed at Nestle site and to be installed at City Hospital. Might be able to get these sites to supply heat to residential units.
ST18	Monks Cross	Office	M	M	ST8; Strategic Employment adjacent	L	H	H	M	Link to ST8 and existing retail/proposed employment site
ST19	North Minster Business Park	Light Industrial	L	M	NA	L	H	H	L	Light industrial load profile; no scope for expansion. Constrained by A59 road to North.

Site Ref	Name	Proposed Development	Large Heat Loads	High Base Loads	Other Loads	Residential Potential	Land Availability	Ease of Access	Expansion Potential	Commentary
ST20	Castle Piccadilly	Retail	L	L	Small retail in surrounding area	L	M	M	L	Small scale opportunity unless retrofit is undertaken with adjacent premises
ST21	Naburn Designer Outlet	Leisure	M	M	Expansion of Existing Retail Outlet	L	H	H	L	Reliant on existing site energy solution
ST22	Germany Beck	Residential	L	L	Fulford School	L	M	M	L	Without other anchor loads this would be a small scheme.
ST23	Derwenthorpe	Residential	M	M	Industrial Estate to East	L	H	H	M	Potential to link with ST7 and Industrial Estate to East of site
ST24	York College	Mixed Use	M	M	College Buildings	L	H	H	L	Reliant on existing site energy solution

Appendix B
Supporting Data

Energy Demand Data

City of York - Present Electricity Demand

City of York – Present Gas Demand

Projected Energy Demand – Strategic Sites

Grid Electricity Information

Figure B-1 EHV (33 kV) Generation Capacity

Figure B-2 HV (11 kV) Generation Capacity

Figure B-3 Sub Stations in City of York

Present Electricity Demand

The trend in electricity consumption within the City of York is shown in Table B-1.

Table B-1 Annual Electricity Consumption (City of York)

Consumer	Annual Consumption (GWh/yr)						
	2005	2006	2007	2008	2009	2010	2011
Domestic	356.48	348.06	342.40	326.69	330.96	333.18	330.26
Commercial and Industrial Consumers	531.42	509.53	476.57	472.60	480.63	506.36	479.32
All Consumers	887.90	857.59	818.97	799.29	811.58	839.54	809.58
UK (All Consumers)				119,800	118,541	118,836	111,603

Source: DECC

Table B-2 Average Electricity Demand (City of York)

Consumer	Average Annual Consumption (kWh/yr)						
	2005	2006	2007	2008	2009	2010	2011
Domestic	4,178	4,074	3,977	3,817	3,820	3,819	3,779
UK (Domestic)	NA	NA	NA	4,599	4,526	4,513	4,221
Commercial and Industrial Consumers	75,454	72,212	67,598	67,631	70,216	73,856	68,848
UK (Commercial and Industrial)							

Source: DECC ((Note – NA = Not Available)

Present Natural Gas Demand

Table B-3 Annual Gas Consumption (City of York)

Consumer	Annual Consumption (GWh/yr)						
	2005	2006	2007	2008	2009	2010	2011
Domestic	1,414	1,381	1,337	1,295	1,194	1,203	1,146
Commercial and Industrial Consumers	1,197	1,183	812	740	632	648	617
All Consumers	2,611	2,564	2,149	2,034	1,826	1,851	1,764
UK (All Consumers)							

Source: DECC

Table B-4 Average Gas Demand (City of York)

Consumer	Average Annual Consumption (kWh/yr)						
	2005	2006	2007	2008	2009	2010	2011
Domestic	19,030	18,266	17,563	16,938	15,506	15,575	14,792
UK (Domestic)	NA	NA	NA	16,546	15,217	17,774	13,252
Commercial and Industrial Consumers	805,762	833,706	607,144	592,327	549,193	565,557	533,060
UK (Commercial and Industrial)							

Source: DECC (Note – NA = Not Available)

Projected Demand – Strategic Sites

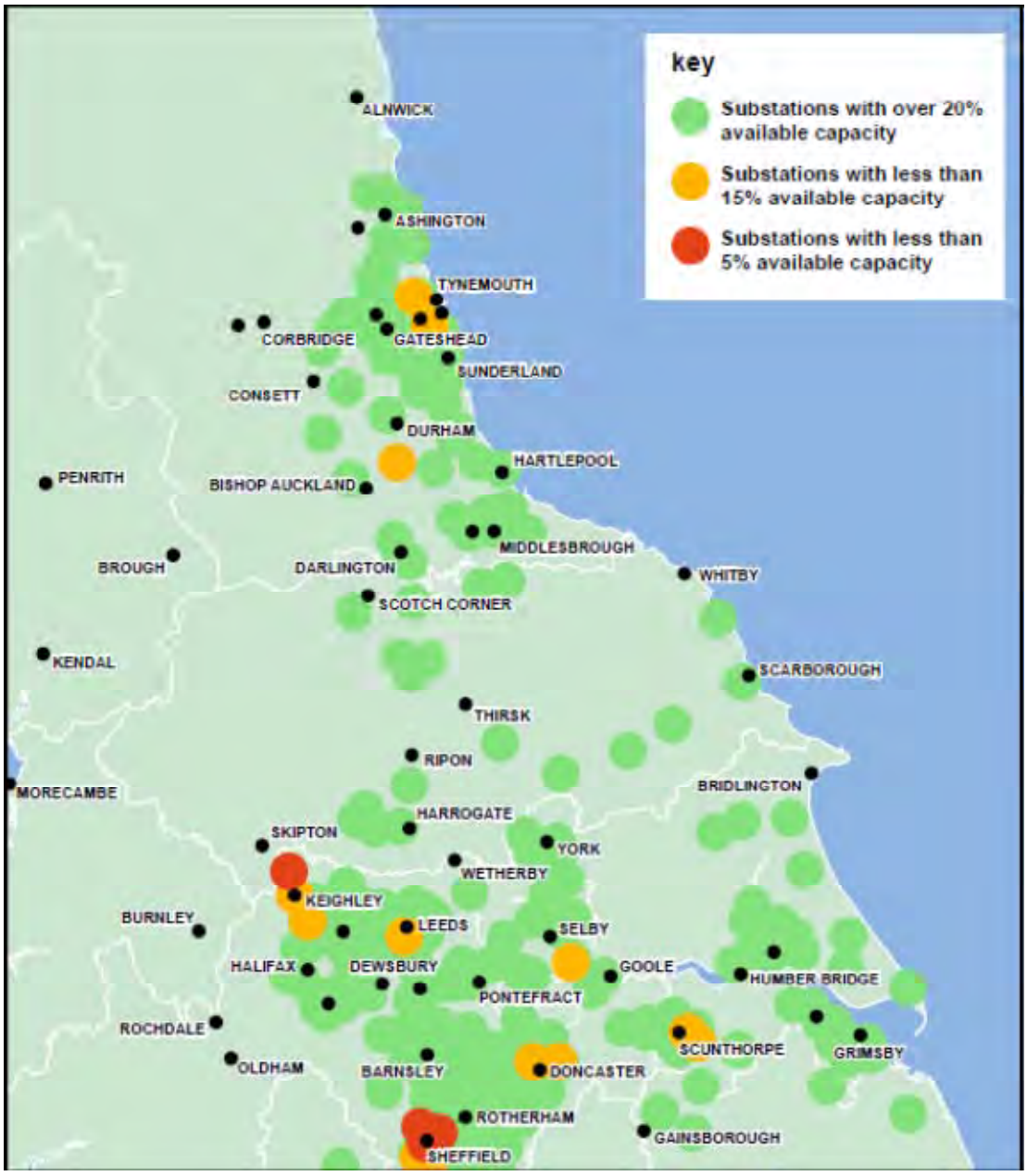
Table B-5 Strategic Sites and Energy Demand Estimate

#	Strategic Site	Proposed Development	Est Electricity Demand (kWh/yr)	Est Heating Demand (kWh/yr)
ST1	British Sugar	998 dwellings	4,483,000	10,858,000
ST2	Former Civil Service Sports Ground, Millfield Lane	308 dwellings	1,382,830	3,349,420
ST3	The Grainstores, Water Lane	216 dwellings	962,195	2,330,510
ST4	Land adjacent Hull Road and Grimon Bar	211 dwellings	948,330	2,296,740
ST5	York Central	438 dwellings; Office B1a	2,560,895	5,196,070
ST6	Land East of Grimston Bar	154 dwellings	691,415	1,674,710
ST7	Land East of Metcalf Lane	1800 dwellings	8,087,400	19,587,600
ST8	Land North of Monks Cross	1569 dwellings	7,054,010	17,084,740
ST9	Land North of Haxby	747 dwellings	3,357,085	8,130,610
ST10	Land at Moor Lane, Woodthorpe	511 dwellings	2,296,230	5,561,340
ST11	Land at New Lane, Huntington	411 dwellings	1,846,930	4,473,140
ST12	Land at Manor Heath Road, Copmanthorpe	354 dwellings	1,727,600	4,146,240
ST13	Land at Moor Lane, Copmanthorpe	115 dwellings	561,200	1,346,880
ST14	Land North of Clifton Moor	4020 dwellings	18,061,860	43,745,640
ST15	Whinthorpe	5580* dwellings	25,070,940	60,721,560
ST16	Terry's	Office B1a	855,000	1,080,000
ST17	Nestle South	130 dwellings	644,800	1,547,520
ST18	Monks Cross	Office B1a	475,000	600,000
ST19	NorthMinster Business Park	R&D, light industrial, storage and distribution (B1b/B1c/B2/B8)	400,000	1,240,000
ST20	Castle Piccadilly	Retail A1 (25,000 sq. m net)	4,125,000	0
ST21	Naburn Designer Outlet	Leisure D2 (12,000 sq. m net)	1,920,000	5,280,000
ST22	Germany Beck^{+++}		0	0
ST23	Derwenthorpe^{+++}	540 dwellings	0	0
ST24	York College^{+++}		0	0

Source: Details of strategic sites from Local Plan. * Note: this includes the 900 that will be post 2030
$^{+++}$ These sites already have consent granted for development

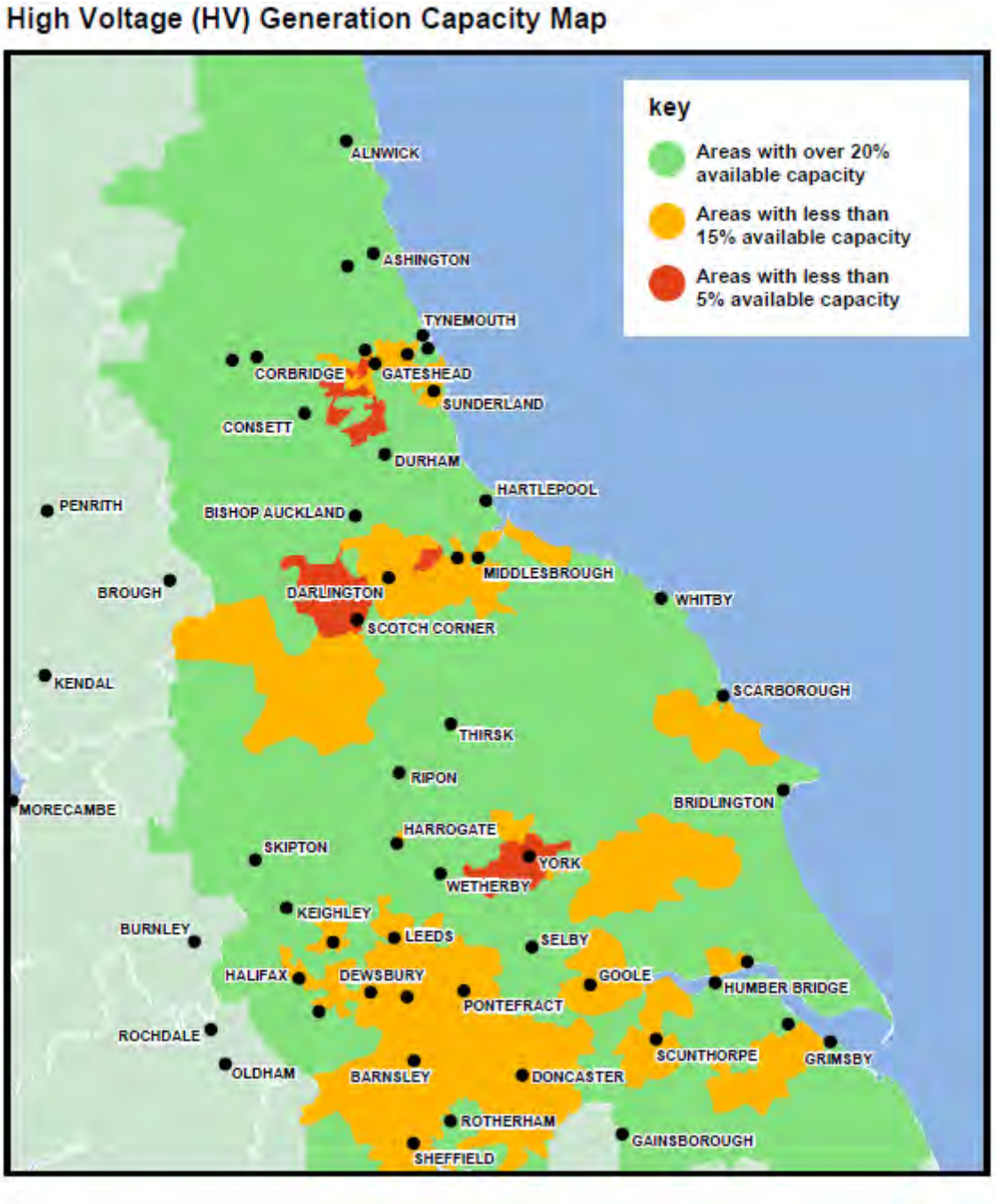
Grid Electricity Information

Figure B-1 EHV (33 kV) Generation Capacity



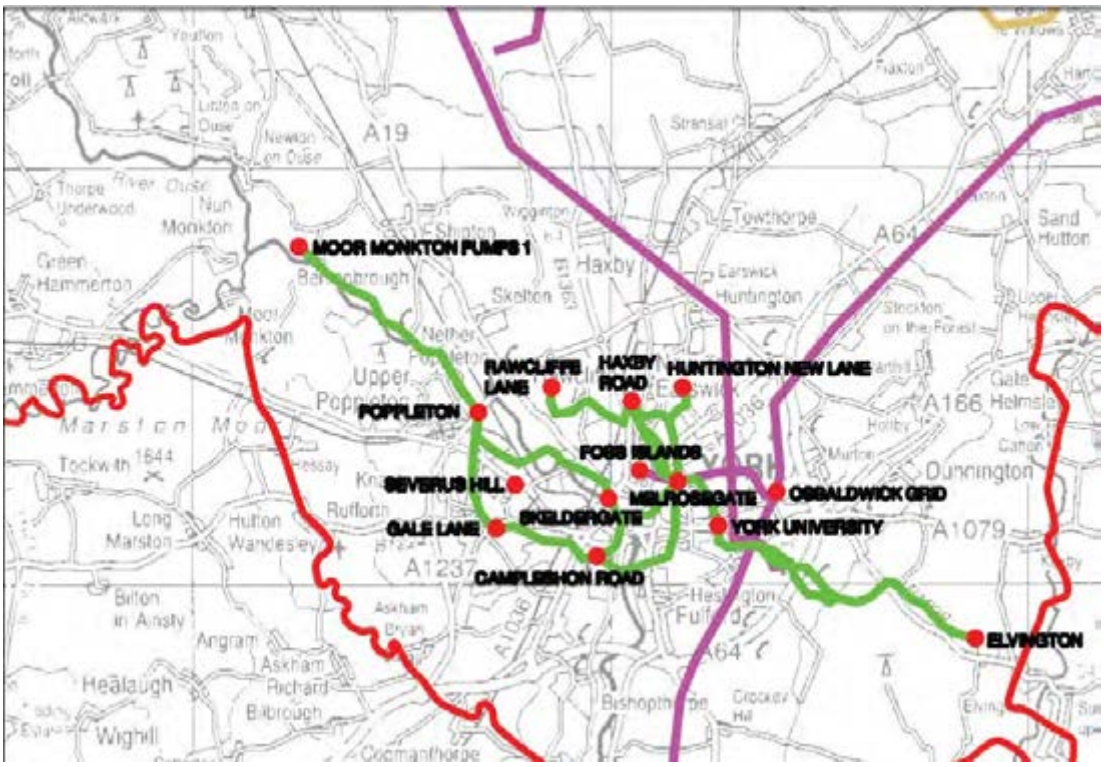
Source: Northern PowerGrid

Figure B-2 HV (11 kV) Generation Capacity



Source: Northern PowerGrid

Figure B-3 Sub Stations in City of York



Source: Northern Grid

Appendix C
Strategic Sites Summary Guidance Matrix

In setting policy requirements for the strategic sites identified in the plan, and in order for developers to consider what technologies may help them to meet national or local policy targets/standards, Table C-1 provides an appraisal of what renewable/low carbon energy technologies are likely to be best suited.

Nine different technologies are considered for each strategic development site with conclusions regarding whether the potential is low, medium or high:

- 'Low' means that there is either a limited resource or significant constraints to the technology coming forward from a practical, planning or environmental perspective, e.g.
    - For wind it means that the proximity of existing and proposed residential development would generally preclude wind turbines coming forward as an integral part of it (noise and marketing impacts for example).
    - For biomass it means that there is a limited resource or prospects to incorporate biomass heating or AD plant as part of a scheme.
    - For solar PV/solar thermal it means that there is no south facing roof space suited to this technology or the nature of the proposed development would otherwise preclude it.
    - For heat pumps it would mean that there is no available capacity to do this.
    - For hydro it means that there is no watercourse within or adjacent to the site with sufficient flow that could be exploited.
    - For geothermal it means that there is no available resource.
    - For micro-CHP it means that the technology is still untested on a significant scale in the UK.
    - For district heating it means that the mix of uses in terms of heat load and density of the scheme in terms of length of pipework are unlikely to be commercially attractive.
- 'Medium' means there is some resource availability and whilst there are constraints, there is potential for these constraints to be overcome.
- 'High' means that there is an abundant resource and very little in the way of constraints to the technology coming forward.

Of course, the further constraint that needs to be considered is cost, so in Table C-2 we identify the key capital costs for installing such a system on a per dwelling basis. This can then feed into the wider viability testing being

undertaken in support of the plan. It should also be noted that these technologies could form *part* of the solution for achieving higher Building Regulation standards or particular levels of the CSH or BREEAM. Through the viability testing care will need to be taken to avoid double counting.

Table C-1 Strategic Sites Renewable Energy Technology Guidance Matrix

#	Strategic Site	Wind	Solar PV	Solar Thermal	Biomass	Heat Pumps	Hydro	Micro-CHP	Geothermal	District Heating
ST1	British Sugar	L	H	H	L	M	L	L	L	L
ST2	Former Civil Service Sports Ground, Millfield Lane	L	H	H	L	M	L	L	L	L
ST3	The Grainstores, Water Lane	L	H	H	M	M	L	L	L	L
ST4	Land adjacent Hull Road and Grimon Bar	L	H	H	M	M	L	L	L	M
ST5	York Central	L	H	H	L	M	L	L	L	H
ST6	Land East of Grimston Bar	L	H	H	M	M	L	L	L	L
ST7	Land East of Metcalf Lane	L	H	H	M	M	L	L	L	H
ST8	Land North of Monks Cross	L	H	H	M	M	L	L	L	M
ST9	Land North of Haxby	L	H	H	M	M	L	L	L	L
ST10	Land at Moor Lane, Woodthorpe	L	H	H	H	M	L	L	L	L
ST11	Land at New Lane, Huntington	L	H	H	H	M	L	L	L	M
ST12	Land at Manor Heath Road, Copmanthorpe	L	H	H	H	M	L	L	L	M
ST13	Land at Moor Lane, Copmanthorpe	L	H	H	H	M	L	L	L	L
ST14	Land North of Clifton Moor	M	H	H	M	M	L	L	L	M
ST15	Whinthorpe	M	H	H	H	H	L	L	L	H
ST16	Terry's	L	H	H	L	M	L	L	L	L
ST17	Nestle South	L	H	H	L	M	L	L	L	M
ST18	Monks Cross	L	H	H	H	M	L	L	L	M
ST19	NorthMinster Business Park	L	H	H	H	M	L	L	L	L
ST20	Castle Piccadilly	L	H	H	L	M	L	L	L	M
ST21	Naburn Designer Outlet	L	H	H	H	M	L	L	L	L

#	Strategic Site	Wind	Solar PV	Solar Thermal	Biomass	Heat Pumps	Hydro	Micro-CHP	Geothermal	District Heating
ST22	Germany Beck+++	L	H	H	H	M	L	L	L	M
ST23	Derwenthorpe+++	L	H	H	H	M	L	L	L	H
ST24	York College+++	L	H	H	H	M	L	L	L	L

Note: L = Low Potential; M = Moderate Potential; H = High P

Table C-2 Technology costs per dwelling

Technology	*Typical* cost per dwelling
Wind	£21,000-£30,000 *Source: Energy Saving Trust*[54]
Solar PV	£6,000 -£7,400 *Source: Energy Saving Trust*
Solar thermal	£3,000-£5,000 *Source: Energy Saving Trust*
Biomass	Pellet stove: £4,300 Pellet fed boiler: £14,000-£19,00 Log boiler: £11,000-£23,000 *Source: Energy Saving Trust*
Heat pumps	Air source heat pumps: £7,000 to £14,000 Ground source heat pumps: £11,000 to £15,000 *Source: Energy Saving Trust*
Hydro	£25,000 *Source: Energy Saving Trust*
Micro-CHP	Limited/no cost information currently available

[54] http://www.energysavingtrust.org.uk/Generating-energy/Choosing-a-renewable-technology/Solar-panels-PV#3 (accessed July 2014)

Technology	*Typical* cost per dwelling
Geothermal	Limited/no cost information currently available
District heating	£2,400-£2,800 *Source: PBA*[55]

[55] City of York Local Plan Area Wide Viability Study, PBA, June 2013 (based on figures from the Potential and Costs for District Heating Networks, A Report to DECC, POYRY and Faber Maunsell, April 2009

Appendix D
Sites for Potential Allocation

Four sites are being considered by the Council for allocation for renewable energy uses in the emerging plan. These sites were identified following their identification at previous stages of the plan-making process having been promoted by the developer/landowner.

Further details regarding each site are provided here.

Knapton Moor (2), Wetherby Road

Owner: City of York Council

Land Area: 2.4 Ha

Estimated Available Land Area for Solar Development: 1.9 Ha

Potential Solar Farm Capacity: 1.3 MWp

Estimated Annual Energy Output: 1,103 MWh

Site description: Agricultural field located south west of Knapton village and north of Wetherby road (B1224). The site is located 150 m south east of Harewood Whin, a former landfill site.

Key technical considerations: the site is considered to have good technical potential for solar PV having been considered as part of the solar appraisal in Section 5 (Tables 5-2 and 5-3). This concludes that the site could generate circa 1,103 MWh per annum.

Key Planning and Environmental Considerations:

- The site's location within the Green Belt means that regard would need to be had to the findings of the Green Belt review to justify the allocation of the site in the plan (as inappropriate development that could impact on Green Belt openness). If the site were not allocated, any planning application would need to demonstrate the very special circumstances for such inappropriate development in the Green Belt as per NPPF policy (e.g. environmental benefits from renewable energy generation, responding to climate change and the temporary nature of the development).

- As with any solar scheme key environmental issues to consider will include landscape and visual impact, ecology, archaeology and heritage, hydrology and flood risk.

- The need for ancillary works such as access roads and fences/security would also need to be considered.

Recommendation: This site has clear potential for solar PV, with no overriding technical or environmental constraints identified at this stage. The main constraint concerns planning policy with regard to the site's location within the Green Belt. Via the plan-making process the case would need to be made for the site's allocation, reflecting the findings of York's Green Belt review. If a draft allocation were to be taken forward then this would need to be tested further through wider consultation with key stakeholders and the local community.

Land to NW of Hermitage

Owner: Gem Holdings (York) Ltd

Land Area: 9.7 Ha

Estimated Available Land Area for Solar Development: 8.8 Ha

Site Description: Agricultural land (Grade 2) and reclaimed tip being promoted as a solar farm by the developer.

Potential Solar Farm Capacity: 6 MWp

Estimated Annual Energy Output: 5,110 MWh

Key technical considerations: the site is considered to have good technical potential for solar PV having been considered as part of the solar appraisal in Section 5 (Tables 5-2 and 5-3). This concludes that the site could generate circa 5,100 MWh per annum.

Key Planning and Environmental Considerations:

- The site's location within the Green Belt means that regard would need to be had to the findings of the Green Belt review to justify the allocation of the site in the plan (as inappropriate development that could impact on Green Belt openness). If the site were not allocated, any planning application would need to demonstrate the very special circumstances for such inappropriate development in the Green Belt as per NPPF policy (e.g. environmental benefits from renewable energy generation, responding to climate change and the temporary nature of the development).

- As with any solar scheme key environmental issues to consider will include landscape and visual impact, ecology, archaeology and heritage, hydrology and flood risk. In this case, the site is located directly north of Strensall Common Nature Reserve and Special Area of Conservation (SAC).

- The need for ancillary works such as access roads and fences/security would also need to be considered.

- The loss of Grade 2 agricultural land would need to be balanced against the site's potential for renewable energy generation, albeit that the proposed land use would only be temporary (solar PV has a typical lifetime of up to 25 years)

Recommendation: This site has clear potential for solar PV, with no overriding technical constraints identified at this stage. The main constraints concern potential environmental effects which would need to be understood in more detail, as well as planning policy with regard to the site's location within the Green Belt. Via the plan-making process the case would need to be made for the site's allocation, reflecting the findings of York's Green Belt review. If a draft allocation were to be taken forward then this would need to be tested further through wider consultation with key stakeholders and the local community.

Harewood Whin

Owner: City of York Council

Land Area: 68 Ha

Estimated Available Land Area for Solar Development: 17 Ha

Site Description: Landfill site for waste disposal.

Potential Solar Farm Capacity: 11.5 MWp

Estimated Annual Energy Output: 10,000 MWh

Key Technical Considerations: the site is considered to have good technical potential for solar PV having been considered as part of the solar appraisal in Section 5 (Tables 5-2 and 5-3). The full potential of the site as assessed in Section 5 has been rationalised based on subsequent proposals for remediation work at the site and a planning application (13/00041/FULM) for a materials recycling facility (MRF) and waste transfer station.

Key Planning and Environmental Considerations:

- As with any solar scheme key environmental issues to consider will include landscape and visual impact, ecology, archaeology and heritage, hydrology and flood risk.
- The need for ancillary works such as access roads and fences/security would also need to be considered.

North Selby Mine

Owner: Peel Environmental and North Selby Waste Ltd

Land Area: 23.3 Ha

Site Description: Former Coal Mine proposed for 60,000 tonnes per year anaerobic digestion (AD) and horticultural glasshouse facility. The Council has resolved to grant planning consent for this scheme at Planning Committee on 23rd January 2014 (ref. 12/03385/FULM)[56], however as inappropriate development in the Green Belt the decision has had to be referred to the Secretary of State before a formal decision can be issued.

The technical, planning and environmental constraints presented by this proposal are rehearsed at length within the Officer's Report to planning committee, reflecting the EIA submitted by the developer and views of statutory consultees and others. As inappropriate development in the Green Belt, the Council needed to consider the very special circumstances for the proposed scheme, including the environmental benefits associated with the increased production of energy from renewable sources in accordance with NPPF policy. On balance, the Council decided that this is a suitable site for development when considered against Green Belt policy and wider environmental

[56] http://planningaccess.york.gov.uk/online-applications/files/9BD56E4925FD1459E808EB0D8BBD435D/pdf/12_03385_FULM--1475468.pdf (accessed March 2014)

impacts. The Council may choose to allocate this site in the emerging plan given that its committee decision and Officer's report confirm it is a suitable site and proposal, albeit that this may need reviewing pending the Secretary of State's response which is now awaited.

Askham Bryan

Owner: Lindum York

Land Area: 4.5 Ha

Estimated Available Land Area for Solar Development: 3.0 Ha

Site Description: Greenfield site classified as a Major Developed Site in the Green Belt. It is adjacent to Natural Gas National Grid and a compressed natural gas facility is proposed for the site.

Key Technical Considerations: Main issues around the development of the facility will centre on electrical supply for compressors and gas supply infrastructure. The compressors used on site will need an electrical supply so discussions with the DNO would need to establish the nearest suitable grid connection and capacity available to enable this. Given the adjacent gas facility there should not be extensive additional works required to provide gas supply to the site.

The site has been separately assessed for its potential solar development capacity in the event of the CNG facility not being taken forward. The site would offer potential capacity for a 2 MWp solar farm capable of generating in the region of 1,742 MWh of electricity per year. Further details are provided in Section 5 (Tables 5-2 and 5-3).

Planning and Environmental Considerations: In terms of the proposal's relationship to this study, a compressed natural gas facility is not strictly considered as a renewable or low carbon source of energy. Whilst the site may be also suited to renewable energy type uses (e.g. solar), we are not currently aware of the developer interest to do so, interest which would be essential in order to propose a site for allocation in the emerging plan.

If a solar scheme were to be pursued, then the environmental constraints would be similar to Knapton Moor and the Gem Holdings site, albeit that the site may not be as constrained in planning policy and Green Belt terms since it is already identified as a Major Developed Site.

Appendix E
Illustrative Cost of Technologies

Technologies costs are linked to market developments and, to an extent, the direction of UK Government policy in the level of market support that it provides to different forms of energy generation. While recognising the fluid nature of such costs it is useful to provide some guidance figures here in terms of the relative scale of costs associated with each technology type considered in this report. These details are provided in Table E.1.

Table E-1 Illustrative Costs of Technologies

Technology Type and Scale		**Installation Cost Range (£/kW)**		
Technology	**Scale of Capacity (MW)**	**Low**	**Medium**	**High**
Wind	< 0.015	5,000	5,500	6,100
Wind	1 – 5	1,600	2,000	2,300
Wind	> 5	1,130	1,600	2,040
Solar (Domestic)	< 0.004	1,500	1,900	2,500
Solar (Commercial)	1 - 10	900	1,000	1,100
Dedicated Biomass	5 - 50	2,540	3,695	5,210
Biomass CHP	5 - 50	2,700	3,900	5,000
Anaerobic Digestion	< 0.25	4,000	6,000	8,000
Anaerobic Digestion	> 0.5	3,000	4,500	6,000
Hydro	< 0.015	4,200	9,500	21,400
Hydro	0.1 – 1	2,000	4,500	10,000
Hydro	5 - 16	NA	3,150	NA
Heat Pumps*	0.001 – 0.02	700	1,100	1,600
Micro-CHP**	0.001 – 0.005	1,800	NA	3,000
Geothermal	> 0.1	2,350	4,740	7,000
Geothermal CHP	> 1	2,650	5,240	7,540

Source: 'Electricity Generating Costs 2013' (DECC, July 2013). Note that this includes an estimate of pre-development as well as construction costs. * Average of small market survey at April 2014. Water and air source pumps are at lower end of this range; ground source heat pumps at upper end. ** https://spiral.imperial.ac.uk/bitstream/10044/1/9844/6/Green%202012-08.pdf