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Prepared By: [REDACTED]
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Introduction

A natural capital assessment was undertaken for the proposed development at Hoo St Werburgh and neighbouring villages to support ongoing masterplanning, and the aspiration to deliver a high-quality development which delivers environmental net gain. This note provides background information on the **Natural Capital Planning Tool (NCPT)** which was implemented to assess potential ecosystem services benefits and environmental impacts associated with the proposed development.

This note sets out the methodology of the NCPT, the data used to produce an Ecosystem Service Impact Score (ESIS) and a Development Impact Score (DIS). Supporting assumptions that have been made to support the NCPT model and examples of other proposed developments assessed using the NCPT are also presented to provide a comparative context.

The Hoo Peninsula, within which the site is within the region of Kent, in south east England. The site falls within the jurisdiction of Medway Council. The majority of the site comprises large expanses of open farmed land and arable farm land within the larger urban area of Medway, which includes the village of Hoo St Werburgh and the village of Chattenden. The proposed development is for 10,600 homes and associated transport infrastructure to 2035. The proposed development will be designed based on Garden City principles.

What is the NCPT?

The **NCPT** is a Microsoft Excel based tool that allows the user to assess the natural capital value of a site. The NCPT is a multi-criteria analysis tool which weights different ecosystem services and quantitatively scores a development based on spatial land use information for existing and proposed uses as well as other indicators such as local population density, accessibility and size of green spaces and the agricultural land classification. All information required to run the NCPT is commonly available as part of the planning process and/or easily and freely accessible online. The NCPT was initially released in March 2018 and an updated version of the tool was released in February 2019. The more recent version was used to undertake this natural capital assessment. The NCPT was designed specifically for the planning and development context. The NCPT provides an up-to-date, holistic tool to appraise the proposed development in a quantitative way.

The NCPT assesses and quantifies the impacts of development proposals on Natural Capital and the ecosystem services an area provides to people, such as recreational opportunities, air quality regulation and climate regulation. The NCPT calculates two scores, an Ecosystem Service Impact Score (ESIS), which indicates the likely magnitude of the impact that the proposed plan will have on each of the ten assessed ecosystem services over an assessment timescale of 25 years post-development. It also calculates an aggregated Development Impact Score (DIS) which provides a broad overview of the overall performance on the proposed development. The NCPT also calculates a theoretical min/max impact score for each ecosystem service. These scores indicate the potential of the proposed development to deliver for ecosystem service enhancements (and loss). This is discussed further in the Outcomes of the NCPT section below.

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The NCPT was designed to enable planners and developers to effectively implement Government commitments made in the 25-Year Environment Plan:

“...to put the environment at the heart of planning and development to create better places for people to live and work. We will seek to embed a ‘net environmental gain’ principle for development to deliver environmental improvements locally and nationally. [...] That will enable us to achieve measurable improvements for the environment – ‘environmental net gains’” (HM Government 2018, p.32)

The NCPT has been used for a number of different projects. Birmingham City Council used the NCPT to improve the sustainability credentials of the Langley Sustainable Urban Extension, which aimed to be an ‘*exemplar sustainable development*’. Central Bedfordshire Council used the NCPT to assess 8 potential sites in the area for suitability as sites to help deliver the 20,000 required homes. [REDACTED]

Why are we using the NCPT?

There is an aspiration to deliver a sustainable rural settlement that is integrated with the local landscape¹. The settlement aims to make a significant contribution to meeting Local Housing Need and to provide associated transport infrastructure to unlock potential in the wider Medway area. The development will be designed with Garden City principles at the forefront and delivering a sustainable development will remain a key objective as the design progresses. A network of green infrastructure, improved accessibility to new and existing areas of countryside, and providing open green space are key features of the development. The NCPT provides a particularly useful tool for the ongoing appraisal of potential environmental benefits and impacts which can feed into the masterplanning as the development proposals evolve in future.

Benefits of the tool include²:

- The tool is free to use;
- It can be applied by a non-specialist in a short time-period although it is recommended that it is applied by an individual with good ecological understanding;
- All the information required to run the NCPT is commonly available as part of the planning process and/or easily and freely accessible online;
- The NCPT can be applied at all stages of the planning/development process and the design can be subsequently improved along the process;
- The NCPT is a recently developed tool, developed with input from lots of different research bodies and technical experts including Royal Town Planning Institute (RTPI), Department for Environment and Rural Affairs (DEFRA) and the Natural Environment Research Council (NERC); and
- The outputs allow the site and proposed uses to be assessed in ‘one go’ and provides a holistic evaluation of a range of ecosystem services.

Limitations of the tool include:

- The NCPT tool recognises land use types as set out in the masterplan but does not factor in how sensitive design principles will be employed and have the potential to improve certain indicator scores. For example, the implementation of SUDs would improve the flood risk and water quality associated with the site;

¹ Hoo Development Framework Draft Document 03/01/2019

² NCPT (2018) *About the NCPT* <http://ncptool.com/about-the-ncpt/>

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- The tool is more difficult to implement accurately when assessing at an early stage when less detail is available for different development plots and phases, and more assumptions are required to be made;
- The tool does not consider impacts associated with the proposed development such as additional usage of the local transport network and the potential impacts associated with noise and air quality;
- The tool does not account for land use parcel interaction. For example, an area of woodland is likely to provide higher biodiversity value if it is linked with other green infrastructure and ecological corridors; and
- Pre- and post-development land use types that remain the same are not included in the model, and therefore opportunities for improved scores may be missed. For example, if an area of woodland was incorporated in a masterplan, and an improved woodland management scheme was implemented then ecosystem services such as biodiversity would improve.

What data was used to inform the NCPT?

All information required to run the NCPT is easily and freely accessible online. This includes data on population density, heat exposure & proportion of built-up area, flood risk & drinking water safeguard zone, air quality management area, importance within ecological network, accessibility & size of greenspace sites, soil drainage and agricultural land classification. Within the NCPT, hyperlinks to sources of information are provided. Where external information sources were used, they have been referenced within this note.

The site masterplan is in the early stages of development, and therefore a number of assumptions for the proposed development were made in relation to delivery of Garden City principles. Some of these assumptions are based on Garden City principles, and particular design priorities which are identified in the development framework document. These assumptions are summarised in Table 2.

ArcGIS

GIS was used to analyse and split the site in relation to overlapping areas of similar attributes according to different data layers, including pre-development and post-development land use type, flood risk, and Agricultural Land Classification (ALC) as shown in Figure 1. Areas were split into polygons which had an area reference according to their land-use habitat type.

Area reference	Pre-development land-use/habitat type	Post-development land-use/habitat type	Area	Unit	Average width in m	Area in ha
PBA 101	J.1.1 Cultivated/disturbed land - arable	J.3.6.a Buildings - area covered with green roof	0.65	ha (area)		0.65
PBA 102	J.1.1 Cultivated/disturbed land - arable	J.3.6.a Buildings - area covered with green roof	1.45	ha (area)		1.45
PBA 103	J.1.1 Cultivated/disturbed land - arable	J.3.a.c Built-up areas - low density	0.53	ha (area)		0.53
PBA 104	J.1.1 Cultivated/disturbed land - arable	J.3.a.c Built-up areas - low density	0.76	ha (area)		0.76

Figure 1. The NCPT model showing pre-development and post-development land use type

Extended Phase 1 Habitat Map – aerial classification

A desk-based analysis of habitats on-site was undertaken using aerial photography by a Chartered Ecologist to inform the pre-development (existing) land-use types on site. The GIS team digitised the desk-based Phase 1 Habitat survey to produce a breakdown of pre-development land-use types in accordance with JNCC Phase 1 habitat classifications.

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Initial Masterplan

The illustrative masterplan (see **Appendix A**) was used to determine the post-development land use type on site. The masterplan is in the early stages of development, therefore detailed information on development parcels, and blue and green infrastructure is not available. Assumptions have therefore been made and are highlighted in **Table 1**.

Outcomes of the NCPT

The NCPT allows the user to manually review and alter the impact score multiplier used to calculate the overall DIS to factor in specific design features and other potential improvements. This aggregate score takes account of any manual adjustments made by the user. Some impact score multipliers were altered to account of high-quality design features which would be delivered. This section explains the outcome of each ecosystem service and the manual adjustments that were undertaken for each section.

The NCPT also provides a minimum possible score and a maximum possible score. This score is worked out relative to the size of the site and the land use types that exist on site. The minimum possible score is the lowest score that can be achieved through the tool based on the information that the user has entered in to the tool. The maximum possible score is the highest score that can be achieved through the information inputted. Achieving the maximum score would indicate that the Proposed Development has made the highest level of improvement possible in the masterplan from the pre-development land use type to the post-development land use type. [REDACTED]

Table 2 shows the output of the NCPT, the DIS, as a total for the whole development and on a per hectare (ha) basis. The DIS provides an aggregated score that indicates the impact of the proposed development, averaged over 25 years post-development, on each of the assessed ESIS. The NCPT allows the user to input 100 rows of data, however, with advice from the creator of the NCPT, it was deemed appropriate to use two NCPT spreadsheets and the scores were added together. This score was then divided by the total hectares assessed across both spreadsheets to get the per ha score. This methodology was checked with the creator of the NCPT to ensure it was correct³.

Overall the development achieves a positive impact score, indicating the potential for natural capital gain through the proposed development. The NCPT produced an aggregate score of +123.7, or +0.20 per hectare, which indicates that the site has the potential to provide additional ecosystem services based on the assumptions that have been made.

The average per hectare score in Table 2 takes account of the same factors as the overall DIS. A number of manual adjustments were made for the harvested products, aesthetic values, biodiversity, flood risk regulation and recreation ecosystem service indicators as reasonable assumptions could be made based upon Garden City principles.

³ Email Communication with Oliver Hoelzinger 15th February 2019.

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Table 1. The Development Impact Score of the Natural Capital Planning Tool, total and per hectare

Ecosystem Service	Development Impact Score (total)	Development Impact Score (per ha)
Harvested Products	-1402.5	-2.27
Biodiversity	-13.8	-0.02
Aesthetic Values	+1116.9	1.80
Recreation	+666.8	1.08
Water Quality Regulation	+101.4	0.16
Flood Risk Regulation	+5	0.01
Air Quality Regulation	-8.0	-0.01
Local Climate Regulation	-176.6	-0.29
Global Climate Regulation	+165.8	-0.27
Soil Contamination	0	0
TOTAL	+123.7	+0.20

Harvested Products

The justification of loss of agricultural land or the range of other benefits brought by new development is not assessed as part of the NCPT. The loss of harvested products is unavoidable for the Hoo development scenario because the majority of the site currently consists of grassland and arable cultivated/disturbed land, which yields a high harvested products value. A key garden city principle is that opportunities to grow food will be incorporated, and it is anticipated that the score can therefore be improved as the design evolves.

Biodiversity

The pre-development biodiversity provision was determined using aerial Phase 1 Habitat classifications. Ecological-led landscaping will be incorporated through the design of the site and will be an important factor for achieving planning permission for the site. An evidence-based Strategic Environmental Management Scheme (SEMS) has also been developed and will be critical to the sustainable delivery of the Hoo Peninsula development. The delivery of plans is required to be sensitive to the localised ecological context because there are extensive sites of both national and international importance near the site. The SEMS is proposed to include additional provision of native hedging, hedgerow trees, parkland trees, native woodland and community orchard, wetlands, nationally important habitat protected from recreational pressures and disturbance and a recreational centre to raise awareness of Hoo St Werburgh countryside. The proposed SEMS currently comprises 12 Strategic Environmental Management Areas (SEMA's), some of which are outside of the current area included in the masterplan and assessed through the NCPT. Therefore, it is expected that the biodiversity score would be positive if improvements were factored in.

Aesthetic Values

The aesthetic value of the site has the highest value, which is achieved through the delivery of Garden City principles through the masterplan. The proposed development will include high-quality, well designed buildings, open green space and infrastructure in keeping with the local Hoo Peninsula landscape context.

Recreation

Provision of recreational space is fundamental within Garden City principles and this is reflected in the high positive score that the post-development land-use type provides. The exact provision of green

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and blue infrastructure is not detailed at this stage and is largely based on assumptions, aligned with the draft masterplan and from advice sought from Medway Council.

Water Quality Regulation

The water quality regulation ecosystem service is informed by the risk of flooding (potential extent) and the surface and groundwater safeguard zones present on the site. It is also impacted by the pre-development and post-development land use type. The masterplan will include Sustainable Urban Drainage Systems (SUDs) that have the potential to improve water quality regulation through naturally treating surface water runoff from the site. The NCPT does not have the ability to assess the positive impact that SUDs would have on the water quality regulation ecosystem service, however, as the masterplan design evolves, the pre-development and post-development land use type will change to incorporate SUDs principles.

Flood Risk Regulation

The flood risk regulation is informed by the risk of flooding (potential extent) as determined through the Environment Agency flood risk maps. There is scope for improvement in the score throughout the evolution of a more detailed masterplan showing green and blue infrastructure provision. However, the NCPT does not allow for information to be entered in to relation to Sustainable Urban Drainage Systems (SUDs) and associated infrastructure which could improve the flood risk regulation score.

Air Quality Regulation

Air quality regulation produces a slightly negative score. However, air quality regulation has the potential to improve as the other indicators improve and more detail is incorporated, such as specific knowledge of incorporation of land-use types that have air quality regulation qualities. No manual adjustment has been undertaken directly for the air quality regulation ecosystem service.

Local Climate Regulation and Global Climate Regulation

Local and global climate regulation have the potential to be improved significantly through improvements made in other indicators as the masterplan develops further and through the detailed design stage. Energy demand reduction principles will be designed in to the buildings through spatial planning, green infrastructure provision and development context, however, the NCPT does not have the ability to incorporate these positive design improvements.

Soil Contamination

Soil contamination was not considered as part of the NCPT because the data required for this indicator is not readily available, and the indicator has not been tested in real-world scenarios.

Summary

The vision for Hoo is centred on Garden City principles with generous provision of green infrastructure, a proportion of buildings with green and brown roofs, community buildings, allotments, green corridors, improved woodland management and improved public accessibility to open areas and the wider countryside. The NCPT produced a positive aggregate score of +123.7, which indicates that the site has the potential to provide additional ecosystem services post-development, over a 25-year period, based on the assumptions that have been made. The masterplanning is at an early stage of development so as improved iterations emerge and the design progresses, it is expected that the aggregate development impact score would improve.

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Table 1. Table of Assumptions used in the NCPT⁴

Indicator	Which ecosystem service does this indicator inform?	Assumptions	Commentary
Land-use and Habitat Changes	Harvested Products, Biodiversity, Aesthetic Values, Recreation, Water Quality Regulation, Flood Risk Regulation, Air Quality Regulation, Local Climate Regulation, Global Climate Regulation, Soil Contamination	<p>Aerial photography Phase 1 Habitat Survey undertaken.</p> <p>Assumed the provision of green space, green roofs, brown roofs, community buildings, allotments, green roads and improved woodland management and public accessibility to open areas and community buildings based on the Garden City principles.</p>	<p>No detailed site surveys have been undertaken due to the nature of the business case being at an early stage of development.</p> <p>Garden City principles are part of the Hoo Development framework, therefore it has been deemed appropriated to make assumptions based on these principles.</p> <p>Due to the size of the area assessed (618.85 ha) it was deemed acceptable to exclude areas of <0.04 because in the worst-case scenario this would result in a maximum of 6.4 ha not included in the model, equivalent to ~1% of the overall site.</p> <p>The NCPT does not account for areas of land use that do not change as the development is built out. This excess area of site is likely to be made publicly accessible and will therefore have recreational value that is not accounted for within the NCPT.</p>

⁴ NCPT (2018) Resources <http://ncptool.com/ressources/>

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Indicator	Which ecosystem service does this indicator inform?	Assumptions	Commentary
Population Density	Aesthetic Values, Recreation, Local Climate Regulation		The population assumption of 26,131 residents was taken from Office for National Statistics ⁵⁶ data.
Heat Exposure & Proportion of Built-up Area	Flood Risk Regulation, Air Quality Regulation, Local Climate Regulation	Proportion of built up areas was calculated on GIS using the masterplan.	The proportion of built up areas has been estimated based on the masterplan provided by Medway Council. This masterplan is not yet fixed but to undertake the NCPT it was necessary to use the most up-to-date masterplan at the time of the assessment.
Flood Risk & Drinking Water Safeguard Zone	Water Quality Regulation, Flood Risk Regulation		Information on risk of flooding ⁷ and surface and groundwater safeguard zones ⁸ was incorporated in to the preliminary GIS model of the site that informed the NCPT.
Air Quality Management Area	Air Quality Regulation	In the NCPT it has been assumed that there are no Air Quality Management Areas (AQMA) in the area.	The site does not fall within an AQMA. The nearest AQMA is located along stretches of the Four Elms Roundabout on Four Elms Hill, which lies west of the site boundary.
Importance within Ecological Network	Biodiversity	Desk-based aerial photography Phase 1 Habitat classification produced using JNCC Phase 1 Habitat Survey classifications – no preliminary site surveys were undertaken.	No preliminary site surveys have been undertaken due to the nature of the business case being at an early stage of development.

⁵ ONS (2018) Population projections for local authorities.

<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/localauthoritiesinenglandtable2>

⁶ ONS (2018) Household projections for England. <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/householdprojectionsforengland>

⁷ UK Government (2019) *Flood Warning Information* <https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>

⁸ Environment Agency (2019) *Environment Agency data* <https://environment-agency.cloud.esriuk.com/farmers/>

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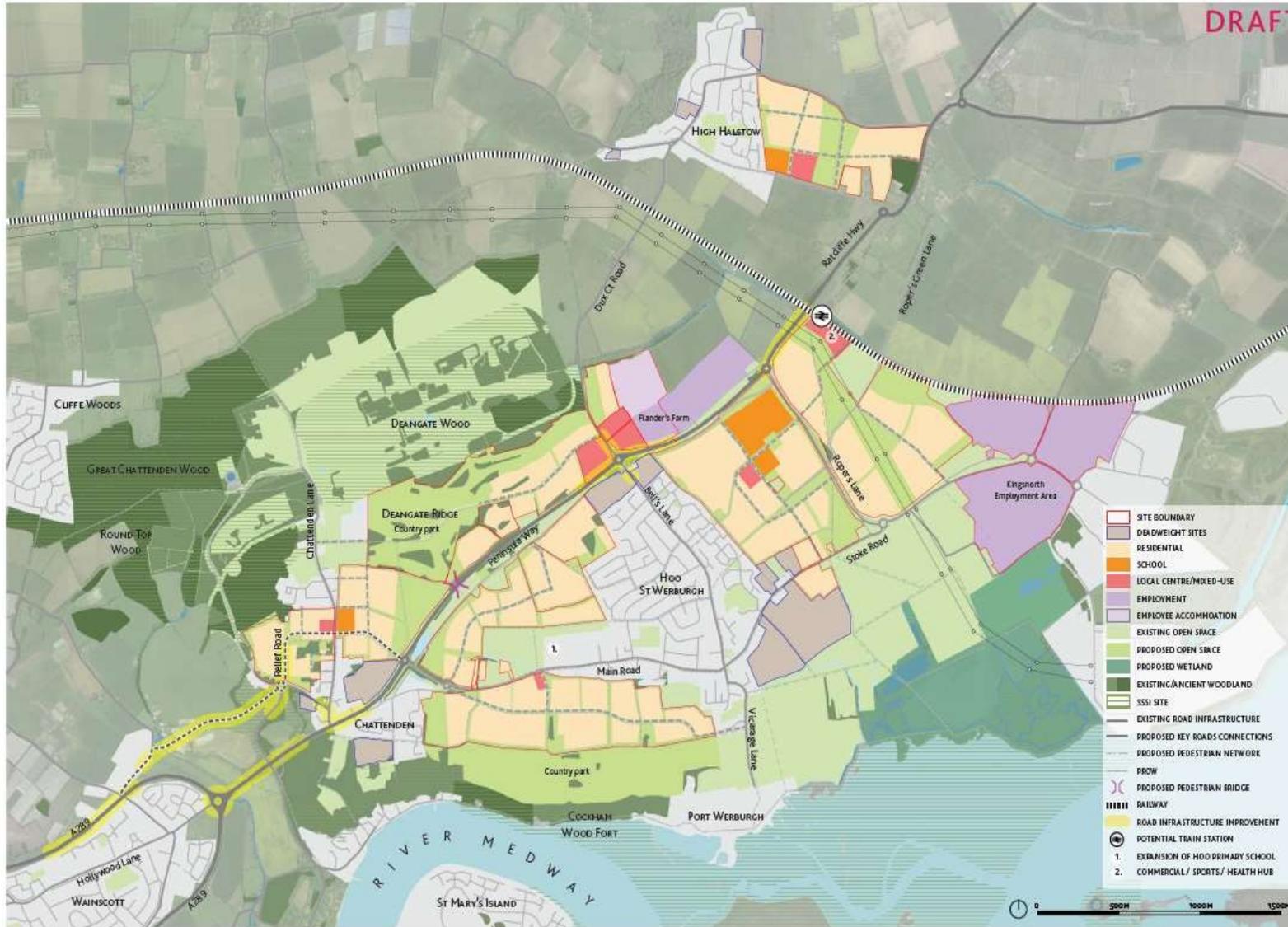
Indicator	Which ecosystem service does this indicator inform?	Assumptions	Commentary
Accessibility & Size of Greenspace Sites	Recreation	It was assumed that no public access was provided to the pre-development land use type areas classified as 'cultivated/disturbed arable land', which consists of most of the site, because it is likely that these fields are owned by private landowners. Much of this land was altered to be publicly accessible post-development.	Currently, parts of the site are inaccessible to the public, however, many of these areas will be opened up to the public through provision of green space, green infrastructure and community spaces.
Soil Drainage	Flood Risk Regulation		Both the flood risk dataset and surface water ⁹ were used, along with the NCPT recommended Soilscales page ¹⁰ .
Agricultural Land Classification	Harvested Products	See Land Use & Habitat changes assumptions.	UK Government Provisional ALC data which was last updated on 4 th March 2019 was used to determine the ALC of the site, which was then entered in the GIS model that informed the NCPT.

⁹ DEFRA (2019) *Defra Data Services Platform* <https://environment.data.gov.uk/>

¹⁰ Landis (2019) *Soilscales* <http://www.landis.org.uk/soilscales/>

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Appendix A. Medway Masterplan



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Appendix B. NCPT Case Study Examples

Case Studies

Langley Sustainable Urban Extension (SUE) Birmingham City Council¹¹

The Birmingham Langley SUE adopted the NCPT because the development aimed to be an ‘*exemplar sustainable development*’. Birmingham City Council (BCC) undertook the assessments to assess progress towards natural capital net gain as the masterplan design iterations progressed. Subsequently, the masterplan design was altered to ensure improvements in the embedded natural capital value of the site.

The initial masterplan had a Development Impact Score (DIS) of -6.5 which influenced subsequent masterplan revision. Similarly to the Grazeley development, the loss of harvested products remained as a low score because of the loss of agricultural land. Improvements were made to accessibility, proximity and connectivity of the land uses, which helped BCC achieve the maximum housing number and a marginal net gain for natural capital, 25 years post-development.

Development Impact Score	
Average Per-Hectare	
Ecosystem Service	Adjusted Scores
1. Harvested Products	-5.4
2. Biodiversity	+0.1
3. Aesthetic Values	+0.6
4. Recreation	+0.2
5. Water Quality Regulation	-0.2
6. Flood Risk Regulation	-0.1
7. Air Quality Regulation	+0.0
8. Local Climate Regulation	+0.0
9. Global Climate Regulation	-1.7
10. Soil Contamination	+0.0
Development Impact Score	-6.5

“Birmingham City Council tested the NCPT on a Masterplan for a new housing development for 5,000-6,000 new homes in the north-east of Birmingham. The aim was to assess the impact of the design against the ambition to achieve overall Natural Capital net-gain over a 25 year timeline.”

“Nick Grayson, Climate Change and Sustainability Manager at Birmingham City Council, says: “With the advent of the 25 Year Environment Plan, its commitment to net gain and the NPPF review (2018) – there is the real possibility of the NCPT providing that all important bridging device between national planning policy and the Government’s environmental restoration ambitions – at the site scale.”

Central Bedfordshire Land Allocation¹²

The NCPT was used to assess 8 potential sites in the Central Bedfordshire Council (CBC) area to help CBC deliver the 20,000 required homes, expected for delivery in the next 20 years. All 8 sites that had available draft masterplans were assessed using the NCPT. The maximum possible scores were used to guide improvements of the DIS and therefore the potential for creation of additional natural capital on the site.

The NCPT was run initially to understand the potential of each site for providing ecosystem service improvements, which is indicated through the minimum and maximum possible scores. The higher the maximum positive score, the higher the potential for ecosystem service improvements on site. CBC then ran the NCPT a second time to indicate whether the proposed design would improve or reduce the ecosystem services score. At the initial masterplanning stage, all scores were low. This fed

Development Impact Score			
Average Per-Hectare			
Ecosystem Service	Min Possible	Adjusted Scores	Max Possible
1. Harvested Products	+0.2	-2.33	-3.0
2. Biodiversity	+4.6	+0.27	-0.4
3. Aesthetic Values	+6.6	+0.98	-3.4
4. Recreation	+10.0	+4.68	+0.0
5. Water Quality Regulation	+2.3	+0.02	-2.3
6. Flood Risk Regulation	+3.0	+0.51	-0.0
7. Air Quality Regulation	+0.8	+0.11	-0.4
8. Local Climate Regulation	+5.4	+0.79	-2.7
9. Global Climate Regulation	+4.0	-0.32	1.0
10. Soil Contamination		+0.00	
Development Impact Score		+4.71	

¹¹ NCPT (2018) Case Studies <http://ncptool.com/case-studies/>

¹² NCPT (2018) Case Studies <http://ncptool.com/case-studies/>

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in to the process of improving the masterplan design to achieve a higher DIS.

“Central Bedfordshire Council used the NCPT to assess eight potential growth locations – predominantly housing developments of between 500 and 7,000 units on greenfield sites. The aim was to test both, the acceptability of the sites and the acceptability of the proposed design. The outcome was that all sites were in principle capable of providing natural capital net gains but the performance of the site designs varied. The Council is determined to implement the NCPT into local planning practice.”

 *Principal Planning Officer at Central Bedfordshire Council, says: “The toolkit has provided us with an objective and simple means of assessing both, the location and design of development proposals put forward for consideration through the emerging Local Plan for Central Bedfordshire. We have found it especially useful in working collaboratively with site promoters – negotiating enhancements to masterplans, and giving us a tangible way to measure whether proposals are capable of achieving a net gain in natural capital. This will ensure that we get the very best out of our sites.”*