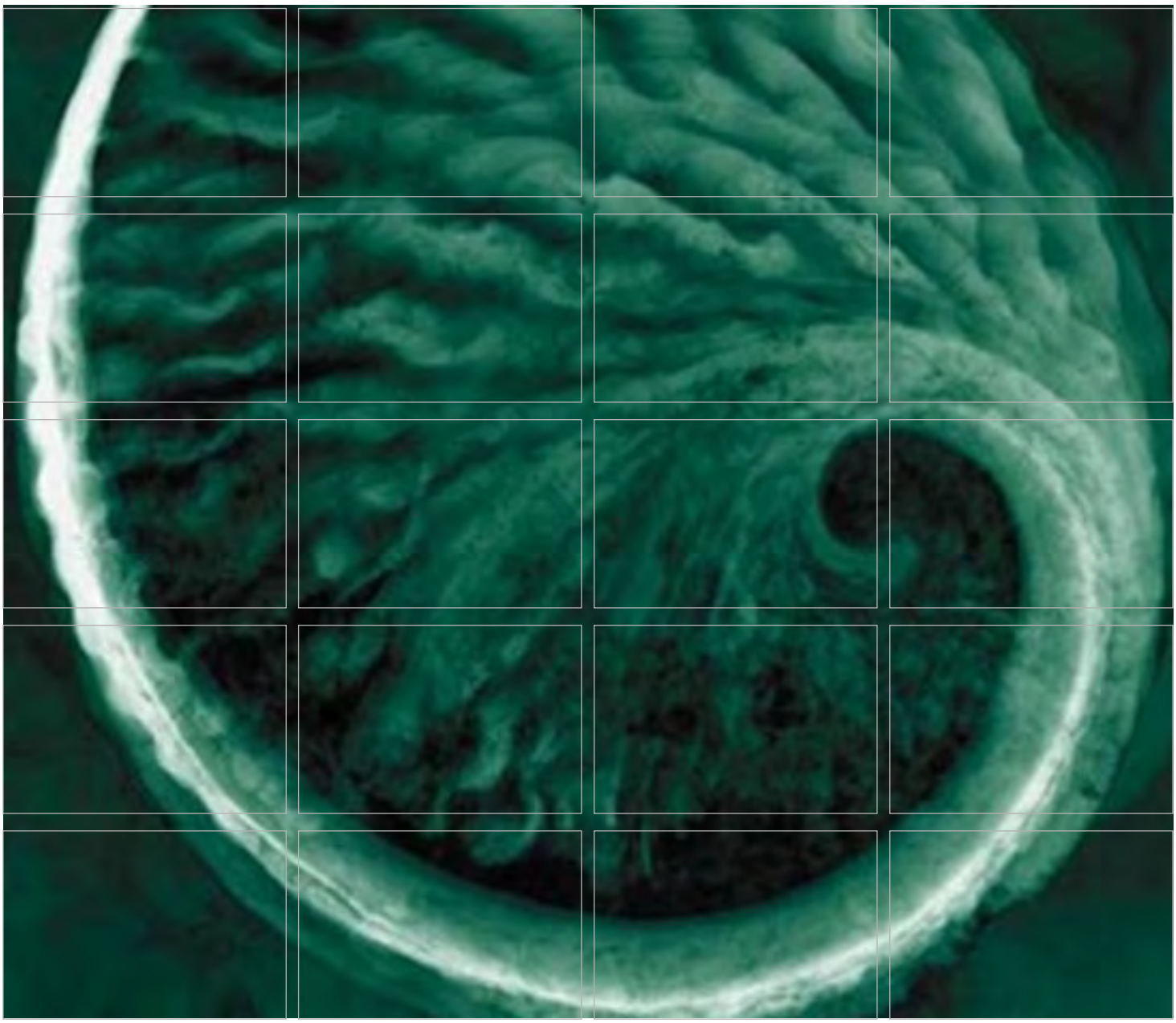

Worcestershire County Council

Waste Core Strategy Habitats Regulations Assessment

FINAL REPORT

March 2011

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Worcestershire County Council

Waste Core Strategy Habitats Regulations Assessment

Final Report

Reference: 0123097

March 2011

Prepared by: Beth Seldon

For and on behalf of
Environmental Resources Management Limited

Approved by: Geraint Bowden

Signed:
Position: Partner

Date: 21st March 2011

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CONTENTS

1 INTRODUCTION

Worcestershire County Council (WCC) is currently preparing a Waste Core Strategy (WCS) which will set out their approach to waste management facilities in the County until 2027.

In accordance with *The Conservation of Habitats and Species Regulations 2010* (the 2010 Regulations [1]), it is necessary for WCC in preparing these documents to consider any impacts that might arise on Natura 2000 sites [2] and Ramsar sites [3], referred to as 'European sites' in this report. This is required to ensure that the strategy will not result in significant effects on the European sites and the overall Natura network. This requirement was enforced through amendments in 2007 to the original 1994 Habitat Regulations following a European court ruling [4]. This process is referred to in this report as a Habitats Regulations Assessment (HRA). This HRA needs to be undertaken prior to the plan being adopted.

1.1.1 HRA Process

European guidance on assessing plans against the requirements of the Habitats Regulations includes a staged process to the assessment (*Box 1.1*) [5].

Box 1.1 HRA Process

1. Define the plan.
2. Establish that the plan is not necessary to the management of the site for nature conservation purposes.
3. Determine whether the plan is likely to have a significant effect on the site.
4. If plan is likely to have a significant effect, assess the implications of the plan for the site's conservation objectives so as to answer the question *"can it be demonstrated that the plan will not adversely affect the integrity of the site?"* This is referred to as the Appropriate Assessment.
5. If the Appropriate Assessment indicates that no adverse effect will occur the competent authority may proceed to consider the assessment complete. If not, and the plan is consequently undeliverable, policy changes or further consideration of IROPI may be required to demonstrate specific reasons why the plan should be permitted before the plan may be found sound.

(1) The 2010 Regulations are a consolidation of previous amendments to the Habitats Regulations.
(2) In May 1992 European Union governments adopted legislation designed to protect the most seriously threatened habitats and species across Europe. This legislation is called the Habitats Directive and complements the Birds Directive adopted in 1979. At the heart of both these Directives is the creation of a network of sites called Natura 2000. The Birds Directive requires the establishment of Special Protection Areas (SPAs) for birds. The Habitats Directive similarly requires Special Areas of Conservation (SACs) to be designated for other species, and for habitats. Together, SPAs and SACs make up the Natura 2000 series. All EU Member States contribute to the network of sites in a Europe-wide partnership from the Canaries to Crete and from Sicily to Finnish Lapland.
(3) Ramsar sites are wetland sites of international importance designated under the Ramsar Convention, signed in Ramsar, Iran, in 1971. It is Government policy that Ramsar sites are also treated as if they are European designated sites in accordance with the Habitats Regulations.
(4) ECJ case C - 6/04, Commission of the European Communities v United Kingdom of Great Britain and Northern Ireland, 20th October 2005.
(5) European Commission (2001). Assessment of plans and projects significantly affecting Natura 2000 sites. Office for Official Publications of the European Communities, Luxembourg.

1.1.2 Definition of Likely Significant Effect

'Likely significant effect' in this context is any effect that may reasonably be predicted as a consequence of the plan that may significantly affect the conservation or management objectives of the features for which a site was designated (1).

A significant effect is different from any effect, for example insignificant effects plainly do not constitute significant effects. The effect must be an effect on a European site and a judgement as to significance must take into account factors relevant to the question of significance.

These factors will include such matters as temporal considerations (*ie* length of time of effect), physical considerations (*ie* extent of effect on the European site and the elements of the site including its conservation objectives).

It is possible, therefore, for an effect to damage something on the European site, but because such damage is fleeting, limited in extent or damaging to something outwith any conservation objectives, the effect is insignificant on the European site. The judgement should also take into account the likely effects of mitigation following the Dilley Lane High Court Judgement (2) which concluded no legal requirement that a Habitats Regulations Assessment under Regulation 48(1) must be carried out in the absence of any mitigation measures that form part of a plan or project. On the contrary, the competent authority is required to consider whether the project as a whole, including such measures if they are part of the project, is likely to have a significant effect on the European site.

1.1.3 Aim of the HRA Process

The aim of the HRA process and Appropriate Assessment (where necessary) is to demonstrate that the plan will not have an adverse effect on the integrity of the European designated site. Site integrity is defined as:

"the coherence of its structure and function across its whole area that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified" (3)

The decision on whether the site integrity could be adversely affected by the plan should be focussed on and limited to the European site's conservation objectives. The conservation objectives for the European sites are included in the baseline descriptions presented in *Chapter 2.*

(1) Habitats Regulations Guidance Note 3. The Determination of Likely Significant Effect under The Conservation (Natural Habitats &c) Regulations 1994. English Nature, 1999.
(2) Dilley Lane Judgement - Hart District Council v The Secretary of State for Communities and Local Government, Luckmore Limited and Barratt Homes Limited (CO/7623/2007) 1st May 2008.
(3) European Communities (2000) Managing Natura 2000 sites - The provisions of Article 6 of the 'Habitats' Directive 92/43/CEE. EC

The consideration the Competent Authority will have to make will take into account a number of factors. These include natural fluctuations, timescales as the assessment is not a snapshot but needs to consider the effects on the European site over time, and the manner in which the proposals are to be carried out subject to any conditions or restrictions imposed by the Competent Authority.

1.2 WCS/HRA BACKGROUND

To date WCC has prepared the following documents which are relevant to this study:

- "*Waste Core Strategy: Regulation 28 Submission Document and Proposals Map*" submitted to the Secretary of State in January 2007 (1)

- *WCC WCS Refreshed Issues and Options Report, autumn 2008* – which brought together the previous work and public consultations and was the first stage in recommencing the work.

- *Habitats Regulations Screening Assessment of the Worcestershire Waste Core Strategy ERM August 2009* - this document provided a high level screening approach prior to the specification of any waste facility sites. *Section 1.2* below discusses the HRA Screening report in greater detail.

- *Waste Core Strategy for Worcestershire – Emerging Preferred Options Consultation Report, November 2009* – a consultation document produced to promote further discussion about the planning of waste management facilities in Worcestershire which informed the development of the First Draft Submission report.

- *Worcestershire Waste Core Strategy First Draft Submission Consultation Report, September 2010* – this consultation document proposes a policy framework and identifies 'Areas of Search' which are considered suitable in principle for waste management facilities.

- *Bailey, R, Dean, N. and Joynes, M (2010) Worcestershire Waste Core Strategy Background Document: Identifying areas of search. Last updated 27th September 2010.* This background document sets out the method used to identify Areas of Search.

During the development of the WCS, WCC have taken into account the need to consider the potential affects on European sites of nature conservation importance and to assess the strategy against the Habitats Regulations.

(1) This document was withdrawn following advice from the Planning Inspectorate and in anticipation of emerging government guidance as it was clear that it would not be found "sound".

The screening report (ERM, 2009) assessed the draft strategy (*WCC WCS Refreshed Issues and Options Report, 2008*) at a high level as site allocations had not been specified at that time. Therefore, rather than focussing on the identification of potential impacts from specific Areas of Search, the screening assessment filtered the County using indicative impact buffers centred on the European sites.

The buffers, based on recognised guidance for the consideration of likely significant effects, were used to identify broad areas within the County which were unlikely or less likely to result in significant effects from the development of waste management facilities.

Further commentary was provided on the need to screen different potential impacts arising from various waste facilities and the potential for in-combination effects when site allocations were available, particularly where these site allocations could not commit to the broad areas of less concern which had been identified.

The findings of the screening assessment (ERM, 2009) indicated that the WCS would require further assessment under the Habitats Regulations as it was unable to conclude that there would be no likely significant effect on any European sites, particularly because the location of the Areas of Search had not been confirmed at that time and may therefore be within 15 km of the European sites. European sites included within this assessment are considered in *Chapter 2*.

1.3 PURPOSE OF THE REPORT

ERM has been commissioned by WCC to carry out an HRA on the proposed site allocations or 'Areas of Search'. The HRA has been carried out as an iterative process feeding into the drafting of the WCS *First Draft Submission Consultation (September 2010)*. Following completion of the Final Publication WCS, this report will be updated to include an HRA of the Final WCS to ensure the strategy is compliant with the requirements of the Habitats Regulations, and hence deliverable.

The purpose of this report is not to provide advice about which waste facility types should be adopted. Instead the report documents the effects on European sites taking account of where the strategic assessment indicates that certain facility types may occur at certain Areas of Search. This provides an indication of which Areas of Search may be potentially unsuitable for the development of certain waste facility types based on the modelling parameters used which may in turn influence the deliverability of the WCS.

1.4 *ASSESSMENT ASSUMPTIONS AND LIMITATIONS*

The delivery of the WCS is likely to require a mixture of waste facility types across the Areas of Search. The WCS is intended as a strategic planning document and is as such is technology neutral and does not recommend facility types for Areas of Search. As the waste facility type proposed at each of the Areas of Search is not known, the HRA considers the development of the full range of potential waste facilities in terms of impact identification. The waste facility types considered in this assessment as agreed with WCC are described in *Chapter 4* and *Annex A*. Whilst the WCS does not state that there is a requirement for, or propose any locations specifically for thermal treatment facilities, WCC has advised that a capacity of 250 ktpa and 80 m stack should be modelled as a worst case scenario.

Modelling parameters used for the air dispersion assessment for thermal treatment follow a worst case scenario in terms of inputs and limits due to the strategic level of the assessment (see *Chapter 5*). Therefore where likely significant effects are identified, it may be that when detailed design parameters are known, the impact may be reduced to an insignificant level. The findings are therefore explained with a caveat that they should be treated as an indication at this stage. The report also considers mitigation and technological advances in waste facility design which if implemented could allow the development of waste facility types at locations which have been deemed potentially unsuitable by the current assessment in this report.

It should therefore be noted that due to the strategic level of this study, the lack of specific site detail, and environmental benefits possible technological advances future planning applications for Areas of Search should take account of the findings of this assessment, but cannot be totally reliant on it (*eg* due to potential future environmental improvements from technological advances). Each planning application will still need to demonstrate that the requirements of the Habitats Regulations in consultation with Natural England.

1.5 *REPORT STRUCTURE*

The remainder of the report is set out as follows:

- *Chapter 2*: Identification of European sites for Inclusion in the Assessment
- *Chapter 3*: Selection of Areas of Search and Scoping for Inclusion in the Assessment
- *Chapter 4*: Identification of Connecting Pathways which may lead to Significant Effects
- *Chapter 5*: Screening for Likely Significant Effects Methodology
- *Chapter 6*: Screening for Likely Significant Effects
- *Chapter 7*: Summary of Assessment Findings
- *Chapter 8*: In-combination Assessment

- *Chapter 9*: Review of the Publication Stage WCS against the Habitats Regulations
- *Chapter 10*: Report Conclusions

Additional supporting information is provided in the following *Annexes*:

- *Annex A*: Waste Facility Impact Identification;
- *Annex B*: Air Dispersion Modelling Report; and
- *Annex C*: Consideration of In-combination Effects.

2 IDENTIFICATION OF EUROPEAN SITES FOR INCLUSION IN THE ASSESSMENT

2.1 INTRODUCTION

Due to constraints from a range of other site selection criteria, it was not possible for WCC to locate Areas of Search within areas over 15 km from European sites as per a recommendation within the ERM high level screening report (ERM, 2009).

The first stage in this HRA has therefore been to review the location of the Areas of Search, review sites of European nature conservation importance in the region and to identify those that are likely to be at risk from the potential development within the Areas of Search.

2.2 EUROPEAN SITES FOR INCLUSION IN THE ASSESSMENT

2.2.1 *European Sites Excluded from the Assessment*

As site allocations were not identified during the screening assessment (ERM, 2009), a precautionary approach to the screening was adopted. This involved consideration of all European sites within the County boundary and also any within 15 km of the County boundary.

The effects of air pollution, water pollution and bird disturbance were considered at this high level; however it was not possible to screen European sites out of the assessment as there was limited information related to the locations and scale of potential waste management sites. Now that the locations of Areas of Search are known, it has been possible to screen out some of the European sites previously considered as described below.

Air Pollution

Air pollution effects from emissions from thermal treatment type facilities (and any local impacts from road traffic) are generally considered unlikely to have an adverse effect on European sites over 15 km. The Environment Agency H1 guidance for the consideration of effects from emitting facilities also advises that affects over 15 km are unlikely (see *Section 4.2.2*). The Severn Estuary SAC, SPA and Ramsar, the River Wye SAC and Walmore Common SPA are over 15 km from the closest Areas of Search and therefore are unlikely to have adverse effects from air pollution from the development of thermal treatment facilities at the closest areas of search. In addition, the qualifying features of these three European sites are not specifically sensitive to airborne pollutants typically emitted by thermal treatment facilities.

Water Pollution

Following a review of OS mapping for linking surface water features and the physical distance between the Areas of Search and the European sites, it is considered unlikely that there would be any significant effects from water pollution on the Severn Estuary SAC, SPA and Ramsar, the River Wye SAC and Walmore Common SPA which are over 15 km from the closest Areas of Search or from Fens Pools SAC and Dixton Wood SAC where there are no linking pathways. In particular consideration is given to standard control measures that would require consideration for any waste management facility (see further details in *Chapter 7*) and the dilution effect that it is considered would neutralise any incidental pollution before it reached the European sites at this distance. A further caveat regarding the consideration of water pollution effects is given at *Chapter 7* and discussed in *Chapters 9* and *10*.

Bird Disturbance

The closest Area of Search to the Severn Estuary SPA and Ramsar and Walmore Common SPA is over 15 km and therefore any effects of disturbance to qualifying bird species during construction and operation are considered to be insignificant.

Therefore the Severn Estuary SAC, SPA and Ramsar, the River Wye SAC and Walmore Common SPA have been scoped out of the assessment.

2.2.2 *European Sites Included in the Assessment*

As described above, air pollution from thermal treatment facilities is likely to be the most far reaching impact source which may result in significant effects on European sites. Therefore a 15 km buffer has been used as a worst case search radius around each of the 65 Areas of Search (see *Figure 3.1*) for air pollution effects and the effects of water pollution and disturbance are also considered further.

The assessment acknowledges that it is possible that air pollution effects could occur at distances over 15 km, however caution was observed over the strict use of this search radius during the previous high level screening assessment and caution has been followed when carrying out the air dispersion modelling and writing the findings of this assessment. In addition, in our experience of air dispersion modelling within an adjacent County (Gloucestershire), significant effects over 15 km are unlikely.

The remaining European sites to be included in the assessment are Lyppard Grange Ponds SAC, Bredon Hill SAC, Dixton Wood SAC and Fens Pools SAC (see *Figure 3.1*).

2.3 *CONSERVATION OBJECTIVES, KEY SITE SENSITIVITIES, CONDITION AND THREATS*

To identify the likelihood of significant effects on European sites from the potential development within the Areas of Search, the qualifying interest features of each site were reviewed along with the following:

- Conservation objectives - conservation management objectives define what constitutes favourable conservation status by defining broad targets which should be met if the feature is judged to be favourable (1).

- Key site sensitivities - key site sensitivities were established by reviewing information provided within the conservation objectives for the site and identifying the main sensitivities and vulnerabilities for each qualifying habitat or species.

- Current condition and threats - information regarding the condition of the site and threats to the integrity of the site are taken from the conservation objectives for and general knowledge of the site.

Baseline information relating to European sites was gathered for the initial screening assessment (ERM, 2009) and has been updated and confirmed with Natural England in October 2010.

Table 2.1 provides a summary of the European sites included in the assessment and lists their qualifying interests, conservation objectives and current condition and threats. A summary of the key sensitivities of the European sites with the potential to be affected by the development of waste management facilities at the 65 Areas of Search is also provided.

The locations of the 65 Areas of Search, 15 km search radius around the Areas of Search and the identified European sites for inclusion in the assessment are shown on *Figure 3.1*.

(1) Conservation Objectives are set by NE to ensure that the obligations of the Habitats Directive are met, particularly to ensure that there should be no deterioration or significant disturbance of the qualifying features from their condition at the time the status of the site was formally identified.

Table 2.1 Summary of European Sites Included in the Assessment

Site	Summary of Qualifying Features	Summary of Conservation Objectives/ Vulnerabilities and Key Environmental Conditions to Support Site Integrity	Key Site Sensitivities from General Waste Facility Impacts		
			Water Pollution / Hydrological Impacts	Air Pollution	Disturbance
Lyppard Grange Ponds SAC -	Great Crested Newt (*Triturus cristatus*)	Conservation Objectives (11) : Subject to natural change, to maintain the following habitats in favourable condition (or restored to favourable if features assessed as unfavourable) for great crested newts: • Lowland ponds and neutral grassland/parkland. Favourable condition is defined in relation to habitat extent and site-specific attributes (eg presence of eggs and adult GCN, pond presence and persistence, % macrophyte cover, % shading etc). **Key Vulnerabilities:** • Recreational pressure from public (site composed of two ponds in an area of public open space surrounded by residential development); and • Introduction of fish (one of the ponds is currently overrun with sticklebacks which is affecting the long-term survival of the new population). **Current Management:** Includes development of management plan, removal of stickleback, construction of hibernacula/refugia and water management systems.	✓ Pollution from run-off or change in groundwater levels resulting in change to quantity or quality of water.	✓ Atmospheric deposition of pollutants	✓ Development - disturbance to suitable terrestrial habitat for great crested newts within proximity of breeding ponds. Increased recreational pressure or interference from public.

(11) Lyppard Grange Ponds - Conservation objectives and definitions of favourable condition for designated features of interest. Natural England Draft 21 November 2008. Format Version 1.5.

Site	Summary of Qualifying Features	Summary of Conservation Objectives/ Vulnerabilities and Key Environmental Conditions to Support Site Integrity	Key Site Sensitivities from General Waste Facility Impacts		
			Water Pollution / Hydrological Impacts	Air Pollution	Disturbance
Bredon Hill SAC	Violet Click Beetle (*Limoniscus violaceus*)	Conservation Objectives [12] : To maintain the presence of dead ash wood and pollards for *Limoniscus violaceus* (Violet click beetle). Subject to natural change, to maintain the following habitats in favourable condition (or restored to favourable if features assessed as unfavourable): • Lowland calcareous grassland; • Lowland parkland and wood pasture; and • Broadleaved, mixed and yew woodland. Favourable condition is defined in relation to habitat extent and species population objectives (ie maintenance of habitat structure and associated invertebrate assemblages). **Key Vulnerabilities:** • The lack of a replacement generation of trees for the relatively small number of ancient trees that support the violet click beetle (many younger trees have been removed to increase stock grazing areas). **Current Management:** Management agreements being used to preserve existing tree stocks and to provide replacement planting.	✓ Pollution from run-off or change in groundwater levels. Old ash trees thrive in damp soil conditions. Site would be affected if Areas of Search resulted in contamination of the soil water.	✓ Atmospheric deposition, particularly of nitrogen on woodland.	✖
Dixton Wood SAC	Violet Click Beetle	Conservation Objectives [13] : To maintain the presence of dead ash wood and pollards	✓ Pollution from run-off or	✓ Atmospheric	✖

(12) Bredon Hill - Conservation objectives and definitions of favourable condition for designated features of interest. Natural England Consultation Draft. 1 December 2008. Format Version 2.1.

(13) Dixton Wood - Conservation objectives and definitions of favourable condition for designated features of interest. Natural England Draft 12 March 2009. Format Version 2.1.

Site	Summary of Qualifying Features	Summary of Conservation Objectives/ Vulnerabilities and Key Environmental Conditions to Support Site Integrity	Key Site Sensitivities from General Waste Facility Impacts		
			Water Pollution / Hydrological Impacts	Air Pollution	Disturbance
	(*Limoniscus violaceus*)	for *Limoniscus violaceus* (Violet click beetle). Subject to natural change, to maintain the following habitats in favourable condition (or restored to favourable if features assessed as unfavourable): • Broadleaved, mixed and yew woodland. Favourable condition is defined in relation to habitat extent and species population objectives (ie maintenance of habitat structure and associated violet click beetle and other invertebrate assemblages). **Key Vulnerabilities:** • the lack of future replacement pollards (age-class skewed to older generation); and • game management practices. **Current Management:** Management Agreement with site owner, including creation of new pollards and management of existing resources to prevent further loss of trees.	change in groundwater levels or water movements. Old ash trees like damp soil conditions. Site would be affected if Areas of Search resulted in contamination of the soil water.	deposition of nitrogen on ash woodland.	
Fen Pools SAC	Great Crested Newt (*Triturus cristatus*)	Conservation Objectives (1) : To maintain the extent of amphibian habitat (terrestrial and aquatic). No loss of area or fragmentation of site (through significant barriers to amphibian dispersal) compared with status at designation.	✓ Pollution from run-off or change in groundwater levels resulting in change to quantity or quality of water.	✓ Atmospheric deposition has potential to affect supporting terrestrial habitat.	×

(1) Fens Pools - Conservation objectives and definitions of favourable condition for designated features of interest. Natural England. Consultation Draft 26 March 2008.

Site	Summary of Qualifying Features	Summary of Conservation Objectives/ Vulnerabilities and Key Environmental Conditions to Support Site Integrity	Key Site Sensitivities from General Waste Facility Impacts		
			Water Pollution / Hydrological Impacts	Air Pollution	Disturbance
		At this site favourable condition is not defined by the extent of each habitat type, but by great crested newt and amphibian assemblage targets (eg presence of eggs and adult GCN, maintenance of habitat features for GCN such as habitat cover, pond shading, pond persistence, lack of fish, few wildfowl etc). **Key Vulnerabilities:** • desiccation of ponds; • human disturbance; • fish introductions; and • maintenance of adequate water quality (urban catchment). **Current Management:** Expansion of the number of ponds in the current cluster to reduce the vulnerability of the population to factors listed above and to reduce the population's relative isolation (due to urban setting).			

3 SELECTION OF AREAS OF SEARCH AND SCOPING FOR INCLUSION IN THE ASSESSMENT

3.1 IDENTIFICATION OF AREAS OF SEARCH

To focus the development of future waste management, WCC has identified 65 Areas of Search which are in locations that are considered most suitable for waste management facilities. The identification of these areas considered a five staged approach (15) including:

1. identification of areas for consideration (including land use compatibility with waste management development; suitability of existing infrastructure);

2. assessment of constraints (including designated and non-designated areas and features) – this included a review of the location in relation to European sites;

3. assessment of connectivity to the strategic transport network;

4. assessment of proximity (to waste arisings, onward treatment facilities and end users); and

5. final identification of Areas of Search.

Further details on the selection of these Areas of Search are included in the WCC background document 'Identifying areas of search' (16). It should be noted that whilst the location of European sites were considered during the selection of Areas of Search, due to a range of other constraints it was not possible to locate Areas of Search in areas over 15 km from European sites, as was recommended in the ERM high level screening report (ERM, 2009).

Table 3.1 shows the approximate distances between each of the Areas of Search and European sites included in the assessment. The locations of these Areas of Search are shown in *Figure 3.1*.

3.2 SCOPING AREAS OF SEARCH FOR INCLUSION IN THE ASSESSMENT

Further to the findings of *Section 2.2*, it is concluded that significant effects are unlikely to arise from Areas of Search over 15 km from European sites.

(15) Worcestershire County Council Waste Core Strategy First Draft Submission report, September 2010.
(16) Bailey, R, Dean, N. and Joynes, M (2010) WWCS Background Document: Identifying areas of search. 27th Sept 2010.

The following Areas of Search are over 15 km from European sites and therefore these are scoped out of the assessment and it is concluded that development at these general locations will have no likely significant effect on European sites: **Areas of Search 17-24, 26-35 and 58-60.**

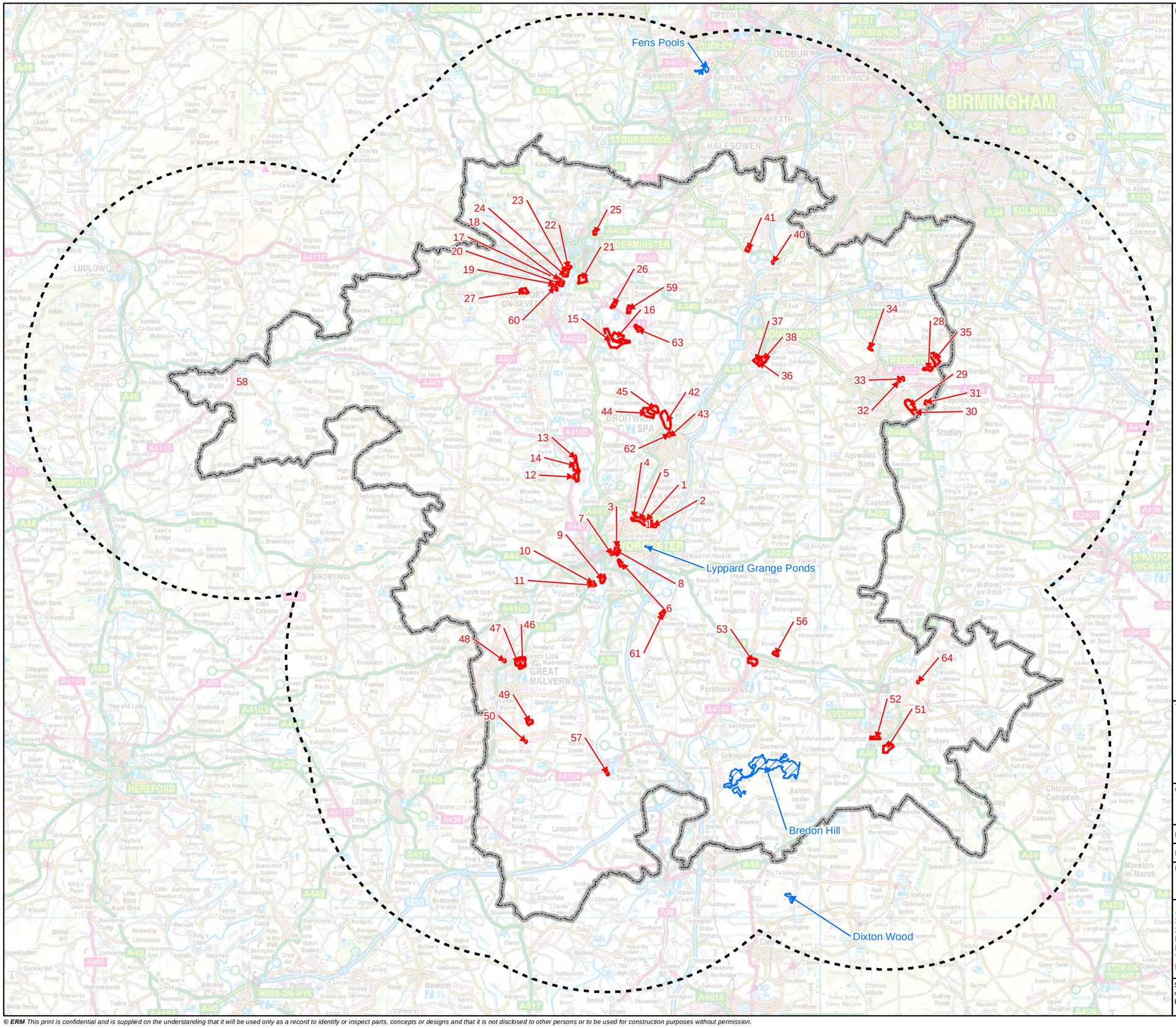
The following Areas of Search are 15 km or less from European sites and therefore these are included in the assessment as it cannot be concluded at this stage that development at these general locations will have no likely significant effects on European sites: **Areas of Search 1-16, 25, 36-57 and 61-65.**

Table 3.1 Distance between the Areas of Search and European Sites Included in the Assessment

Areas of Search		European Sites (Distances in km)			
		Lyppard Grange Ponds SAC	Bredon Hill SAC	Dixton Wood SAC	Fen Pools SAC
1	Shire Business Park	1.4			
2	Berkeley Business Park	1.4			
3	Great Western Business Park	1.8			
4	Buckholt Business Centre	2.1			
5	Warndon Business Park	1.4			
6	Newtown Road Industrial Estate	1.9			
7	Shrubhill Industrial Estate	2.2			
8	Sherriff Street Industrial Estate	2.0			
9	Diglis Industrial Estate	3.4			
10	Venture Business Park	4.3			
11	Weir Lane Industrial Estate	4.3			
12	Ball Mill Top Business Centre	6.9			
13	Top Barn Business Centre	7.6			
14	Ball Mill Quarry Complex	6.5			
15	Hartlebury Trading Estate	13.9			
16	Waresley Quarry	14.3			
17	Gemini Business Park				
18	Oldington Trading Estate				
19	Birchen Coppice Trading Estate				
20	Foley Business Park				
21	Hoo Farm Industrial Estate				
22	Foley Industrial Estate				
23	Former British Sugar Site				
24	Vale Industrial Estate				
25	Greenhill Industrial Estate				13.0
26	Ikon Trading Estate				
27	Blackstone Quarry				
28	East Moons Moat				
29	Park Farm Industrial Estate				
30	Pipers Road Park Farm				
31	Washford Industrial Estate				
32	Kingfisher Enterprise Park				
33	Lakeside Industrial Estate				
34	Weights Farm Business Park				
35	Ravensbank Business Park				

Areas of Search		European Sites (Distances in km)			
		Lyppard Grange Ponds SAC	Bredon Hill SAC	Dixton Wood SAC	Fen Pools SAC
36	Buntsford Hill Industrial Estate	14.7			
37	Buntsford Gate Business Park	14.7			
38	Silver Birches Business Park	15.0			
39	Bromsgrove Technology Park	15.0			
40	Pinches Quarry				13.8
41	Stanley Evans Quarry				12.3
42	Berry Hill Industrial Estate	8.2			
43	Former Coal Yard, Union Lane	8.0			
44	Stonebridge Cross Business Park	8.9			
45	Hampton Lovett Industrial Estate	9.3			
46	Enigma Business Park	11.3			
47	Spring Lane Industrial Estate	11.6			
48	Link Business Centre	12.4			
49	Blackmore Business and Technology Park	14.3	13.9		
50	Merebrook Industrial Estate		14.0		
51	Vale Business Park		5.8	11.7	
52	Four Pools Industrial Estate		5.1	12.1	
53	Keytec7 Business Park	10.3	6.2		
54	Racecourse Road Trading Estate	10.3	6.2		
55	Pershore Trading Estate	10.3	6.2		
56	Hill and Moor landfill site	11.3	6.8		
57	Upton upon Severn Industrial Estate		8.0	14.8	
58	Tenbury Business Park				
59	Cursley Distribution Park				
60	Finepoint Business Park				
61	Area 7 Industrial Park, Norton	4.3			
62	North Street Industrial Estate	8.0			
63	Rushock Industrial Estate	15			
64	Bennets Hill Business Park		10		
65	Upton Business Centre		12.5		

Coloured shading indicates areas of search fall within 15 km of the corresponding European site.
Grey shading indicates areas of search which have no European sites within a 15 km buffer



KEY:

- Areas of Search
- 15km Buffer of Areas of Search
- Special Area of Conservation
- Worcestershire County Boundary

TITLE:

Figure 3.1
Location of European Sites and Areas of Search

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DATE: 21/03/2011	CHECKED: BS	PROJECT: 0123097
DRAWN: AK	APPROVED:	SCALE: As Scale Bar
DRAWING: Designations_Rev210311.mxd		REV: 0

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4 IDENTIFICATION OF CONNECTING PATHWAYS WHICH MAY LEAD TO SIGNIFICANT EFFECTS

4.1 INTRODUCTION

This chapter scopes the generic construction and operation impacts associated with the development of the confirmed range of waste management facilities to determine whether there are any cause and effect pathways, which could link the development of the proposed waste facilities from the identified 43 Areas of Search (1-16, 25, 36-57 and 61-65) to the identified three European sites.

The identification of links draws on the known sensitivities of those European sites (see *Table 2.1*), the types of impacts generated by the development of different waste facility types (see *Section 4.2* and *Annex A*), and the connecting pathways between the two.

Where any effects are scoped out, relevant guidance is referenced in support of these conclusions. The effects requiring a screening assessment to determine whether they are likely to be significant are summarised in *Table 4.3*.

4.2 WASTE FACILITY DEVELOPMENT IMPACTS

The waste facility types which have been considered for development through the WCS are listed in *Annex A* (*Section A1.1*).

A summary of the impacts which can result from the range of waste facilities being considered is listed in *Table 4.1* below.

Table 4.1 Summary of Potential Impacts and Effects on European sites from the Development of Waste Facilities

Potential Impact	Facility Type	Potential Effect	Development Phase
Land take	All	Loss of habitat.	Construction
Air Pollution			
Stack emissions	Thermal treatment, MBT	Direct pollution of habitats and any indirect effects on qualifying species.	Operation
Traffic emissions	All	Pollution of habitats and any indirect effects on qualifying species.	Construction and operation
Bio-aerosols	MBT	Emissions contribute to climate change causing successional change to habitats and species.	Operation

Potential Impact	Facility Type	Potential Effect	Development Phase
Dust	All	Smothering of leaves, chemical toxicity of deposited dusts and changes in soil chemistry affecting sensitive flora. Degradation if flora adversely affecting qualifying species [17].	Construction
Water Pollution			
Ground water	All	Pollution of watercourses from pollutants soaking into groundwater and damaging habitats and indirect effects on qualifying species.	Construction / operation
Surface waters	All	Surface water run-off carrying pollutants (diesel, oil, paint, solvents, cleaners, other harmful chemicals and construction debris and dirt) and damaging habitats and any direct or indirect effects on qualifying species.	Construction / operation
Abstraction	All	Abstraction affecting hydrological regime of habitat and resulting change in habitat communities and indirect effects on species.	Operation
Disturbance			
Noise, visual, human presence	All	Direct disturbance of species sensitive to disturbance effects.	Construction and operation

The impact types listed in *Table 4.1* are discussed below and whether there is a need for them to be screened identified.

4.2.1 *Land Take*

The development of a waste facility within an Area of Search will not result in any direct land take from within or adjacent to a European site and therefore this impact is scoped out of the assessment.

4.2.2 *Air Pollution*

Stack Emissions

The development of a thermal treatment facility or MBT facility has the potential to affect European sites through air pollution and therefore further consideration is required.

Thermal Treatment

The Environment Agency has produced guidance [18] for all sectors regulated under the Environmental Permitting Regulations (EPR). *Annex F* of this guidance addresses air emissions and the minimum distance over which emitting facilities should consider pollution effects on European sites (*Box 4.1*). This supersedes the previous Environment Agency guidance [19] which was

(17) Source Air Pollution Information System APIS website. www.apis.ac.uk.
(18)Environment Agency (2010) Horizontal Guidance Note H1- annex F
(19) Work Instruction: (Appendix 7) – Stage 1 & 2 Assessment of New Integrated Pollution Control (IPC), Pollution Prevention and Control (PPC) Permissions under the Habitats Regulations, Version 6, October 2006, Environment Agency.

referenced in the WCC screening report but which includes the same distance ranges.

Box 4.1 Excerpt from Environment Agency H1 Guidance

"Screening for nature conservation sites

Nature conservation sites should be screened against the relevant standards [20](to protect ecosystems from air emissions) if they occur within specified distance criteria, as detailed below.

- *Special Protection Areas (SPAs), Special Areas of Conservation (SACs) or Ramsar sites within 10km of the installation (or 15km coal- or oil-fired power station)*
- *Sites of Special Scientific Interest (SSSIs) within 2 km of the installation*

Some larger emitters may be required to screen to 10km or 15km for SSSIs. Relevant screening distances should be discussed with the permitting officer where clarification is required."

In terms of thermal treatment technologies, an Energy from Waste (EfW) facility is considered to be the worst-case emission source, from an air pollution perspective. This is because during combustion of the handled waste, air pollutants that have an impact on ecology (eg NO_X, SO_2, and NH_3) will be emitted as a result of the combustion process, and the emission of the flue gas through a stack (ie a point source) has the potential to result in impacts further afield through dispersion.

For the purposes of this study, taking account of the Environment Agency guidance and recent comments from Natural England [21], effects on European sites up to 15 km from Areas of Search with the potential for the development of thermal treatment have been considered as a worst case scenario. It is recognised that stack emissions can have impacts on European sites over 15 km if habitats are present that are particularly sensitive to pollutants. This has been considered throughout the assessment however, and following the findings of the air pollution and water pollution assessment it is confirmed that significant effects on European sites over 15 km from the Areas of Search are unlikely to occur in this case.

Areas of Search 1-16, 25, 36-57 and 61-65 are within 15 km of the three identified European sites and therefore further impact assessment relating to stack emissions has been undertaken (*Section 6.2*).

MBT

In comparison MBT facilities involve no combustion of the actual waste. Instead methane from bio-degradation of the waste is the main pollutant which whilst a potent greenhouse gas does not result in the direct deposition of pollutants on habitats. Any emissions from such facilities are considered to have localised impacts only within a maximum distance of a few hundred

(20) Critical levels and critical loads for the relevant pollutants are discussed in Section B2.3, Annex B.
(21) Natural England pers. comm. with Dominic Coath regarding scoping of European sites for inclusion in the London Plan Replacement HRA (2009).

metres or so of the facility, and much less with standard mitigation to reduce emissions. The dispersion is minimal as emissions are not generally emitted via point sources. Given that Areas of Search 1, 2 and 5 are the closest to European site (Lyppard Grange Ponds SAC) at 1.4 km when considering the above, it is considered unlikely that there would be any potential effects from air pollution arising from an MBT facility.

Therefore air pollution impacts from emissions relating to non-combustion related waste facilities are ruled out of the assessment.

Autoclave

Autoclave is an intermediary technology designed to render waste biologically inert, clean metals (ie strip paint), and compact some plastics to aid recycling. However, autoclave achieves only a limited reduction in total waste arisings, and therefore there would still be a need for further treatment such as thermal treatment to process the arisings. The process utilises steam, and therefore the main emissions associated with autoclave plants are oxides of nitrogen associated with the combustion of fuel (typically gas) in order to raise steam; there are also potentially important emissions of volatile organic compounds. As the technology is likely to be a small element in the waste management chain, and does not remove the need for larger scale final disposal, autoclave was not considered an option in its own right, and it is anticipated that use of autoclave would only be as an integrated element of a large scheme, and would therefore contribute to only a modest increases in overall emissions, if indeed there are any increases in emissions at all.

Therefore air pollution impacts from emissions related to autoclave waste facilities are ruled out of the assessment based on the above.

Traffic Emissions

Guidance produced by the Highways Agency, Transport Scotland, Welsh Assembly Government and the Department for Regional Development Northern Ireland for *Design of Roads and Bridges – Air Quality* (May 2007) [(22)], states that:

'The Designated Sites that should be considered for this assessment are those for which the designated features are sensitive to air pollutants, either directly or indirectly, and which could be adversely affected by the effect of local air quality on vegetation within the following nature conservation sites: SACs and cSACs, SPAs, SSSIs and Ramsar sites. Only properties and designated sites within 200 m of roads affected by the project need be considered.'

For the purposes of this assessment it has been assumed that traffic movements to and from the Areas of Search will use major highways (motorways or A-class roads) which can accommodate such increased load

(22) Design Manual for Roads and Bridges. Volume II Environmental Assessment, Section 3 Environmental Assessment Techniques. Part 1. May 2007.

levels. The main access routes for each of the Areas of Search have been reviewed on base mapping to locate any that pass within 200 m of European sites.

Of the European designated sites considered in the assessment, only Fen Pools SAC has any major roads (the A4101 and A461) which pass within 200 m of the site. However, these roads do not connect directly link to any Area of Search and there is not expected to be any additional traffic use along this road as a result of waste development within any of the Areas of Search. None of the other European sites lie within 200 m of a major or busy access road.

None of the major or busy access roads most likely to be used by transport vehicles to and from each of the Areas of Search pass within 200 m of any European site and therefore impacts from traffic emissions are scoped out of the assessment.

Dust

The Interim Advice Note 61/05 (Ref.16), issued by the Highways Agency discusses the potential harmful effects of air pollution, including the dust generated from construction related activities upon ecosystems and provides guidance on the effects assessment. The advice note required the locations of any designated species or habitats within 200 m of a construction site to be clearly identified and mitigation measures applied.

Dust is therefore only likely to have an adverse impact at a local level and in addition mitigation measures are likely to effectively minimise dust to an insignificant level. Mitigation measures include controlling construction dust through fine water sprays, screening the whole site to stop dust spreading, covering or dampening skips, trucks and piles of loose materials.

None of the Areas of search are within 200 m of a European site and therefore impacts from dust are scoped out of the assessment.

Bio-aerosols

The potential effect of bio-aerosols is usually of more concern regarding human health and typical distances for the consideration of these potential effects are around 200 m.

None of the Areas of Search are within 200 m of a European site and therefore impacts from aerosols are scoped out of the assessment.

4.2.3 Water Pollution

The screening report identified the potential for hydrological pathways between the Areas of Search and European sites. *Section 2.2.1* scoped out water pollution effects for the Severn Estuary SAC, SPA and Ramsar, the River Wye SAC, Walmore Common SPA, Fens Pools SAC and Dixton Wood

SAC as no hydrological links have been identified and certain sites are over 15 km and dilution effects are considered likely to avoid adverse effects. Potential water pollution pathways require further consideration for the two remaining European sites: Lyppard Grange Ponds SAC and Bredon Hill SAC where surface water features were identified. These links have been considered in detail below in terms of sources of significant effects.

Surface Water and Groundwater Links

Environment Agency groundwater vulnerability mapping data, flood mapping and OS mapping was used at a 1:10,000 scale to scrutinise the potential for hydrological links between the Areas of Search and the designated sites. These are described below;

Lyppard Grange Ponds SAC

The closest Areas of Search to Lyppard Grange Ponds SAC and those most likely to have connecting hydrological links are Areas of Search 1, 2, 3 and 5 to the north and 3, 6, 7 and 8 to the west.

Lyppard Grange Pond SAC is located within a residential area and surrounded by houses, roads and commercial development with no identified rivers, streams or ditches within 100 m of the designated site.

No connecting surface or groundwater links including flood zones have been identified between Lyppard Grange Pond SAC and Areas of Search 1, 2, 4 and 5 to the north. The open space to the southwest of the SAC and in-between Areas of Search 3, 6, 7 and 8 is elevated from the surrounds and includes a golf course with no identified watercourses. No further connecting watercourses, groundwater links or flood zones have been identified between Lyppard Grange Ponds SAC and Areas of Search 3, 6, 7 and 8.

Bredon Hill SAC

The closest Areas of Search to Bredon Hill SAC and those most likely to have connecting hydrological links are Areas of Search 50, 51, 52 and 53 to the north and 48, 49 to the east.

The River Avon flows northeast-southwest to the north of Bredon Hill and at the closest point is approximately 1.5 km to the northwest. Field drains flow northwards from the SAC into the River Avon and therefore it is unlikely that water flowing through the Avon would reach the European site.

No connecting surface or groundwater links or flood zones have been identified between Areas of Search 50, 51 and 52 and the River Avon or through any other surface water links to Bredon Hill SAC.

No surface water or groundwater links have been identified between any of the 65 Areas of Search and the three identified European sites and certain

sites are considered to be at such a distance that dilution would avoid adverse effects and therefore water pollution impacts are scoped out of the assessment.

4.2.4 Disturbance

Disturbance to wildlife can result from a number of different sources as follows:

- noise (construction and operation);
- visual (construction and operation) (including from work on construction sites with people, cranes, lighting, fluorescent jackets *etc)*;
- human presence (construction and operation);
- litter; and
- attracting predators (*eg* through provision of building perches for predatory birds), and pests.

Given that disturbance distances vary and to consider worst case scenarios, the following Environment Agency Guidance (23) has been used to select waste sites for consideration of potential disturbance effects.

Box 4.2 Environment Agency Guidance

For all other waste management activities (24) these should be assessed for potential impact where:

'The location of the facility falls within 1 km of a European site,…'

Given the suggested disturbance distances provided within the literature are well within the 1 km distance suggested by the Environment Agency guidance, it is concluded that the consideration of the development of waste sites within 1 km of a European site provides an adequate precautionary approach.

Relevant European sites for the consideration of disturbance effects include Lyppard Grange Ponds SAC and Fens Pools SAC which are designated for populations of great crested newt. Great crested newts (25) will generally

(23) Habitats Directive: Work Instruction (Appendix 6). Further Guidance applying the Habitats Regulations to Waste Management Facilities.
(24) Assumed as excluding thermal treatment facilities for this study.
(25) Great crested newts are protected under European law through Annex IIa and IVa of the EC Habitats Directive (92/43/EC), as applied in UK under the Conservation of Habitats and Species Regulations, 2010 (the 2010 Regulations). The legislation makes it an offence to deliberately or recklessly disturb great crested newts in any way; damage or destroy a breeding site or resting place of such an animal.

disperse up to 500 m from breeding ponds although they have been recorded over greater distances, up to 1.3 km from breeding sites [26].

All of the Areas of Search occur over 1.3 km from European sites and therefore general disturbance effects and impacts on great crested newt populations are scoped out of the assessment.

4.3 *IDENTIFIED EFFECTS*

Table 4.2 summarises the potential effects that could not be scoped out in *Section 4.2* and which therefore require further screening assessment in order to determine whether they are likely to have a significant effect

Table 4.2 Summary of Identified Potential Significant Effects

Identified Significant Effect on European Sites and Associated Waste Facility Type	Area of Search	European site
Air pollution stack emissions from thermal treatment facilities.	1-16, 25, 36-57 and 61-65	• Lyppard Grange Ponds SAC • Bredon Hill SAC • Dixton Wood SAC • Fens Pools SAC

(26) English Nature (now Natural England) Great Crested Newt Mitigation Guidelines, 2001.

5 SCREENING FOR LIKELY SIGNIFICANT EFFECTS METHODOLOGY

5.1 INTRODUCTION

This chapter describes the approach to the screening assessment of the significant effects identified in *Table 4.2* to determine whether they are likely to occur. The screening assessment and findings are documented in *Chapter 6*.

The screening assessment focuses on the impacts identified in *Chapter 4* which comprises air pollution, potentially from stack emissions from the development of thermal treatment facilities which could affect sensitive habitats and species.

The following sections provide a brief description of the methodology followed and guidance used to assess the likely significance of the identified effects on the European sites in the study area.

5.2 AIR POLLUTION – STACK EMISSIONS

Air dispersion modelling has been used to assess whether the development of thermal treatment waste facilities is likely to have a significant effect on Areas of Search 1-16, 25 and 36-57.

5.2.1 *Dispersion Model*

The dispersion model AERMOD has been used, promulgated by the United States Environmental Protection Agency, and recognised by the Environment Agency (EA) in the United Kingdom (UK). AERMOD has been chosen over the alternative model ADMS, however both models are equally valid.

5.2.2 *Facility Parameters*

As modelling has been carried out for a hypothetical facility in the absence of an actual engineering design, certain assumptions have to be made (see *Section C2.2.2*, *Annex B*). Given the type of facility that will be selected for each location is unknown, the air quality assessment assumes a generic EfW thermal treatment facility as regulated by the Waste Incineration Directive (WID). This is regarded as a facility with the highest expected air emissions. The Environment Agency and recent published assessments were consulted to generate the most suitable parameters for the generic facility [27].

Throughput was set at the maximum capacity as advised by WCC for each Area of Search together with a realistic stack height as informed by WCC and the industry through recent planning applications. The capacity used for Phase 1 reflects the worst case which could be promoted by the WCS.

(27) Emails between ERM and Alistair Wintle at the Environment Agency dated 29.09.2008 and various phone calls.

5.2.3 Approach

Due to the large number of modelling runs that would be required to assess each Area of Search individually, a sample based approach has been followed which involved four phases of air dispersion modelling. A selection of 10 Areas of Search were selected which included those in closest proximity to European sites and therefore most likely to have the highest impacts, and also considering the orientation of the Area of Search to the European site as prevailing wind direction is an important factor.

The results of each phase of modelling were used to inform any further modelling such that if impacts were acceptable at the nearest and most sensitive European sites, impacts at further or less sensitive European sites will also be acceptable. Conversely where it could not be concluded that there would be no likely significant effects for some scenarios, further modelling was considered necessary

The results for each of the modelled Areas of Search were used to predict the conclusion for Areas of Search that were not modelled. For example where it could be concluded that a certain Area of Search would have no likely significant effect, it was assumed that more distant Areas of Search which were not modelled would also be unlikely to have a significant effect. Conversely where it could not be concluded that a certain Area of Search would have no likely significant effect, it was assumed that all Areas of Search in close proximity which were not modelled, would have the same result.

Phase 1

The 12 Areas of Search modelled and corresponding European sites are as follows:

- Areas of Search 2, 3, 7, 8 and 12, 43, 46 and 54 for Lyppard Grange Ponds SAC;
- Areas of Search 25 and 41 for Fens Pools SAC;
- Areas of Search 52, 54 and 57 for Bredon Hill SAC; and
- Areas of Search 52, 54 and 57 for Dixton Wood SAC.

The Phase 1 model assumed a generic EfW facility with a capacity of 250 ktpa and 80 m stack height. Areas of Search for which it could not be concluded that there would be no likely significant effect on the corresponding European site were then taken forward into Phase 2.

Phase 2

Areas of Search 3, 7 and 8 were taken forward into Phase 2 of the modelling. Phase 2 assumed a capacity of 250 ktpa and an increased stack height of 100 m. Areas of Search for which it could not be concluded that there would be no likely significant effect on the corresponding European site were then taken forward into Phase 3.

Phase 3

Areas of Search 7 and 8 were taken forward into Phase 3 of the modelling. Phase 3 assumed a reduced capacity of 150 ktpa and a stack height of 80 m.

Phase 4

Areas of Search 7 and 8 were also modelled at 150 ktpa and a stack height of 100 m to confirm the findings at these parameters.

5.2.4 Assessment Criteria - APIS Habitats Selected

The criteria for the assessment of likely significant effects from stack emissions on the qualifying features and supporting habitats of the relevant European sites are divided into critical levels and critical loads for each pollutant. These values are obtained from the Air Pollution Information System (APIS) [28] website. The APIS website also provides baseline deposition and concentration data for the European sites. The assessment criteria and effects of each pollutant and background levels are discussed in detail in *Section B2, Annex B*.

The APIS database was used to obtain the critical levels (for NO_X, SO_2 and NH_3) which are not habitat-dependent. A site relevant search was used to obtain acid and nutrient nitrogen critical loads using a habitat selected from the APIS list as a best match for the qualifying features of the European sites. APIS habitats do not always directly relate to habitats listed in the citations for the European sites and in these cases a closest match is selected, following a worst case most sensitive habitat where necessary. Selected APIS habitats are shown in *Table 5.1*.

(28) www.apis.ac.uk

Table 5.1 ***Phase 1 Areas of Search Modelled and Corresponding APIS Habitats used to derive Background Conditions for Acid and Nutrient Nitrogen Deposition Rates***

European Site	**Fens Pools**	**Lyppard Grange Ponds**	**Bredon Hill**	**Dixton Wood**
Closest Matching APIS Habitat	Acid Grassland and Lowland Heath	Low and medium altitude hay meadows	Broadleaf and Mixed Yew Woodland	Broadleaf and Mixed Yew Woodland
Area of Search 2	-	✓	-	-
Area of Search 3	-	✓	-	-
Area of Search 7		✓		
Area of Search 8		✓		
Area of Search 12	-	✓	-	-
Area of Search 25	✓	-	-	-
Area of Search 41	✓	-	-	-
Area of Search 43	-	✓	-	-
Area of Search 46	-	✓	-	-
Area of Search 52	-	-	✓	✓
Area of Search 54	-	✓	✓	✓
Area of Search 57	-	-	✓	✓

Full details of the methodology used and the assessment thresholds used based on Environment Agency guidance [29] are described in *Annex B*.

(29) Work Instruction: (Appendix 7) – Stage 1 & 2 Assessment of New Integrated Pollution Control (IPC), Pollution Prevention and Control (PPC) Permissions under the Habitats Regulations, Version 6, October 2006, Environment Agency.

6 SCREENING FOR LIKELY SIGNIFICANT EFFECTS

6.1 INTRODUCTION

This chapter sets out the screening assessment for air pollution effects. Mitigation measures are discussed where appropriate. The limitations of this strategic level assessment are discussed and issues inherent with the various assessment methodologies are considered where necessary. These should be considered carefully when interpreting the findings in terms of deliverance of the WCS.

6.2 AIR POLLUTION – STACK EMISSIONS

The air quality assessment (*Annex B*) sets out the results of the four phases of air dispersion modelling. The results are set out below and findings discussed in terms of the potential likely suitability or otherwise of Areas of Search for the development of thermal treatment type facilities, based on the parameters used in the modelling. The findings for the modelled Areas of Search are then used to predict the findings for the Areas of Search which were not included in the modelling.

6.2.1 *Results*

Modelling Phases 1 to 4

Table 6.1 summarises the results of the air dispersion modelling. A question mark indicates that it cannot be concluded at the stage, at the modelled parameters, that the development of a thermal treatment facility would have no likely significant effect on European sites. A tick indicates that it can be concluded, at the modelled parameters, that the development of a thermal treatment facility would have no likely significant effect. A hyphen indicates these scenarios were not modelled.

It should be noted that a question mark does not automatically preclude the development of thermal treatment at these Areas of Search. It suggests that further air dispersion modelling assessment would be required at the planning application stage using exact development parameters if a facility based on these scenarios was to be pursued. For example further assessment would be required to incorporate more specific plant design parameters such as (but not limited to) abatement measures, specific exhaust characteristics, and building downwash effects.

Table 6.1 Air Dispersion Modelling Results

Areas of Search	250 ktpa Thermal Treatment Facility		150 ktpa Thermal Treatment Facility	
	80 m Stack Height	100 m Stack Height	80 m Stack Height	100 m Stack Height
2	✓	-	-	-
3	?	?	✓	✓
7	?	✓	✓	✓
8	?	?	✓	✓
12	✓	-	-	-
25	✓	-	-	-
41	✓	-	-	-
43	✓	-	-	-
46	✓	-	-	-
52	✓	-	-	-
54	✓	-	-	-
57	✓	-	-	-

✓ Not likely to give rise to a significant effect at the modelled parameters.
? Cannot conclude no likely significant effect at the modelled parameters.
- Not modelled.

6.2.2 *Findings*

Modelled Findings

The development of a thermal treatment facility at the following Areas of Search is not considered likely to give rise to significant effects on European sites, at the modelled parameters (using current model assumptions shown at WID limits):

- Areas of Search 2, 12, 25, 41, 43, 46, 52, 54 and 57 at 250 ktpa capacity and a stack height of 80 m;
- Area of Search 7 at 250 ktpa capacity and a stack height of 100 m; and
- Areas of Search 3 and 8 at 150 ktpa capacity and a stack height of 80 m.

Predicted Findings

From the above modelling results, predictions can be made for the remaining Areas of Search that were not included in the modelling sample of 12 Areas of Search. These findings are provided with confidence and are based on modelled Areas of Search in close proximity to those predicted, and in a similar orientation to the European sites (See *Annex B*).

Based on the air dispersion modelling findings for Areas of Search 2, 12, 25, 41, 43, 46, 52, 54 and 57 it is predicted that the development of a thermal treatment facility at the following is not considered to give rise to significant effects on European sites:

Areas of Search 1, 4-5, 9-11, 13-16, 36-40, 42, 44-45, 47-51, 53, 55-56 and 61-65 at 250 ktpa capacity and a stack height of 80 m.

Based on the air dispersion modelling findings for Area of Search 3 and 8, it is predicted that Area of Search 6 will have no likely significant effects at 150 ktpa throughput and a stack height of 80 m.

6.2.3 Consideration of Use of Conservative Modelling Parameters for Area of Search 3

It is noted that the emissions have been modelled at the WID limits, which is the maximum allowable emissions under UK law. In reality, most thermal treatment facilities, such as EfW plants, emit at much lower emissions rates for many pollutants than the WID limits.

In addition the application of mitigation measures is standard practice to reduce pollutant emission rates (*eg* using selective non-catalytic reduction (ammonia/ urea) for decreasing NO_X emissions), or acid gas removal systems (dry/semi-dry/wet) for decreasing SO_2 emissions). Ground level concentrations of pollutants (and acid/nitrogen deposition) can also be reduced by increased dispersion (*eg* using higher stack heights than the ones currently modelled).

The impacts will also be influenced by other mitigation factors such as building downwash and operation hours. As the level of mitigation required is project and plant specific, it is not feasible at this current strategic level waste strategy stage to evaluate each proposed site in such detail.

Therefore, using a conservative approach, it has been necessary to apply the WID emission limits in the first instance and to use the corresponding results as a basis for further work.

6.2.4 Consideration of Mitigation Options

In order to reduce pollutants the developer may commit in their application for an Environmental Permit to an additional emission limit as a monthly average and to annual operating hours, for example for oxides of nitrogen (NOx). The combination of these measures may be expressed in terms of a total tonnage limit. It would serve to reduce the maximum permitted emissions by a certain percentage and could therefore reduce the predicted contribution to a given European site (<1% of the benchmark).

7 SUMMARY OF ASSESSMENT FINDINGS

7.1 OVERVIEW OF THE SCREENING ASSESSMENT FINDINGS

7.1.1 Air Pollution Effects

When considering thermal treatment facilities with 150 ktpa capacity and 80 m stack height, the air dispersion modelling assessment concludes that development of a facility on all Areas of Search will have no likely significant effects on European sites.

It cannot currently be concluded that there will be no likely significant effect for Areas of Search 3, 6 and 8 at 250 ktpa and 100 m stack height. Therefore further air dispersion modelling will be necessary if development of a scale greater than 150 ktpa capacity and stack height less than 80 m thermal treatment facility is required at these Areas of Search.

It cannot currently be concluded that there will be no likely significant effect for Area of Search 7 at 250 ktpa 80 m stack height. Therefore further air dispersion modelling will be necessary if development of a scale greater than 250 ktpa capacity and a stack height less than 100 m thermal treatment facility is required at this Area of Search.

7.1.2 Summary of Findings

A summary of the findings of the screening assessment for grouped Areas of Search is provided in *Table 7.1* which includes air pollution assessment findings and predicted findings for Areas of Search that were not included in the modelling runs.

Table 7.1 ***Findings of the Screening Assessment – Sources of Likely Significant Effects from the Development of Waste management Facilities at the Areas of Search***

	1 (see *Figure* 7.1b)	2 (see *Figure* 7.1c	3 (see *Figure* 7.1d	4 (see *Figure* 7.1e
Areas of Search	**Development of Thermal Treatment Facility (potential air pollution effects)**			**Any Other Waste Facility Types (Excluding Thermal Treatment)**
	250 ktpa, 80 m stack	**250 ktpa, 100 m stack**	**150 ktpa, 80 m stack**	
1-2, 4-5, 8-58 and 61-65	No LSE	No LSE	No LSE	No LSE
7	Cannot conclude no LSE	No LSE	No LSE	No LSE
3, 6 and 8	Cannot conclude no LSE	Cannot conclude no LSE	No LSE	No LSE

NB - LSE = Likely Significant Effect

No LSE on European sites is identified for the development of the specified facility.

Cannot conclude no LSE on European sites from stack emissions for the development of the specified thermal treatment facility at the parameters modelled.

The findings are also illustrated on *Figures 7.1 a-e*.

Figure 7.1 a summarises the findings of the HRA as follows:

- yellow shading which is an indicative zone where no likely significant effects are concluded from the development of thermal treatment or other facilities as these areas are over 15 km from European sites (see *Chapter 2*) with a caveat relating to water pollution (see section below);
- orange shading which is an indicative zone where there would be no likely significant effect from the development of thermal treatment at the capacities and stack heights modelled or based on predictions from the modelling, or the development of any other waste facility types included in the assessment with a caveat relating to water pollution (see below); and
- dark purple shading which is an indicative zone where the findings of the air pollution assessment show that likely significant effects from the development of thermal treatment facilities at certain modelled scales are uncertain.

Figure 7.1 b illustrates the zone (purple shading) where this report has concluded from the findings of the air pollution assessment that likely significant effects are uncertain from the development of a thermal treatment facility with 250 ktpa throughput and 80 m stack height or a facility with a higher throughput and/or lower stack height (see Column 1 of *Table 7.1*).

Figure 7.1 c illustrates the zone (pink shading) where this report has concluded from the findings of the air pollution assessment that likely significant effects are uncertain from the development of a thermal treatment facility with 250 ktpa throughput and 100 m stack height or a facility with a higher throughput and/or lower stack height (see Column 2 of *Table 7.1*).

Figure 7.1 d illustrates the zone (orange shading) where this report has concluded from the findings of the air pollution assessment there would be no likely significant effects from the development of a thermal treatment facility with 150 ktpa throughput and 80 m stack height or a facility with a lower throughput and / or higher stack height (see Column 3 of *Table 7.1*).

Figure 7.1 e illustrates the zone (vertical hatching) where this report has concluded there would no likely significant effects from the development of any of the assessed waste facilities other than thermal treatment with a caveat relating to water pollution (see below).

Water Pollution Caveat

Any development that falls within the flood zones 2 and 3 and the groundwater source protection zones (inner zone, outer zone and total catchment) as shown on *Figures 7.1 a-e* would need to consider water pollution effects and demonstrate, including consideration of mitigation and control measures as necessary, that there would be no likely significant effects. Water

pollution prevention measures through development control and mitigation are discussed further in the following sections:

7.1.3 Consideration of Water Environment Protection Policy

Abstractions and discharges will inevitably be required to meet the water and wastewater requirements for the facilities in the region. During the design and planning stages, abstraction and discharge needs will be progressed in accordance with current water policy in England, notably *the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003, Water Resources Act 1991, Water Act 2003* and *the Surface Waters (Dangerous Substances) (Classification) Regulations, 1997* and 1998.

Review of policy pertaining to the water environment should be conducted as facility plans progress. This will ensure that the implications of advances in legislation are fully understood, and that the facilities meet, or exceed, the requirements with regards to abstractions, discharges, water efficiency and runoff. In the immediate forthcoming period, it should be noted that changes due to the *Floods Directive (2007/60/EC)* and *Floods and Water Bill* (in draft, 2010) are anticipated. Directives, such as the *Dangerous Substances Directive (76/464/EEC)*, will be repealed by the WFD in 2013.

7.1.4 Consideration of Consents and Development Control

As no direct abstraction or surface water drainage would occur without appropriate consent approval, which would take account of water quality, water availability, Environmental Quality Standards (EQS), River Quality Objectives (RQOs), species, sites and habitats of ecological importance, it is considered that the risks of any potential ecological impacts occurring will be minimised and managed appropriately through standard mitigation measures and control measures (see below).

Potential indirect impacts through surface or groundwater to sewers and watercourses would occur only if appropriately consented by the water operator.

Due to the nature of the hydrological environment, and the interrelationships between groundwater and surface water quality, flow, channel form, topography and ecology, reference should also be made to Policy WCS 8 for the consideration of Flood Risk and Water Resources, and to the recommendations contained therein.

7.1.5 Mitigation Measures for the Protection of the Water Environment

Table 7.2 presents general mitigation measures relevant to different waste facilities during different stages of the development taken as an excerpt from *Annex A*. This draws together guidance from various sources.

Table 7.2 *Excerpt from Annex A – Facility-specific Impacts and Generic Mitigation relating to Water Pollution*

Facility Type	Potential Impact	Generic Mitigation
Modern Thermal Treatment (MTT) Energy from Waste (EfW) / Incineration (I) and Advanced Thermal Treatment (ATT) (including Pyrolysis and Gasification technologies).	Thermal technologies use minimal amounts of water and discharge minor amounts to sewers.	Standard measures should include capture and treatment/disposal of run-off and leachate, appropriate drainage, bunding wash down washers should prove effective at avoiding releases to waterways and are effective control and mitigation measures.
General biological and mechanical treatment - (MBT)	Limited potential for impact on water resources as operations and storage of materials is enclosed / undercover hence rainfall is unlikely to come into contact with potential pollutants.	Mechanical treatment - controlled surface drainage, capture and treatment of run-off and wash-down water are effective mitigation measures. Biological treatment – see OWC, IVC and AD.
Open Windrow Composting (OWC) and In Vessel Composting (IVC)	Leachate and run-off from compost heaps has a high content of organic substances.	Leachate should be captured and undergo recirculation and / or treatment prior to release (e.g. to sewers) to prevent contamination of surface and groundwaters. Enclosed operations significantly reduce environmental nuisance and pollution risk as it can help to prevent water coming into contact with waste.
Anaerobic Digestion (AD)	Waste water produced during dewatering of solid digestate can contain high concentrations of metals, dissolved nitrogen and organic material.	Potential for pollution if left untreated, this is mitigated by on site drainage, containment and collection systems for waste water, surface and run-off waters and onsite treatment where necessary. Alternatively waste water may be able to be disposed of to sewer and treated at sewage works.
Materials Recycling Facility/ Material Recovery Facility (MRF)	Limited potential for impact on water resources due to nature of operations and materials. Residual liquids (e.g. from bottles and cans) can potentially pose a pollution risk to water resources.	Appropriate site drainage and capture and treatment of run-off and wash down waters are effective mitigation measures.
Waste Transfer Station	Nature of waste collected at depot may have potential risk to water resources.	Enclosed operations reduce exposure of potential pollutants to water, capture and treatment of runoff. Wash-down waters are effective mitigation measures

Facility Type	Potential Impact	Generic Mitigation
Household recycling centre	Limited potential for impact on water resources due to nature of operations and materials. Residual liquids and organic leachate from green waste can potentially pose risk to water resources.	Undertaking operations in enclosed or undercover area, appropriate site drainage and capture and treatment of run-off and wash down waters are effective mitigation measures.

Further examples of generic standard mitigation and control measures for the development of waste management facilities are given in *Table 7.3* which have been adapted from an approved large scale remediation and development scheme. The exact scope of mitigation will be agreed between relevant statutory bodies and developers depending on the technology solution proposed.

Table 7.3 Examples of Generic Development Mitigation Measures for the Protection of the Water Environment [30]

Element	Measures
CONSTRUCTION STAGE	
Waste Water and Groundwater	• PPG 21: Pollution Incident Response Planning, over-arching Pollution Prevention and Emergency Response Plans and site / activity specific procedures developed for the proposed facility. • All waste water and site discharges shall only be permitted where the effluent quality and discharge location is acceptable to Environment Agency. • Any polluted water shall pass through treatment facilities such as sediment traps and/or settlement lagoons, as appropriate, before being discharged. • All drainage and treatment facilities shall be regularly inspected and maintained and a full record will be kept of inspection, maintenance and measures to sustain equipment performance. • Prior to any excavation below the water table, including site de-watering, Environment Agency shall be informed of the works to be conducted. • BS 6031:1981 Code of Practice for Earthworks, regarding the general control of site drainage shall be complied with. • Areas of exposed ground and stockpiles shall be minimised and covered where necessary to reduce mobilisation by water or air. • Geotextiles shall be used as necessary to shield spoil mounds. • Water containing silt shall not be discharged directly into watercourses. • Water will be stored in settlement lagoons or tanks, filtered, or discharged to foul sewer (with agreement of the relevant water authority and Environment Agency). • Water will not be encouraged to infiltrate the site to minimise the potential for contaminant mobilisation. The only instances where this may be permitted will be if soakaway areas located within clean fill have been identified and constructed in agreement with Environment Agency. • Any water that has come into contact with contaminated materials shall be disposed of in accordance with the Water Resources Act 1991 (as amended by the Water Act 2003) and the Water Industry Act 1991 (as amended by the Water Act 2003) (if disposed to the public sewer) to the satisfaction of Environment Agency and the water authority. • All works, abstractions and discharges will be conducted in accordance with the requirements of all relevant regulations and PPGs, such as PPG1: General Guide to the Prevention of Pollution, PPG5: Works In, Near or Liable to Affect Watercourses and PPG 6: Working at Construction and Demolition sites. • Regulatory requirements and the measures outlined within PPGs should be integrated with a Code of Construction Practice (CoCP) for the site. • Sulphate resistant concretes (as detailed within the Code of Practice for Concrete Design BS 5328) will be used throughout the site due to the potential for impacts to surface water and groundwater.

(30) Guidance taken from a range of approved planning application sources.

Element	Measures
	• Any development with a requirement to undertake piling or to utilise other foundation designs using penetrative methods or other similar specialist activities, such as grouting, should be undertaken in accordance with detailed Method Statement to minimise risk of impacts to groundwater quality and flow and must be carried out with the consent of WCC and Environment Agency. • Due regard shall be taken of underlying aquifers, and to the Environment Agency Groundwater Protection Policy. • In all instances, appropriate protection of aquifers shall be undertaken, following liaison with the Environment Agency regarding the piling and construction techniques to be employed. • Details of appropriate measures to prevent groundwater contamination shall be agreed with the Environment Agency, in writing, prior to commencement of the relevant scheme works.
Storage and Use of Materials with the Potential to Pollute	• Provisions made to ensure that potential contaminants stored on the site are controlled in accordance with the Control of Substances Hazardous to Health (COSHH) Regulations 2002 and are properly isolated and bunded (with at least 110% capacity) and that no oil or other contaminants are allowed to reach watercourses or groundwater, including aquifers. • Facilities regularly inspected (especially after heavy rain) to ensure there is no damage or leaks. • Storage locations for such materials should be positioned away from watercourses and agreed with the Environment Agency. • All surface water or other contaminated water which accumulates in a bunded area shall be removed by manually controlled positive lift pumps and not by means of a gravity drain. • Such water will be removed from site and discharged in public sewer in consultation with the water authority. • All refuelling and routine maintenance of vehicles and plant will be undertaken offsite at a suitable facility or in a designated bunded area. • Spill response kits containing equipment appropriate to the quantity and types of materials present on site shall be available and easily accessible in the event of a fuel spillage and personnel will be trained in their use.
Control and Management of Foul Drainage	• Foul water and sewage effluents produced by the construction workforce shall be contained by temporary foul drainage facilities to be installed. All foul water shall be disposed of off-site by a licensed contractor.
Works in the Vicinity of Water	• Suitable precautions shall be taken to prevent the entry of pollutants including sediments and dust into any bodies of water and any incidents shall be reported to the Environment Agency in accordance with incident reporting procedures. • Crossings of watercourses shall be designed and constructed so as not to impede the flow, obstruct the movement of floodwater or exacerbate erosion of the channel and banks. • If any treatment is required in the vicinity of surface water receptors or if intrusive works are required, procedures will be developed and agreed based upon the area concerned and the potential for migration within fractured sediments or aquifers.
Potential Additional Risk Management Measures and	• Specific water quality and flow monitoring programmes could be developed to ensure that any watercourses are not being adversely affected by construction activities or site treatments.

Element	Measures
Monitoring	• Gauges can be used on site to allow ground stability to be monitored where necessary. • Procedures will be developed in consultation with the Environment Agency to be implemented in the event that a risk to water quality is identified. Procedures will include commitments with regard to incident reporting, retention and the treatment of waters. • Dust suppression and erosion minimisation procedures can be developed and implemented. Specific procedures will be implemented during the phases of construction involving works adjacent to, and in the immediate vicinity of watercourses.
OPERATIONAL STAGE	
water use, treatment and disposal.	• No abstraction from watercourses. • Use of mains public supply for amenities and critical applications (such as flue gas cleaning system, backup supply, cleaning and distribution in the fire fighting hydrant network. • Use of rainwater collected from roofs or buildings and roads that would replace mains water for some applications and be used as process water. • Process use of clean, re-circulated water for bottom ash quenching, wash down etc. • No discharge of liquid effluent into the mains sewer. • Waste water treatment will be carried out for chemically contaminated water from boiler blow-down, de-mineralisation unit, cleaning/draining of equipment etc and re-used in the process. • Waste water from offices and staff facilities will be discharged to a septic tank before being tinkered off-site for disposal to a sewage works. Accidental spillages and clean-up water would also be treated prior to release. • Any water from a waste bunker to be separately collected for treatment and/or disposal off site. • On-site water treatment could comprise pH correction and separation of suspended solids. No discharge to ground or groundwater and no effluent discharge. • Surface water runoff to be managed in accordance with SUDs and runoff rates agreed with the Internal Drainage Board (IDB). • Clean surface water (rainwater) from roofs and roads will be captured and stored for use in the process.

KEY:

- Areas of Search
- Worcestershire County Council Boundary
- Special Area of Conservation
- Likely significant effects of thermal treatment facilities at certain scales are uncertain from the HRA findings (see Section 7.1.2.)
- No likely significant effects predicted from the HRA findings (see section 7.1.2 and the water pollution caveat at 7.1.2)
- No likely significant effects (area over 15 km from European sites (see Section 7.1.2 and the water pollution caveat at 7.1.2)

Flood and Groundwater Zones

- Inner Zone, Zone 1
- Outer Zone, Zone 2
- Total Zone, Zone 3
- Flood Zone 2
- Flood Zone 3

Lyppard Grange Ponds

Bredon Hill

Dixton Wood

N W E S

0 5

Kilometres

TITLE:

Figure 7.1a
Likely Significant Effects Summary Including Summary of Uncertain Effects from Thermal Treatment Facilities (see Section 7.1.2)

CLIENT:	SIZE:
Worcestershire County Council	A3

DATE: 16/03/2011	CHECKED: BS	PROJECT: 0123097
DRAWN: IG	APPROVED:	SCALE: As Scale Bar

DRAWING:	REV:
LikelyEffects.mxd	0

ERM
St. Nicholas House
31-34 High Street
Bristol
BS1 2AW
Tel: 0117 315 8510
Fax: 0117 315 8511

PROJECTION: British National Grid

File: 0123097\Worcestershire\HRA\GIS_IG_BS\Mxds\Final_Version_March11\LikelyEffects.mxd

KEY:

- Areas of Search
- Worcestershire County Council Boundary
- Special Area of Conservation
- Likely significant effects of thermal treatment facilities at a scale of 250 ktpa and a stack of 80 m are uncertain from the HRA findings (see Column 1 of Table 7.1)
- No likely significant effects predicted from the HRA findings (see Column 1 of Table 7.1and the water pollution caveat at 7.1.2)
- No likely significant effects (area over 15 km from European sites) (see section 7.1.2 of the HRA Report and the caveat at section 7.1.2 of the report)

Flood and Groundwater Zones

- Inner Zone, Zone 1
- Outer Zone, Zone 2
- Total Zone, Zone 3
- Flood Zone 2
- Flood Zone 3

N W E S

0 1

Kilometres

TITLE:

Figure 7.1b
Location of Uncertain Likely Significant Effects from Thermal Treatment Facilities (see Column 1 of Table 7.1)

CLIENT:	SIZE:
Worcestershire County Council	A3

DATE: 22/03/2011	CHECKED: BS	PROJECT: 0123097
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DRAWING:	REV:
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PROJECTION: British National Grid

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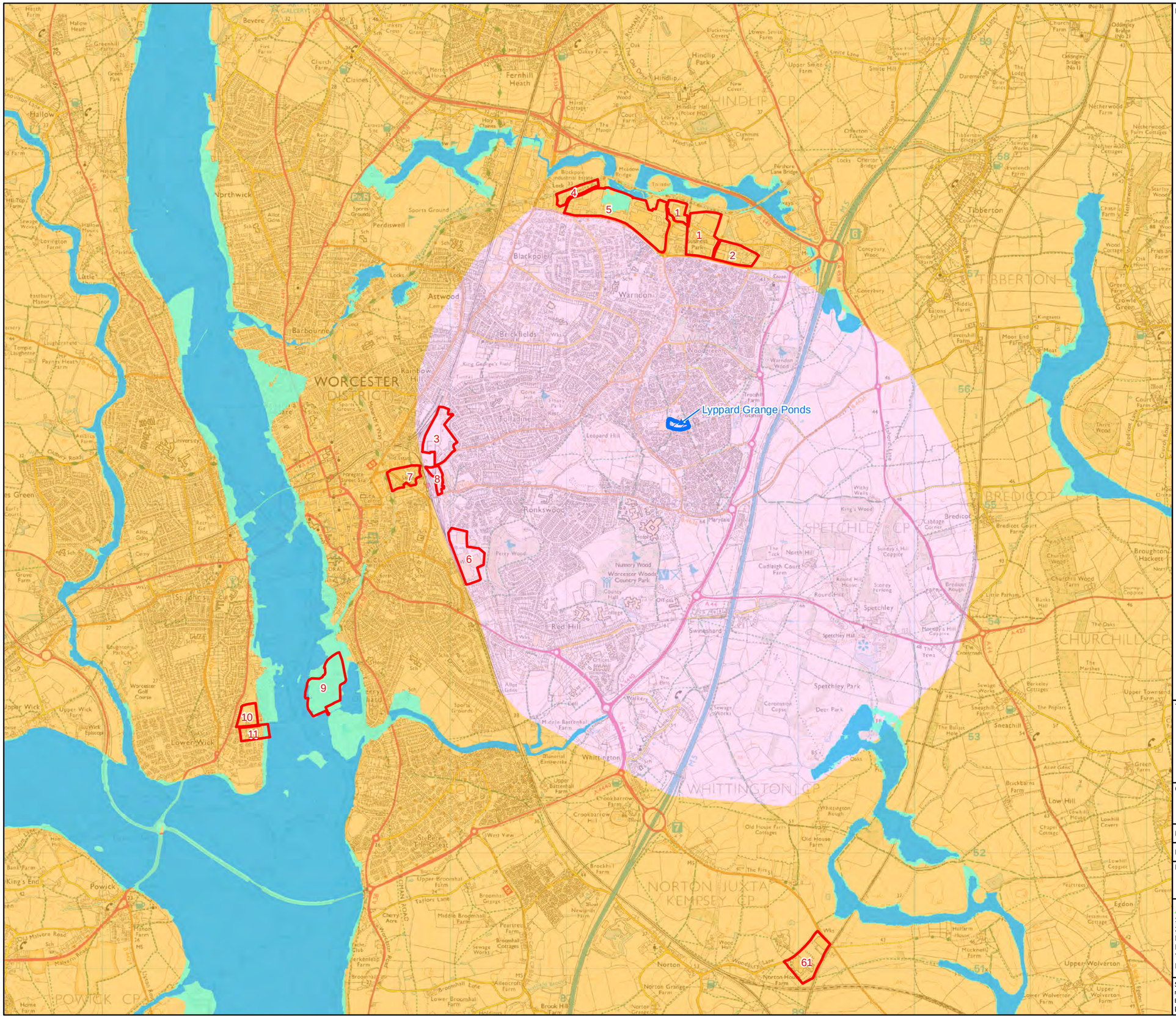

KEY:

- Areas of Search
- Worcestershire County Council Boundary
- Special Area of Conservation
- Likely significant effects of thermal treatment facilities at a scale of 250 ktpa and a stack of 100 m are uncertain from the HRA findings (see Column 2 of Table 7.1)
- No likely significant effects predicted from the HRA findings (see Column 2 of Table 7.1)
- No likely significant effects (area over 15 km from European sites) (see section 7.1.2 of the HRA Report and the caveat at section 7.1.2 of the report)

Flood and Groundwater Zones

- Inner Zone, Zone 1
- Outer Zone, Zone 2
- Total Zone, Zone 3
- Flood Zone 2
- Flood Zone 3

N
W E
S

0 1
Kilometres

TITLE:

Figure 7.1c
Location of Uncertain Likely Significant Effects from Thermal Treatment Facilities (see Column 2 of Table 7.1)

CLIENT:	SIZE:
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DATE: 22/03/2011	CHECKED: BS	PROJECT: 0123097
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DRAWING:	REV:
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PROJECTION: British National Grid

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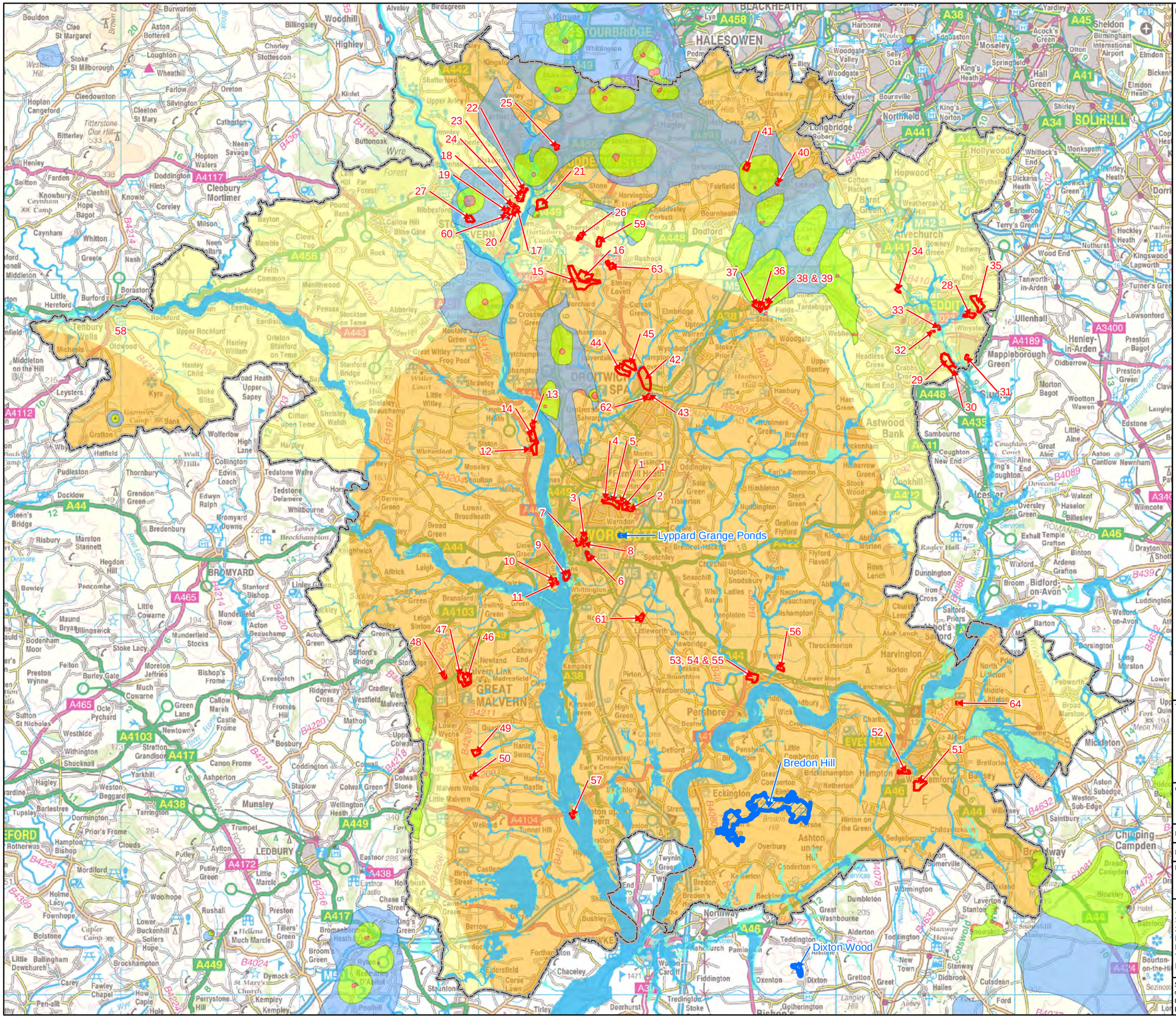

TITLE:

Figure 7.1d
Location of No Likely Significant Effects from Thermal Treatment Facilities (see Column 3 of Table 7.1)

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DRAWING:	REV:
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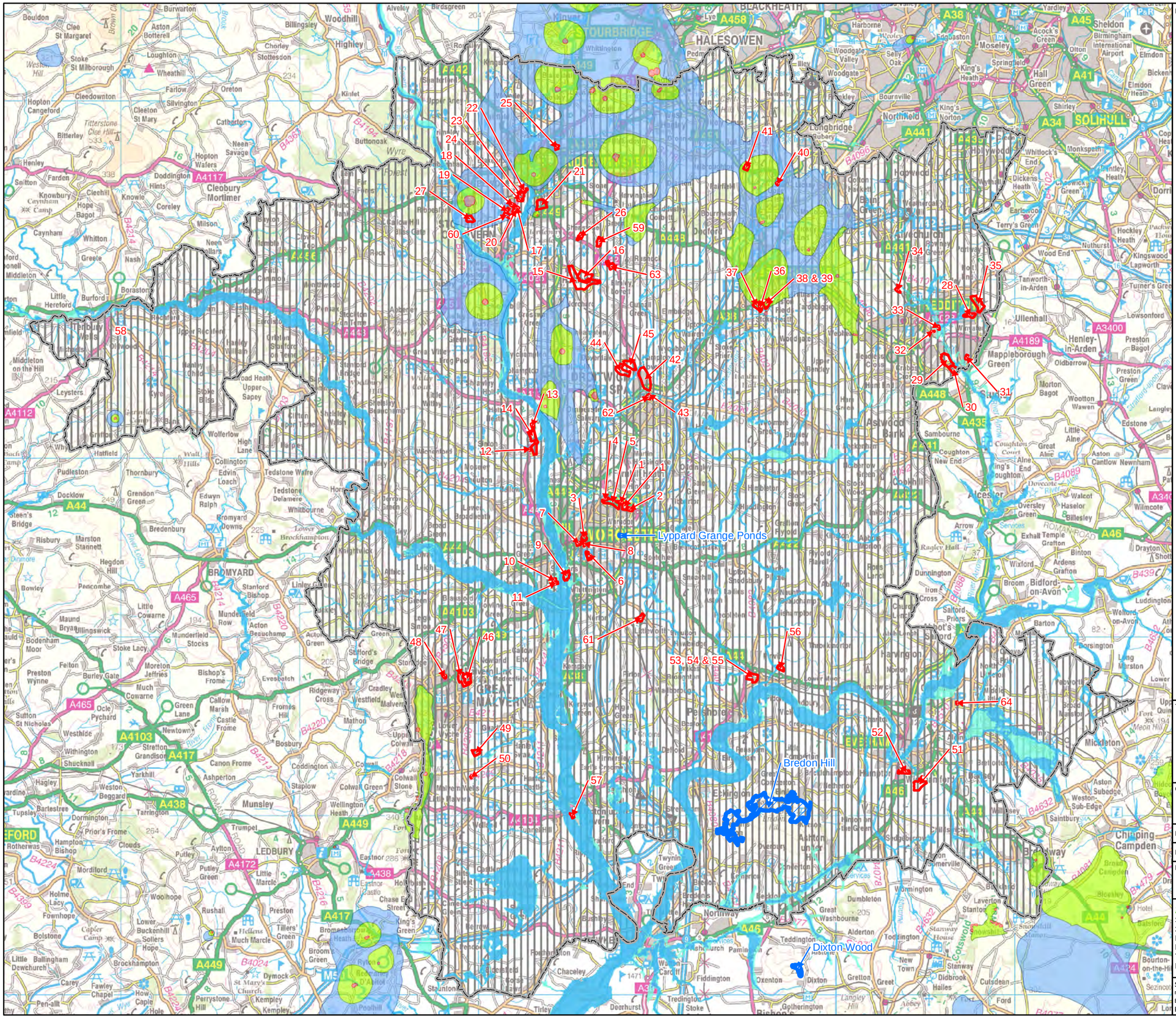

TITLE:

Figure 7.1e
Location of No Likely Significant Effects from Waste Facilities Excluding Thermal Treatment (see Column 4 of Table 7.1)

CLIENT:	SIZE:
Worcestershire County Council	A3

DATE: 16/03/2011	CHECKED: BS	PROJECT: 0123097
DRAWN: IG	APPROVED:	SCALE: As Scale Bar

DRAWING:	REV:
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PROJECTION: British National Grid

File: 0123097\Worcestershire\HRA\GIS_IG_BS\Maps\Final_Version_March11\NoLikelyEffects.mxd

8 IN-COMBINATION ASSESSMENT

8.1 INTRODUCTION

In-combination effects were considered for all Areas of Search with the following conclusions:

- Areas of Search where it is concluded there would be no likely significant effect on European sites; and
- Areas of Search where it cannot be concluded that there would be no likely significant effect on European sites.

8.2 CONSIDERATION OF IN-COMBINATION EFFECTS

The final list of Areas of Search considered for the European sites located within 15 km within the assessment of potential in-combination effects includes the following:

- Areas of Search 1, 2, 4, 5, 9, 10, 11, 12, 13, 14, 15, 16, 42, 43, 44, 45, 46, 47, 48,49, 53, 54, 55, 56, 61, 62 and 63 for potential air pollution effects on Lyppard Grange Ponds SAC where no likely significant effects were concluded;
- Area of Search 7 for potential air pollution effects on Lyppard Grange Ponds SAC where it could not be concluded that there would be no likely significant effects at 250 ktpa and 100 m stack;
- Areas of Search 3, 6 and 8 for potential air pollution effects on Lyppard Grange Ponds SAC where it could not be concluded that there would be no likely significant effects at 250 ktpa and 80 m stack;
- Areas of Search 25, 40 and 41 for potential air pollution effects on Fens Pools SAC where no likely significant effects were concluded;
- Areas of Search 49, 50, 51, 52, 53, 54, 55, 56, 57, 61 and 64 for potential air pollution effects on Bredon Hill SAC;
- Areas of Search 51, 52, 53, 54, 55, 56 and 57 for potential air pollution effects on Dixton Wood SAC; and
- Areas of Search 1, 2, 3, 4, 5, 6, 7, 8, 49, 50, 51, 52, 53, 54 for potential water pollution effects on Lyppard Grange Ponds SAC and Bredon hill SAC.

Projects and plans considered for potential sources of in-combination effects are provided in *Table C1.1, Annex C.*

8.2.1 Consideration of In-Combination Effects for All Areas of Search

Given that the air pollution modelling results for all Areas of Search at given parameters were insignificant and below the 1% benchmark, it is considered unlikely that significant effects would occur in-combination with significant effects from other plans and projects. No further consideration of in-combination effects is therefore given for all Areas of Search excluding Areas of Search 3, 6 and 8.

8.2.2 Consideration of In-Combination Effects for Areas of Search 3, 6 and 8

An area of 15 km around Lyppard Grange Ponds SAC was considered for the identification of significant effects arising from other plans and projects. This included a consideration of surrounding authorities where necessary.

The full list of plans and projects considered are given in Annex C and key plans and projects for Lyppard Grange Ponds SAC are summarised below. For the majority of plans and projects it was concluded there were no pollution pathways that could affect European sites that development at the Areas of Search would affect and therefore they are unlikely to result in in-combination effects.

Plans:

- Regional spatial strategies (revoked July 2010), including West Midlands Regional Spatial Strategy, Herefordshire Unitary Development Plan
- County Structure Plans for Worcestershire, Herefordshire and Birmingham;
- Relevant Adopted District Local Plans for Worcester, Wychavon, Malvern Hills, Wyre Forest, Redditch, Bromsgrove; and
- Relevant Local Development Documents (LDDs) within the Local Development Framework (LDF) of the District Authority in which Lyppard Grange Ponds SAC is located.

Projects:
Bosch Strategic Employment Site

Furthermore, the protection of European sites through policy is considered in *Section 8.3*.

8.3 CONSIDERATION OF PROTECTION OF EUROPEAN SITES THROUGH POLICY

The main focus for much of the future development in Worcestershire is through the adopted District Local Plans.

All development plans include policies which make a commitment to preventing risks to the integrity of European sites and it is expected that the Development Framework Documents will contain similar policies to ensure that their implementation safeguards the interests of European sites.

8.4 CONCLUSION OF THE IN-COMBINATION ASSESSMENT

Areas of Search 1-2, 4-5, 9-58 and 61-65 were screened out of this assessment as insignificant are therefore considered unlikely to act in-combination to result in significant effects.

No specific sources of in-combination effects were identified from other plans or projects for Lyppard Grange Ponds. Therefore the development of Areas of Search 3, 6, 7 and 8 where it cannot currently be concluded that there would be no likely significant effect from air pollution at certain scales of thermal treatment facilities are unlikely to have in-combination effects.

9 REVIEW OF THE PUBLICATION STAGE WCS AGAINST THE 2010 REGULATIONS

The report so far has considered development of waste facilities at the 65 Areas of Search Site and identified potential impacts on European sites to indicate if likely significant effects are predicted. The findings of this assessment have been used to inform the development of the Publication Document WCS (March 2011).

The overall aim of this report is to assess the Publication WCS against the 2010 Regulations to conclude that with the various protections, provisions and caveats in the WCS whether it can be ascertained that the plan (either alone or in-combination with other plans and projects) will not adversely affect the integrity of any European site.

The policies, supporting text and appendices within the Publication WCS have therefore been reviewed against the findings of the HRA of the Site Options to ensure the plan is compliant and deliverable in terms of the 2010 Regulations.

It should be noted that the final list of Areas of Search within the Publication WCS do not include all of the Areas of Search included in the HRA. The following Areas of Search have been removed:

- Areas of Search 14, 16, 27, 40, 41, 43 and 56.

The review has concluded that the WCS is compliant with the 2010 Regulations.

The following section documents the review of relevant policies and include necessary justification behind the conclusion.

9.1 CONSIDERATION OF RELEVANT POLICIES WITHIN THE WCS

Table 9.1 includes a summary of the key policies considered in terms of the 2010 Regulations. Policies relating to specific Site Options are considered to be the most relevant.

Table 9.1 Summary of WCS Policies Considered

Relevant WCS Sections	Consideration of Compliance with the 2010 Regulations
Vision	The 'Vision' is considered to be compliant with the 2010 Regulations.
Strategic Objectives	The 'Strategic Objectives' are considered to be compliant with the 2010 Regulations.
Policy WCS 1: Re-use and Recycling	Policy WCS 1 is considered to be compliant with the 2010 Regulations. No Further Comments.
Policy WCS 2: Other Recovery	The HRA included each of the 58 Areas of Search included in Annex A of the WCS. Policy WCS 2 draws on the findings of the HRA and Appendix 3 of the WCS makes direct reference to Figures 7.1a-e. Policy WCS 2 b) makes direct reference to geographical areas with constraints in terms of significant effects identified from thermal treatment type facilities as identified in this HRA and states where restrictions in terms of scales of facilities apply. These geographical areas are shown on Figure 14 of the WCS. Policy WCS 2 is considered to be compliant with the 2010 Regulations.
Policy WCS 3: Landfill and Disposal	Policy WCS 3 is considered to be compliant with the 2010 Regulations. No Further Comments.
Policy WCS 4: Compatible Land Uses	Policy WCS 4 is considered to be compliant with the 2010 Regulations. No Further Comments.
Policy WCS 5: Development Associated with Existing Temporary Facilities	Policy WCS 5 is considered to be compliant with the 2010 Regulations. No Further Comments.
Policy WCS 6: Site Infrastructure and Access	Policy WCS 6 is considered to be compliant with the 2010 Regulations. No Further Comments.
Policy WCS 7: Environmental Assets	Policy WCS 7 states that proposals for waste management facilities will not be permitted where they will have a likely significant effect on internationally designated sites. Policy WCS 7 is considered to be compliant with the 2010 Regulations.

Relevant WCS Sections	Consideration of Compliance with the 2010 Regulations
Policy WCS 8: Flood Risk and Water Resources	Policy WCS 8 states that waste management facilities will be permitted where it is demonstrated that the design of buildings, layout, landscaping and operation of the facility, and any restoration proposals consider any potential impacts on surface and ground water to ensure that facilities will have no likely significant effects on any international designated site. Cumulative effects must be considered and details of any mitigation or compensation proposals must be included. Policy WCS 8 is considered to be compliant with the 2010 Regulations.
Policy WCS 9: Sustainable Design and Operation of Facilities	Policy WCS 9 is considered to be compliant with the 2010 Regulations. No Further Comments.
Policy WCS 10: Local Characteristics	Policy WCS 10 is considered to be compliant with the 2010 Regulations. No Further Comments.
Policy WCS 11: Amenity	Policy WCS 11 is considered to be compliant with the 2010 Regulations. No Further Comments.
Policy WCS 12: Social and Economic Benefits	Policy WCS 12 is considered to be compliant with the 2010 Regulations. No Further Comments.
Policy WCS 13: New Development Proposed on or Near to Existing Waste Management Facilities	Policy WCS 13 is considered to be compliant with the 2010 Regulations. No Further Comments.
Policy WCS 14: Making Provision for Waste in All New Development	Policy WCS 14 is considered to be compliant with the 2010 Regulations. No Further Comments.

10 REPORT CONCLUSIONS

10.1 INTRODUCTION

This assessment has been an iterative process working alongside and informing the contents of the WCC WCS Site Options and policies. The aim of this study has been to carry out a review of the Publication WCS in terms of compliance with the 2010 Regulations. *Chapter 9* sets out this review and explains how the policies and site options are deliverable.

10.2 ASSESSMENT OF THE WCS AGAINST THE HABITATS REGULATIONS

It is concluded that the WCS, site options and associated policies will have no likely significant effects alone or in-combination on any European designated sites for nature conservation. Therefore the WCS is considered to be compliant with the 2010 Regulations.

10.3 ASSESSMENT OF THE WCS SITE OPTIONS AGAINST THE HABITATS REGULATIONS

10.3.1 *Areas of Search Concluding No Likely Significant Effect*

The screening assessment concludes that there will be no likely significant effect on European sites through the development of any facility types at all 65 Areas of Search with the exception of Areas of Search 3, 6, 7 and 8 at certain modelled facility scales for thermal treatment and with a caveat that further detailed consideration of mitigation to prevent water pollution effects be carried out at the development control stage – see *Table 7.1* and *Section 7.1*.

10.3.2 *Assessment Limitations*

It is important to note the limitations of this study given the high level strategic nature of the WCS within which it has to operate and inform site options and policy.

As the detailed design of waste management facilities are not available at this stage, the precautionary principle adopted for HRA applies which requires a worst case scenario to be adopted for each part of the assessment and does not preclude the need for further assessment and consideration of appropriate mitigation measures at the development control stage to ensure specific proposals do not have a likely significant effect on European sites.

In particular, the air dispersion modelling to inform potential likely significant effects for thermal treatment from stack emissions has a number of precautionary caveats involving the use of conservative modelling

parameters, and gives results in the absence of mitigation which may serve to minimise potential impacts to an insignificant level.

Therefore where potential likely significant effects (for example thermal treatment at sites 3, 6, 7 and 8 at certain parameters) are identified at this stage, it does should not necessarily mean that these Areas of Search are not suitable for the development of a waste facility. Instead the findings of this study should inform the scope of the assessment required at the planning application stage once detailed a design is known.

10.3.3 Next Steps

Consultation with NE and the EA has formed part of the HRA process and consultation on this document will be carried out during March 2011 to complete the process.

Annex A

Waste Impact Identification

A1 WASTE FACILITY IMPACT IDENTIFICATION

A1.1 SPECIFIC WASTE FACILITY OPERATIONAL IMPACTS

The WCS is technology neutral and WCC has adopted a technology neutral position. In order to cover any future commercial and industrial waste uses that could come forward on these sites, WCC consider that the following facilities should be included in the assessment:

- Modern Thermal Treatment / Energy from Waste / Incineration.
- Advanced Thermal Treatment (including Pyrolysis and Gasification technologies;
- Mechanical Biological Treatment (MBT) which includes a range of technologies, including composting, anaerobic digestion and bio-drying; and
- Autoclave.

For the purposes of this assessment, it is assumed that any of the facilities listed in *Table A1.1* could be developed at any of the 58 waste sites.

Potential impacts listed in *Table A1.1* in are derived from ERM waste specialists' knowledge of waste facility impacts, recent planning applications (1) and Northamptonshire County Council Minerals and Waste Framework (2).

Standard control and mitigation measures assumed as standard within the normal operation of a waste facility are given in *Table A1.1.* Impacts are ruled out where it is considered that standard control measures will adequately mitigate the impact.

(1) Environmental Statement. Energy from Waste Facility, Trident Park, Cardiff. SLR for Viridor Waste Management. November 2008.
(2) Recently been found sound at examination and was adopted on 20th May 2010

Table A1.1 Waste Facilities and Associated Impacts

Facility	Description (1)	Impacts and Standard Mitigation Requirements (2)		
		Air Emissions (including dust)	*Protection of Water Resources*	*Disturbance*
Modern Thermal Treatment (MTT) Energy from Waste (EfW) / Incineration (I) and Advanced Thermal Treatment (ATT) (including Pyrolysis and Gasification technologies).	Waste management processes involving medium and high temperatures to recover energy from the waste. ATT includes pyrolysis and gasification based processes.	**Impacts** 1) Air emissions include carbon dioxide, acid gases, heavy metals, particulates and dioxins / dibenzofurans. 2) Limited potential for dust and ash release (mainly through accidental spillage and fugitive emissions). 3) Air emissions associated with emission from vehicles (haulage). **Standard Mitigation and Control Measures** 1) Proposals must satisfy criteria set out in the EC Waste Incineration Directive 2000 and require air pollution control systems. Licensing and regulation ensures effective pollution prevention control and mitigation measures are implemented to maintain operations within air emission standards. 2) Mitigation measures include covering ash, damping down and enclosed operations.	**Impacts** 1) Thermal technologies use minimal amounts of water and discharge minor amounts to sewers. **Standard Mitigation and Control Measures** 1) Standard measures should include capture and treatment/disposal of run-off and leachate, appropriate drainage, bunding wash down washers should prove effective at avoiding releases to waterways and are effective control and mitigation measures.	**Impacts** 1) Noise, light, human presence, litter, bird disturbance (where close to an SPA). **Standard Mitigation and Control Measures** 1) Standard control measures could include restricted seasonal working, directional lighting and fencing.

(1) Taken from Mechanical Biological Treatment of Municipal Solid Waste, Defra 2007 and Advanced Thermal Treatment of Municipal Solid Waste, Defra 2007.

(2) Source: Northamptonshire County Council Minerals and Waste Framework - Issues and Options

Facility	Description (1)	Impacts and Standard Mitigation Requirements (2)		
		Air Emissions (including dust)	*Protection of Water Resources*	*Disturbance*
Mechanical Biological Treatment (MBT)	Waste is usually mechanical treated (shredding or sorting) and then subjected to a biological treatment stage (this can be composting, IVC or anaerobic digestion). An MBT may or may not split organics from non-organics depending on the configuration of the plant. The plant may produce refuse derived fuel and/or stabilised organic material for composting for use on land (*only on contaminated land, not on agricultural*) as well as potential recyclate streams.	**Impacts** 1) Organic compounds and bio-aerosols from biological treatment processes and dust. 2) Air emissions associated with vehicle emissions from haulage. **Standard Mitigation and Control Measures** 1) Undertaking operations in controlled conditions and an enclosed area, sensitive working and strategic design are effective measures.	**Impacts** 1) Limited potential for impact on water resources as operations and storage of materials is enclosed / undercover hence rainfall is unlikely to come into contact with potential pollutants. **Standard Mitigation and Control Measures** 1) Controlled surface drainage, capture and treatment of run-off and wash-down water are effective mitigation measures.	**Impacts** 1) Noise, light, human presence, litter, bird disturbance (where close to an SPA). **Standard Mitigation and Control Measures** 1) Standard control measures could include restricted seasonal working, directional lighting and fencing.
Open Windrow Composting (OWC) In Vessel Composting (IVC)	Green waste is shredded and left in the open to mature. It is turned regularly. The compost can be used on land (*only on contaminated land, not on agricultural*) subject to appropriate controls. The aerobic decomposition of shredded and mixed organic waste within an enclosed container	**Impacts** 1) Potential for bio aerosol effects within 250m of operations. In vessel composting facilities feature part or all of composting processes in enclosed areas (including a concrete base). 2) Open windrow is usually undertaken in the open air on a concrete base. Potential for dust from heaps, processing and haulage. **Standard Mitigation and Control Measures** 1) Mitigation measures may reduce	**Impacts** Leachate and run-off from compost heaps has a high content of organic substances. **Standard Mitigation and Control Measures** Leachate should be captured and undergo recirculation and / or treatment prior to release (eg to sewers) to prevent contamination of surface and ground waters. Enclosed operations significantly reduce environmental nuisance and pollution risk as it can help to prevent water coming into contact with waste.	**Impacts** 1) Noise, light, human presence, litter, bird disturbance (where close to an SPA). **Standard Mitigation and Control Measures** 1) Standard control measures could include restricted seasonal

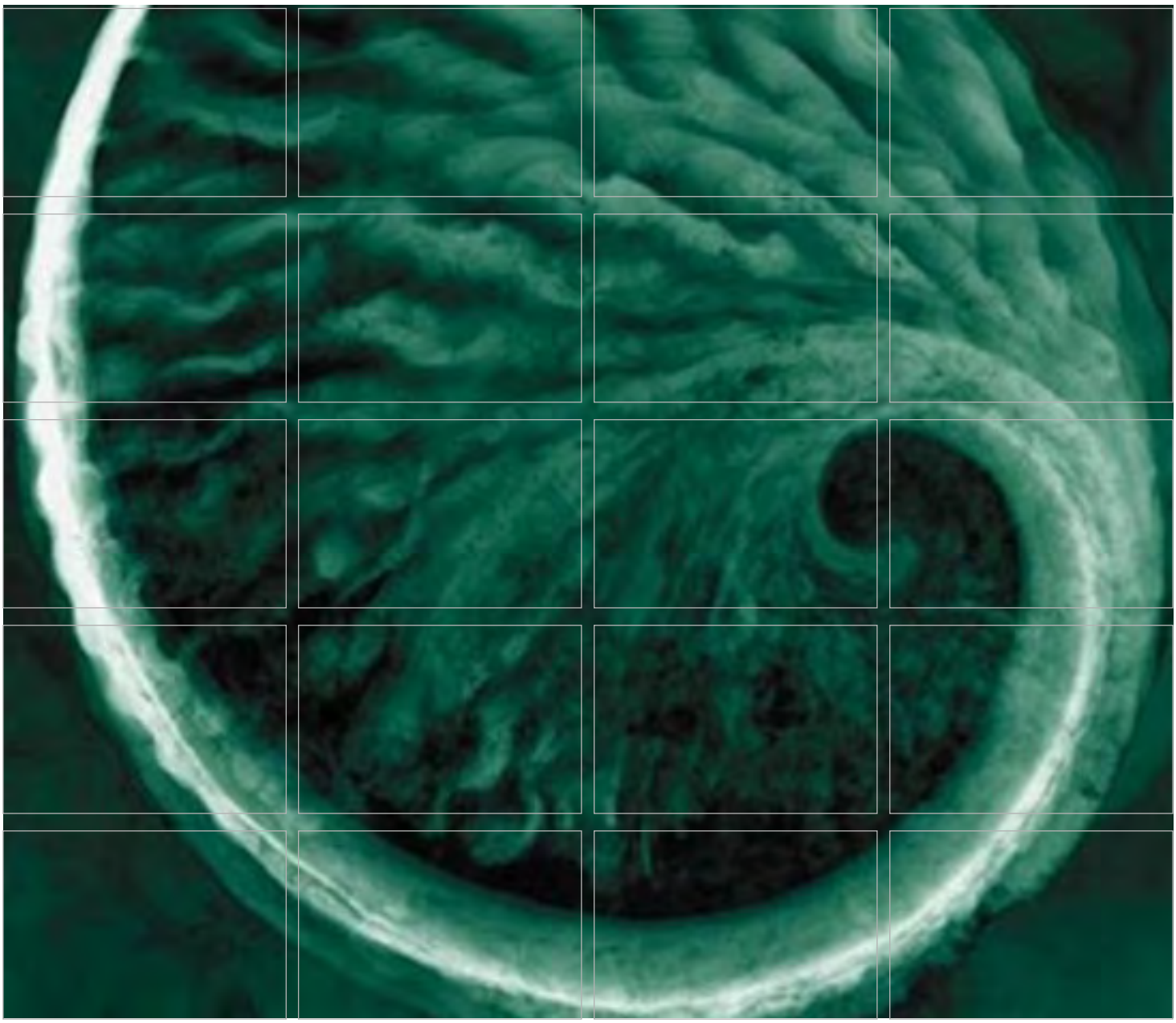
Facility	Description (1)	Impacts and Standard Mitigation Requirements (2)		
		Air Emissions (including dust)	*Protection of Water Resources*	*Disturbance*
		this distance. Enclosed operations reduce potential effects. 2) This is able to be mitigated through damping down during dry conditions, use of physical barriers or alternatively where possible enclosed operations preferred as well as sensitive / strategic operations (avoid operations during windy conditions). Low potential for fugitive emissions.		working, directional lighting and fencing.
Anaerobic Digestion	The anaerobic decomposition of shredded and mixed organic waste within an enclosed container, where the control systems for material degradation are fully automated	**Impacts** 1) Potential release of bio-aerosols, and bio gas emissions. **Standard Mitigation and Control Measures** 1) Operations undertaken in enclosed area hence emissions are controlled. Limited potential for dust. Air filtration and good operating standards (unloading, transport) are effective management measures. However some fugitive emission may arise. Feedstock is converted to biogas, gas must be burnt and can be used to generate heat and power. Results in compost product and liquor (recycled, treated, or used as liquid fertiliser).	**Impacts** 1) Waste water produced during dewatering of solid digestate can contain high concentrations of metals, dissolved nitrogen and organic material. **Standard Mitigation and Control Measures** 1) Potential for pollution if left untreated, this is mitigated by on site drainage, containment and collection systems for waste water, surface and run-off waters and onsite treatment where necessary. Alternatively waste water may be able to be disposed of to sewer and treated at sewage works.	**Impacts** 1) Noise, light, human presence, litter, bird disturbance (where close to an SPA). **Standard Mitigation and Control Measures** 1) Standard control measures could include restricted seasonal working, directional lighting and fencing.
Materials Recycling Facility/ Material Recovery Facility	Dedicated facility for the sorting / separation of recyclable materials.	**Impacts** 1) Air emissions are mainly associated with emission from vehicles (haulage).	**Impacts** 1) Limited potential for impact on water resources due to nature of operations and materials.	**Impacts** 1) Noise, light, human presence, litter, bird

Facility	Description (1)	Impacts and Standard Mitigation Requirements (2)		
		Air Emissions (including dust)	*Protection of Water Resources*	*Disturbance*
(MRF)		**Standard Mitigation and Control Measures** 1) Limited potential for release of dust and other fugitive emissions due to nature of operations (enclosed with sealed surface e.g. concrete base) and materials (non-biodegradable).	Residual liquids (e.g. from bottles and cans) can potentially pose a pollution risk to water resources. **Standard Mitigation and Control Measures** 1) Appropriate site drainage and capture and treatment of run-off and wash down waters are effective mitigation measures.	disturbance (where close to an SPA). **Standard Mitigation and Control Measures** 1) Standard control measures could include restricted seasonal working, directional lighting and fencing.
Waste Transfer Station	A facility to which waste is taken for onward transfer for treatment, recycling or landfill elsewhere.	**Impacts** 1) Air emissions relating to waste transfer would be primarily associated with vehicle emissions from haulage, with low potential for dust and fugitive emissions.	**Impacts** 1) Nature of waste collected at depot may have potential risk to water resources, **Standard Mitigation and Control Measures** 1) Enclosed operations reduce exposure of potential pollutants to water, capture and treatment of runoff. Wash-down waters are effective mitigation measures.	**Impacts** 1) Noise, light, human presence, litter, bird disturbance (where close to an SPA). **Standard Mitigation and Control Measures** 1) Standard control measures could include restricted seasonal working, directional lighting and fencing.

Facility	Description (1)	Impacts and Standard Mitigation Requirements (2)		
		Air Emissions (including dust)	*Protection of Water Resources*	*Disturbance*
Household recycling centre	A facility where the public can bring waste for recycling and/or disposal. Includes oversize, awkward, hazardous and WEEE wastes.	**Impacts** 1) Air emissions are mainly associated with emission from vehicles (haulage). Limited potential for release of dust, fugitive emissions and bio-aerosols. **Standard Mitigation and Control Measures** 1) Enclosed operations and a high rate of turnaround (avoid degradation of waste and release of bio-aerosols) are effective control measures.	**Impacts** 1) Limited potential for impact on water resources due to nature of operations and materials. Residual liquids and organic leachate from green waste can potentially pose risk to water resources. **Standard Mitigation and Control Measures** 1) Undertaking operations in enclosed or undercover area, appropriate site drainage and capture and treatment of run-off and wash down waters are effective mitigation measures.	**Impacts** 1) Noise, light, human presence, litter, bird disturbance (where close to an SPA). **Standard Mitigation and Control Measures** 1) Standard control measures could include restricted seasonal working, directional lighting and fencing.

Annex B

Air Dispersion Modelling



Worcestershire County Council

Annex B – Air Dispersion Modelling Report

FINAL REPORT

March 2011

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Annex B – Air Dispersion Modelling Report

Final Report

Reference: 0123097

March 2011

Prepared by: Kate Fradley

For and on behalf of
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Date: 21st March 2011

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CONTENTS

This annex presents the air dispersion modelling methodology and results. The Areas of Search 02, 03, 12, 25, 41, 43, 46, 52, 54, and 57 were modelled initially, and following these results Areas of Search 07 and 08 were modelled. For convenience, the results from all twelve Areas of Search considered have been combined in the results. These Areas of Search have been selected from the total list of 65 Areas of Search, as these are the nearest potential development sites to the European designated sites of interest, and are therefore likely to result in the worst case impacts (see *Section B2.2.2)*.

The direct toxic effects from NO_X, SO_2 and NH_3, and the indirect effects of acid deposition and nutrient nitrogen deposition have been assessed based on the Critical Level and Critical Loads as defined by the UK Air Pollution Information System (APIS). A phased approach has been used to scope out Areas of Search where no likely significant effects can be predicted. There are four European sites (1) located within 15km of the Areas of Search and therefore need to be considered in more detail:

- Fens Pools SAC;
- Lyppard Grange Ponds SAC;
- Bredon Hill SAC; and
- Dixton Wood SAC.

Initially the 10 Areas of Search mentioned above were assessed, assuming an 80 m stack height with a 250 ktpa throughput. In addition, the study also considered Areas of Search 07 and 08 on the same assessment basis. A phased approach was then used to assess Areas of Search further as necessary.

It has been concluded that it is unlikely that air pollution from a thermal treatment facility modelled at 250 ktpa and 80 m stack height at Areas of Search 02, 12, 25, 41, 43, 46, 52, 54, and 57 will have a significant impact on European sites assessed. The exception was for Areas of Search 03, 07 and 08 for impacts on Lyppard Grange Ponds SAC. Here, the process contribution (PC) were shown to be more than 1% of the critical level for of NO_X, for the initial assessment phase (Phase 1) and further investigation was undertaken to assess whether a taller stack or smaller capacity would allow development on these Areas of Search:

- Phase 2 investigated 250ktpa, and a 100m stack;
- Phase 3 investigated 150ktpa, and a 80m stack; and
- Phase 4 investigated 250ktpa, and a 100m stack.

Of the three Areas of Search investigated further, 03 and 07 demonstrated a PC<1% of the Critical Level for NO_x for Phase 2 and Areas of Search 03 and 08 demonstrated a PC <1% of the Critical Level for NO_x for Phases 3 and 4. From

(1) See Chapter 2 of *Waste Core Strategy HRA Final Report* (ERM 2011) for further details relating to these European sites.

these results, given the close proximity of Area of Search 6 from 3, it is predicted that Area of Search 6 would have similar results.

It is concluded that the effect of NO_X emissions from a thermal treatment facility at Area of Search 07 can be described as not significant with a capacity of 250ktpa and a 100m stack, and Area of Search 3, 6 and 8 for can be described as not significant with a capacity of 150ktpa and 80m or 100m stack.

Following on from the modelling, the results for the ten potential development sites studied were extrapolated to ascertain which Areas of Search are likely to be acceptable for development from the perspective of air quality. The results can be summarised as follows:

- Likely to be acceptable at 250ktpa with an 80m stack: Areas of Search 01, 02, 04, 05, and 09-65 inclusive;

- Likely to be acceptable at 250ktpa with a 100m stack: Area of Search 07; and

- Likely to be acceptable at 150ktpa: Areas of Search 03, 06, 08.

B2 AIR QUALITY IMPACT ASSESSMENT

B2.1 INTRODUCTION

This *Technical Annex* presents the details and results of the air dispersion modelling for emissions from a hypothetical waste thermal treatment facility (*ie* an Energy-from-Waste (EfW) plant) at a number of potential locations. This work has been carried out in support of the Habitats Regulations Assessment (HRA) for the Worcestershire County Council's (WCC) Waste Core Strategy (WCS) for determining the impacts upon the surrounding European designated sites for nature conservation. The European sites have been selected in consultation with the WCC's Waste Planning Authority (WPA) and include the following:

- Special Areas of Conservation (SAC);
- Special Protection Areas (SPAs); and
- Ramsar sites.

The determination of likely impacts upon the surrounding European sites is based on comparing the relative magnitude of the predicted Process Contribution (PC) in terms of toxic effects (pollution impacts from air pollutants), acid deposition and nutrient nitrogen deposition against established critical levels and site-relevant critical loads. In addition, sensitivity analysis has also been carried out for the following parameters to determine the influence on the magnitude of the PCs:

- Varying the waste tonnages to be processed by the EfW plant; and
- Varying the stack height.

B2.2 ASSESSMENT METHODOLOGY

B2.2.1 *Dispersion Model*

The dispersion model AERMOD has been used, promulgated by the United States Environmental Protection Agency, and recognised by the Environment Agency (EA) in the United Kingdom (UK). This model is "new generation" in that it applies up-to-date parameterisations of the boundary layer structure based on the Monin-Obukhov length theory and the boundary layer height. Extensive validation studies have been run for AERMOD by the developers, Trinity Consultants, and independent bodies. AERMOD has been chosen over the alternative model ADMS, as it allows faster setup and run times.

B2.2.2 Modelling Scenarios

Modelling Approach

The 65 areas of search which have been identified for the WCS in the Worcestershire area have been reduced to 10 Areas of Search for the purpose of air dispersion modelling. This approach was adopted because it was considered unfeasible to model all combinations of potential Areas of Search and European sites, due to the large number of model runs and excessive amount of time required to process the models and data. It was considered unnecessary to model areas of search outside of a 15km radius of the European sites, as the impacts would be insignificant, based upon the Environment Agency H1 guidance note ([1]). The remaining 37 Areas of Search within the 15km of European sites which require consideration of the effects of air emissions are as follows:

- Areas of Search 25,40 and 41 for Fen Pools SAC;
- Areas of Search 1-16, 36,37,42-49, and 53-56 for Lyppard Grange Ponds SAC;
- Areas of Search 49-57 for Bredon Hill SAC; and
- Areas of Search 51-57 for Dixton Wood SAC.

The number of Areas of Search for modelling was reduced by selecting preferred Areas of Search within each cluster, so as to sample those closest to European sites and those most likely to have the highest impacts, primarily based on consideration of the prevailing wind direction. Implicit in this approach is that if impacts are acceptable at the nearest and most sensitive European sites, impacts at further or less sensitive European sites will also be acceptable. In most cases this assumption is reasonable, but in a few cases this may not be appropriate, as distance between Areas of Search and European site is not the only factor in determining impacts but direction is also critical.

In accordance with the above, the areas of search included in the initial set of model runs were, 02, 03, 12, 25, 41, 43, 46, 52, 54, and 57. In addition further runs were subsequently undertaken for Areas of Search 07 and 08.

As modelling has been conducted for a hypothetical facility without an actual engineering design, certain assumptions have to be made. For example, the exit volumetric flow rate has been pro-rated from an actual similar facility based on the annual waste tonnage. In the evaluation of air quality impacts from an actual plant, stack height is usually optimised based on factors such as building downwash, visibility impacts, engineering considerations and reducing impacts on receptors to an insignificant level. As an initial

(1) [1] Environment Agency (2010) Horizontal Guidance Note H1- annex F

assumption for this high-level screening study, the base stack height has been assumed to be at 80 m.

The Phase 1 model assumed a thermal treatment capacity of 250 ktpa with a stack height of 80 m for all Areas of Search.

The proposed initial waste throughputs and stack heights are the worst-case inputs; therefore, if impacts are acceptable (see *Section B2.4*) using these initial inputs for a modelled pairing of EfW potential development site and European sites, then there is no need to carry out further model runs for lower waste throughputs and higher stack heights for this scenario. Where impacts in Phase 1 are not acceptable, additional modelling has been carried out with the following hierarchy to determine if the development site would be acceptable with an increased stack height or lower waste throughput:

- Phase 2: increasing stack height to 100 m for the initial waste throughput;
- Phase 3 (if Phase 2 does not produce acceptable impacts): Reducing waste throughput to 150 ktpa. Stack heights will be kept constant at 80 m; and
- Phase 4 (if Phase 3 does not produce acceptable impacts): Increasing stack height to 100 m and reduce throughput to 150 ktpa.

The AERMOD modelling has been carried out for European sites that are nearest to each potential development site location. These locations are shown in *Figure 3.1* in the main report. The European sites corresponding to each of the potential Areas of Search that have been modelled using AERMOD are shown in *Table B2.1*.

Table B2.1 European Sites Corresponding to Each Potential EfW Development Site in the first round of modelling

	Fens Pools	**Lyppard Grange Ponds**	**Bredon Hill**	**Dixton Wood**
Area of Search 02		✓		
Area of Search 03		✓		
Area of Search 12		✓		
Area of Search 25	✓			
Area of Search 41	✓			
Area of Search 43		✓		
Area of Search 46		✓		
Area of Search 52			✓	✓
Area of Search 54		✓	✓	✓
Area of Search 57			✓	✓
Area of Search 07		✓		
Area of Search 08		✓		

Routine Emissions

The EfW facility is specified to achieve the applicable limits on releases to air, based upon Annex V of the Waste Incineration Directive (WID)(2000/76/EC) ([1]). Emission limit values, as specified in the WID for daily mean concentrations, are used to calculate the routine emissions rates of pollutants from the EfW facility.

The assumed stack parameters and emissions rates (as calculated from WID) are summarised in *Table B2.2*. The modelling results presented in later sections of this report are based on the set of assumed modelling inputs in *Table B2.2*.

Table B2.2 Stack Parameters and Emissions Rates

Parameters	**Stack location**	
Stack Parameters		
Location (OS grid)	Area of Search 02 – 388446, 257159 Area of Search 03 – 385907, 255568 Area of Search 12 – 382865, 260519 Area of Search 25 - 384374, 277423 Area of Search 41 – 394984, 276284 Area of Search 43 – 389563, 263577 Area of Search 46 – 379376, 247715 Area of Search 52 – 403834, 242454 Area of Search 54 – 395340, 247759 Area of Search 57 – 385241, 240014 Area of Search 07 – 385605, 255212 Area of Search 08 – 385901, 255241	
Stack height (m)	80, 100 (a)	
Effective exit diameter (m)(f)	2.12, 1.64 (e)	
Exit temperature (°C)	140	
Emissions Concentration (c)		
HCl (mg Nm^{-3})	10	
HF (mg Nm^{-3})	1.0	
SO_2 (mg Nm^{-3})	50	
NO_X (mg Nm^{-3})	200	
NH_3 (mg Nm^{-3}) (d)	10	
Throughput	*250 ktpa*	*150 ktpa*
Actual volumetric flow rate ($Am^3 s^{-1}$) (b)	80	48
Normalised volumetric flow rate ($Nm^3 s^{-1}$) (c)	65	39
Emission Rates		
HCl (g s^{-1})	0.650	0.390
HF (g s^{-1})	0.0650	0.0390
SO_2 (g s^{-1})	3.25	1.95
NO_X (g s^{-1})	13.0	7.81
NH_3 (g s^{-1})	0.650	0.390

(a) Assumed heights.
(b) Assumed to have 6% O_2 and 18% moisture.
(c) Normalised to 11% O_2 and dry conditions.
(d) Assumed concentration for NH_3, which is not part of WID limits.
(e) efflux velocity is constant and therefore diameter changes

(1) [1] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2000:332:0091:0111:EN:PDF

(f) the model is based upon a single assumed stack

Non-routine Emissions

A technically complex process, such as an EfW plant, is highly unlikely to operate for a protracted period of time without some non-routine events occurring. These events are typically short term (a few minutes) but have the potential to result in short term elevated emissions. These events can occur for a number of reasons, such as disturbances/failures of the pollution abatement equipment or measurement devices, during which the emissions to air may exceed the prescribed emission limit values.

Under non-routine operation, the WID does not allow incineration of waste for a period of more than four hours uninterrupted where emission limit values are exceeded. In reality, non-routine events are detected by the process controllers, either due to deviations in typical emissions as measured by the continuous emissions monitoring systems (CEMS) installed on the plant or through monitoring of the process itself (*ie* combustion chamber temperature). On this basis, non-routine events can be swiftly identified and rectified. In most cases a non-routine operation will not necessitate closure of a stream.

In addition, the EA exercises a high level of regulatory control over EfW plants in all areas, including that of non-routine operations. Within the Environmental Permit required for any EfW plant to operate, the EA will stipulate a maximum period of time throughout the year where elevated emissions can occur due to non-routine emissions, typically 60 hours throughout an 8760 hour (1 year) operating period. This stipulation ensures that the process operator has the flexibility to respond to inevitable occasional failures and recognises that elevated emissions will typically only occur for a few minutes, as a problem is rectified.

In light of this, the impacts from non-routine emissions, if any, are likely to be of a very short duration. Therefore, no specific consideration of the potential impacts associated with non-routine emissions have been taken into account, and air dispersion modelling has not been carried out for non-routine emissions.

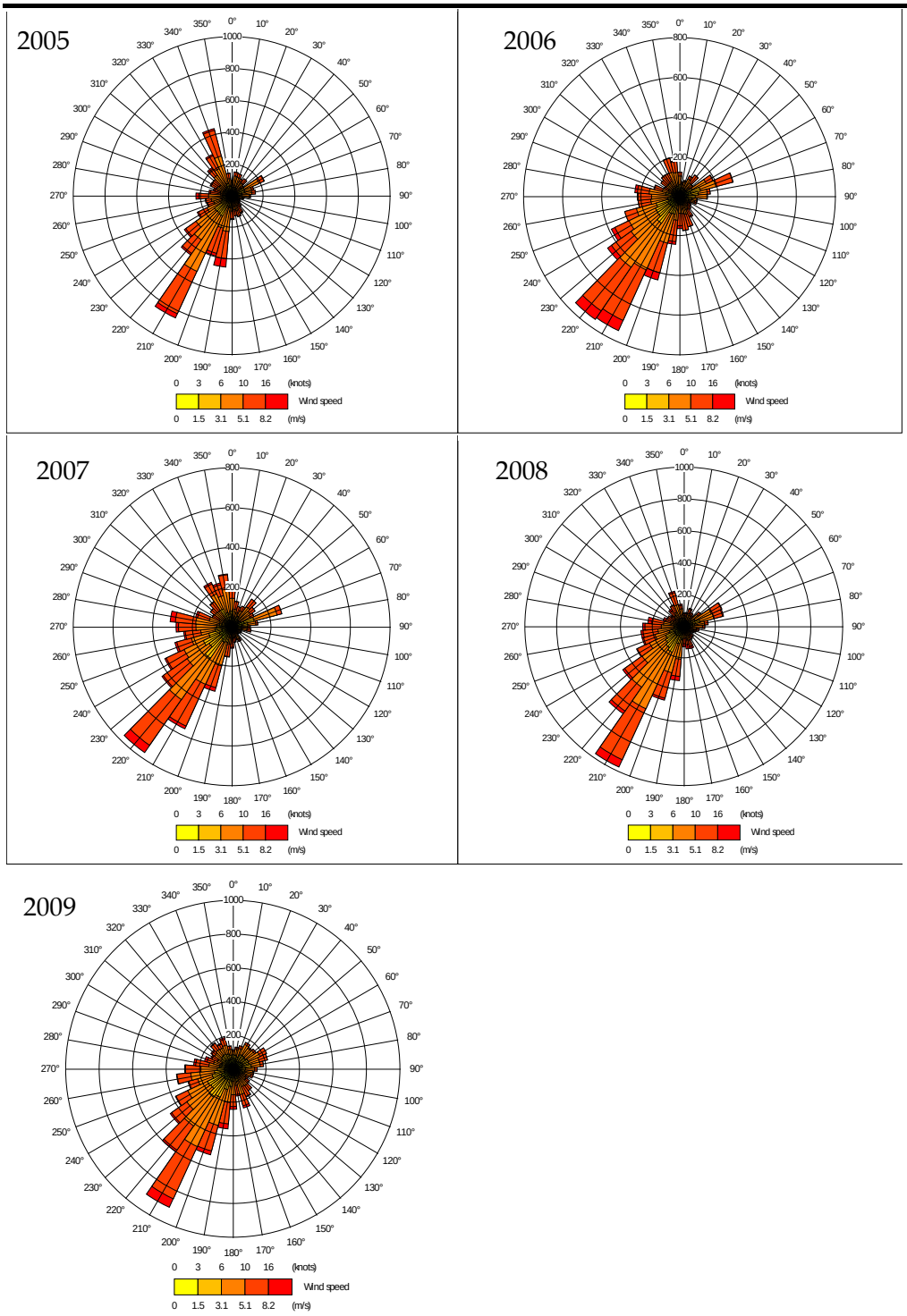
B2.2.3 Meteorological Data

The meteorological data from the Pershore weather observation station have been used. This dataset was selected as it is one of the nearest meteorological observing stations to all the areas of search. The data set utilises the 5 most recent years (2005 – 2009) of wind speed and wind direction observations, with supplementary cloud cover data supplied from the Birmingham Coleshill station prior to December 2008. The hourly cloud cover observations are used to estimate the atmospheric stability, which dictates how AERMOD predicts plume dispersion. As cloud cover is a less commonly made observation there are a limited number of Meteorological Office stations in the UK that are capable of generating a suitable dataset for dispersion modelling.

The location of the Pershore meteorological station is sufficiently representative of the climate at the locations of the areas of search and the European sites, given its proximity, its surrounding land use and its non-coastal location.

The wind roses are shown in *Figure B2.1*. The predominant winds are from the southwest direction, similar to what is experienced in most parts of England.

Figure B2.1 Wind Roses for Pershore (2005 - 2009)



Source: UK Meteorological Office

B2.2.4 Terrain Data

Changes in terrain elevations can have a significant impact on dispersion of emissions, and typically terrain effects are considered where there are sustained gradients of greater than 1:10. However, in this case whilst there are some locations where terrain may be significant, terrain was not included in the model. The key reason for adopting this approach was to allow a level playing field when assessing impacts of Areas of Search that were not

modelled by proxy. It would be appropriate to consider terrain effects in more detailed further assessment for individual Areas of Search.

B2.2.5 Surface Options

The surface options for the dispersion modelling are defined in the preparation of the meteorological data by the albedo, Bowen ratio and roughness length. These parameters are related to the surrounding land use.

The albedo is the fraction of total incident solar radiation reflected by the surface back to space without absorption. The Bowen ratio is a measure of the partitioning of solar energy between evaporating water and heating the air. Surface roughness is related to the height of obstacles to the wind flow.

The predominant surfaces within the area are for urban land use and grasslands.

B2.3 ASSESSMENT CRITERIA – CRITICAL LEVELS AND CRITICAL LOADS

The assessment criteria are divided into critical levels and critical loads, which are obtained from the Air Pollution Information System (APIS) (1) website. The APIS database is an online support tool which provides a comprehensive source of information on air pollution and its effects on habitats and species, including critical loads and levels, as well as baseline deposition and concentration data.

APIS has been developed (and funded) as a partnership consisting of the Centre for Ecology and Hydrology (CEH), the Environment Agency, the Scottish Environment Protection Agency, the Countryside Council for Wales, Environment and Heritage Service, Natural England, the Joint Nature Conservation Committee, Scotland and Northern Ireland Forum for Environmental Research and Scottish Natural Heritage(2).

The information in APIS is used to inform assessments required under the Habitats Regulations or other legislation. However, it is not the purpose of APIS to provide guidance or policies for undertaking such assessments, which are covered separately by the conservation and regulatory agencies.

Critical levels are the ambient threshold levels at which direct toxic effects of pollutant concentrations (NO_X, SO_2 and NH_3) can be shown on a habitat or species, according to current knowledge. Critical loads are the threshold level for the deposition rate of a pollutant above which harmful indirect effects can be shown on a habitat or species, according to present knowledge. Critical loads are set for deposition of acid and nutrient nitrogen.

The APIS database has been used to obtain the critical levels which are not habitat-dependent, and the site-relevant acid and nutrient nitrogen critical

(1) www.apis.ac.uk
(2) http://www.apis.ac.uk/introduction.html

loads which support the conservation objectives of the respective European sites. Site-relevant critical loads are based on the critical load function (CLF), which modifies the empirical critical load (based mainly on soil type) by allowing for non-marine base cation deposition and base cation uptake by vegetation. Combined and separate critical loads are provided for nitrogen (N) and sulphur (S). In the case of nutrient nitrogen, the critical loads are given as a range, i*e* 10-20 kg N/ha/yr, with an exceedence occurring when levels pass the lower limit.

With regard to acid deposition, there is no defined procedure for use of the critical load function in the context of guidance relating to the assessment of the significance of process contributions for individual habitats. In particular, this relates to the necessity of identifying the percentage increase of the process contribution relative to the threshold of 1% for the test of insignificance. To do this for acidity, a value is required for the critical load in terms of total acidity. Both sulphur and nitrogen contribute to acidity, but nitrogen also contributes to nutrient nitrification.

Based upon guidance provided by Natural England, and with consideration of the mechanism of acidification, a single total acidification Critical Load has been derived by summing the CLmaxS and CLminN. This has been used in the determination of significance for those European sites where separate sulphur and nitrogen Critical Loads are defined.

The assessment criteria for the European sites are presented in *Table B2.3* and *Table B2.4* for critical levels and critical loads, respectively.

Table B2.3 European Sites and Critical Levels [(a)]

European Sites	**Interest Feature**	**Critical Levels (µg m^{-3}) (Applicable to All European Sites)**
Fen Pools (SAC)	Great crested newts	NO_X : 30 (annual mean) SO_2 : 20 (annual mean) NH_3 : 3 (annual mean) (excluding woodlands) 1 (annual mean) (for woodlands, as the assumption is made that lichen populations are present)
Lyppard Grange Ponds (SAC)	Great crested newts	
Bredon Hill (SAC)	Violet click beetles	
Dixton Wood (SAC)	Violet click beetles	

(a) Source: APIS (www.apis.ac.uk)

Table B2.4 European Sites and Site-Relevant Critical Loads for Acid and Nutrient Nitrogen Deposition Rates [(a)]

European Sites	Interest Feature	Acid Deposition (Sulphur) Critical Loads (keq ha^{-1} yr^{-1}) CLmaxS	Acid Deposition (Nitrogen) Critical Loads (keq ha^{-1} yr^{-1}) CLminN	CLmaxN	Nutrient Nitrogen Deposition Critical Loads (kg N ha^{-1} yr^{-1})
Fen Pools (SAC)	Great crested newts	1.61	0.44	2.05	10-20
Lyppard Grange Ponds (SAC)	Great crested newts	3.88	0.85	4.74	20-30
Bredon Hill (SAC)	Violet click beetle	2.41	0.14	2.56	10-15
Dixton Wood (SAC)	Violet click beetle	2.44	0.14	2.58	10-15

(a) Source: APIS (www.apis.ac.uk)

B2.4 ASSESSING ACIDIFICATION IMPACTS

B2.4.1 Acidification Processes

Soil is acidified slowly as a result of natural processes. This has been going on since the end of the last ice age, but has been greatly accelerated by forestry and acid deposition. The most serious consequences can be summarised in the following three points.

Plant nutrients are leached out. Nutrients important to plants, particularly base cations (mainly magnesium, potassium and calcium), are leached out by the additional acid. This, combined with lower pH levels, can lead to the displacement of sensitive species of plants. Growth in woodlands can be affected by the reduction in the availability of nutrients, although it does seem that coniferous trees in symbiosis with mycorrhizal fungi and bacteria can speed up weathering to some extent themselves if needed.

Toxic metals are freed. When soil is acidified it increases the concentration of free aluminium ions in the water held within the soil, and these ions are potentially toxic to the root systems of plants. The mobility of many heavy metals also increases when soil becomes more acidic. Perhaps the most serious consequence of the higher metal concentrations is their negative effect on many of the bacterial decomposers that live in the soil.

Phosphates become bound. Increasing levels of dissolved aluminium also affect plants indirectly. The "released" aluminium ions are able to bind the vital nutrient phosphorus (in the form of aluminium phosphate) and make it less accessible to plants. The shortage of phosphate is aggravated by the fact that decomposition in the soil slows down under acidic conditions. In addition to phosphate, certain important micro nutrients – such as

molybdenum, boron and selenium – also become less accessible to plants when soil is acidified.

In describing and quantifying acidification, therefore, the important factors are related to soil chemistry and, in particular, the availability of the base cations and the concentrations of aluminium ions in the soil. At a given site, the susceptibility to additional acid deposition will depend strongly on the soil type; a nutrient rich alkaline soil will have the buffering capacity to absorb additional acid and avoid the effects described above. A naturally acidic and thin soil, however, will not have this capacity and the base cations are readily stripped out of the soil.

B2.4.2 Calculating Critical Loads for Acidification

Once an understanding of the processes that result in damage to trees and plants had been gained by researchers in the 1980s and 1990s, it became possible to define the problem in terms of a threshold deposition rate, above which increasing levels of harm occur and below which an ecosystem is essentially unaffected. This threshold was called a critical load. For acidification processes, it was natural to express the critical load in terms of total acidity, in units of hydrogen ions deposited per hectare per year (keq ha^{-1} $year^{-1}$).

The critical load for a location could be calculated with knowledge of the geology and soil properties, since the critical load is largely a function of the balance between the base cations provided by the mineral weathering of the underlying rocks and the removal of these base cations through leaching.

B2.5 IMPACT SIGNIFICANCE CRITERIA

The impact significance criteria used in this assessment are for long-term impacts and significance for short-term impacts. Long-term impacts (*ie* annual average) are evaluated for NO_X, SO_2, NH_3, acid deposition and nutrient nitrogen deposition. These have been developed jointly by the Environment Agency and Natural England and are described below (1):

- Where the predicted PC within the emission footprint in all parts of the European site is ≤ 1% of the relevant long-term benchmark (environmental assessment level, critical level or critical load), the emission is '*not likely to have a significant impact alone or in combination irrespective of the background levels*'.

- Where the predicted PC within the emission footprint in any part of the European site is > 1% of the relevant long-term benchmark, further consideration is given to the PC in combination with the background concentrations.

(1) (Appendix 7), Stage 1 and 2 Assessment of new PIR Permissions under the Habitats Regulations, Environment Agency, Version 05/06/07.

- The predicted environmental concentration (PEC) is calculated by adding the predicted PC to the appropriate background concentration (obtained from APIS) (1).

- Where the PEC within the emission footprint in all parts of the European site is ≤ 70% of the relevant long-term benchmark, the emission is '*not likely to have a significant impact*'.

- Where the PEC within the emission footprint in any part of the European site is > 70% of the relevant long-term benchmark, the emission '*cannot be concluded not likely to have a significant impact*'.

Results of the impact assessment are discussed in relation to these significance thresholds.

B2.6 BACKGROUND CONDITIONS

Background conditions (ambient concentrations, nutrient nitrogen deposition and acid deposition) for the European sites are presented in *Table B2.5* and *Table B2.6*. The background ambient concentrations for air pollutants (NO_X, SO_2 and NH_3) have been obtained from the APIS website using the coordinates of the European site's respective central locations for critical levels. For critical loads, the background acid and nutrient nitrogen deposition rates have been obtained based on a site-relevant search on APIS.

Table B2.5 Background Conditions vs. Critical Levels (a)

European Sites	Interest Features	NO_X Baseline Conditions (µg m^{-3})	SO_2 Baseline Conditions (µg m^{-3})	NH_3 Baseline Conditions (µg m^{-3})
Fen Pools (SAC)	Great crested newts	**40.5**	1.1	1.3
Lyppard Grange Ponds (SAC)	Great crested newts	27.1	1.0	2.1
Bredon Hill (SAC)	Violet click beetles	13.2	1.0	**1.7**
Dixton Wood (SAC)	Violet click beetles	14.8	1.0	**2.1**
	Critical Levels (annual means)	30	20	3 (Fens Pools and Lyppard Grange Pools) 1 (Bredon Hill and Dixton Wood)

(a) Source: APIS, based on the central coordinates of the European site using location search. Annual mean concentrations only. Exceedances of the critical loads are highlighted in bold.

(1) The PEC includes the additional contribution which could be made from authorised processes which are yet to be constructed. For this initial screening stage, this has not been included in the PEC due to lack of timely information. This will be refined at a later stage if such information becomes available.

Table B2.6 Background Conditions vs. Critical Loads [(a)]

European Sites	Interest Features	Acid Deposition (keq ha^{-1} yr^{-1})		Nutrient Nitrogen Deposition (kg N ha^{-1} yr^{-1})	
		Baseline Conditions	Critical Loads	Baseline Conditions	Critical Loads
Fen Pools (SAC)	Great crested newts	1.87	2.05	13.6	10-20
Lyppard Grange Ponds (SAC)	Great crested newts	1.47	4.73	15	20-30
Bredon Hill (SAC)	Violet click beetles	1.79	2.55	**20.7**	10-15
Dixton Wood (SAC)	Violet click beetles	1.93	2.58	**22.7**	10-15

(a) Source: APIS, using site-relevant search. Annual deposition rates only. Exceedances of the critical loads are bolded.

It can be seen from the tables above that, for some European sites, the baseline conditions on their own have already exceeded the critical levels and critical loads. Where such exceedances exist a potential EfW development site cannot demonstrate an insignificant impact on its own unless its contribution (PC) ≤1% of the critical level or critical load.

In such cases where the PEC is already >100% of the critical load, the PC will need to be reduced to < 1% of critical load before any thermal treatment option at that development site can be considered as being non-contentious. More stringent mitigation measures (which may not necessarily be technologically feasible in all cases) may have to be applied, in order to achieve this. In certain cases, even with mitigation measures, the impacts may not be sufficiently reduced to enable a thermal treatment facility to operate at some development sites.

B2.7 CALCULATION OF ACID DEPOSITION RATES

Contributions to acid deposition have been derived from the maximum modelled ground level concentration (GLC) obtained from modelling. Acid deposition results from the deposition of a variety of pollutants including NO_x, SO_2, HCl and NH_3. However, following guidance from Natural England, only NO_x and SO_2 are considered to be critical. In addition, acid deposition can occur through dry and wet mechanisms. However, according to EA guidance [(1)], for short-range effects, NO_2 and SO_2 wet deposition is less significant when compared with dry deposition. Therefore, for NO_2 and SO_2, only dry deposition has been assessed.

Dry deposition rates were calculated using methods recommended by the Environment Agency (EA) [(2)], as follows:

(1) Spanton, A.M., Hall, D.J. and Powlesland, C.B. Calculation of Near-field Critical Load Exceedance from Generating Stations, Environment Agency, May 2008.
(2) AQTAG06 – Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air, Environment Agency, produced 06/02/04, Version 8.

- Step 1: Calculate dry deposition flux.

Dry deposition flux ($\mu g\ m^{-2}\ s^{-1}$) = GLC ($\mu g\ m^{-3}$) × Deposition velocity ($m\ s^{-1}$)

The deposition velocities set out in *Table B2.2*, as recommended by the EA, have been used.

Table B2.2 Dry Deposition Velocities ($m\ s^{-1}$)

Pollutants	Grassland	Forest
SO_2	0.012	0.024
NO_2	0.0015	0.003

- Step 2: Convert units from $\mu g\ m^{-2}\ s^{-1}$ to units of $kg\ ha^{-1}\ yr^{-1}$ by multiplying the dry deposition flux by standard conversion factors in *Table B2.3*.

Table B2.3 Conversion Factors from $\mu g\ m^{-2}\ s^{-1}$ to $kg\ ha^{-1}\ yr^{-1}$

Pollutants	From $\mu g\ m^{-2}\ s^{-1}$ to $kg\ ha^{-1}\ yr^{-1}$
SO_2	157.7
NO_2	96

- Step 3: Convert to unit of equivalents ($keq\ ha^{-1}\ yr^{-1}$) which is a measure of how acidifying the chemical species can be, by multiplying the dry deposition flux in units of $kg\ ha^{-1}\ yr^{-1}$ by the standard conversion factors in *Table B2.4*.

Table B2.4 Conversion Factors from $kg\ ha^{-1}\ yr^{-1}$ to $keq\ ha^{-1}\ yr^{-1}$

Pollutants	From $kg\ ha^{-1}\ yr^{-1}$ to $keq\ ha^{-1}\ yr^{-1}$
S	0.0625
N	0.071428

- Step 4: Add predicted dry N and S deposition ($keq\ ha^{-1}\ yr^{-1}$) to determine total acid deposition.

B2.8 CALCULATION OF NUTRIENT NITROGEN DEPOSITION RATES

Contributions to nutrient nitrogen deposition have been derived from the maximum process contributed ground level concentration obtained from modelling for NO_2 and NH_3 only. Dry deposition rates of nitrogen were calculated by first calculating the dry deposition flux ($\mu g\ m^{-2}\ s^{-1}$) and converting that to $kg\ ha^{-1}\ yr^{-1}$ of nitrogen. Wet deposition of nitrogen in the near-field has not been considered as the contribution of dry deposition dominates.

Dry deposition rates were calculated using methods recommended by the Environment Agency (EA) [(1)], as follows:

- Step 1: Calculate dry deposition flux.

Dry deposition flux ($\mu g\ m^{-2}\ s^{-1}$) = GLC ($\mu g\ m^{-3}$) × Deposition velocity ($m\ s^{-1}$)

The dry deposition velocities for NO_2 and NH_3 are provided in *Table B2.2*.

- Step 2: Convert units from $\mu g\ m^{-2}\ s^{-1}$ to units of $kg\ ha^{-1}\ yr^{-1}$ by multiplying the dry deposition flux by standard conversion factors for NO_2 and NH_3 in *Table B2.3*.

(1) AQTAG06 – Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air, Environment Agency, produced 06/02/04, Version 8.

B3 MODELLING RESULTS

B3.1 OVERVIEW

This section presents the results of the assessment of potential impacts for the ten Areas of Search considered. The results are set out for the Phase 1 assessment for all Areas of Search, and further for the Phase 2, Phase 3 and Phase 4 for the Areas of Search as appropriate.

B3.2 PHASE 1 MODELLING RESULTS

The results from the Phase 1 modelling, as described in *Section B2.5* are presented here in *Table B3.1* to *Table B3.8*. These present a summary of the long-term modelling results for direct toxic effects (SO_2, NO_X and NH_3) and a summary of the long-term modelling results for acid deposition and nutrient nitrogen deposition, for each habitat. The Process Contribution (PC) is the highest value taken from the five years of meteorological data used (2005-2009). The tables include colour coding to highlight Areas of Search where impacts are not acceptable.

Table B3.1 Phase 1 - Contribution to direct toxic effects at Fens Pools against Critical Levels

	SO_2 ($\mu g\ m^{-3}$)						NO_X ($\mu g\ m^{-3}$)						NH_3 ($\mu g\ m^{-3}$)					
	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL
AoS 02	1.1	20	0.00394	0.0197%	1.10	5.52%	40.5	30	0.0157	0.05%	40.52	135%	1.3	3.0	0.000787	0.0262%	1.30	43.4%
AoS 03	1.1	20	0.00419	0.0210%	1.10	5.52%	40.5	30	0.0168	0.06%	40.52	135%	1.3	3.0	0.000839	0.0279%	1.30	43.4%
AoS 12	1.1	20	0.00667	0.0333%	1.11	5.53%	40.5	30	0.0267	0.09%	40.53	135%	1.3	3.0	0.00133	0.0445%	1.30	43.4%
AoS 25	1.1	20	0.0289	0.1450%	1.13	5.64%	40.5	30	0.116	0.39%	40.62	135%	1.3	3.0	0.00578	0.193%	1.31	43.5%
AoS 41	1.1	20	0.00930	0.0465%	1.11	5.55%	40.5	30	0.0372	0.12%	40.54	135%	1.3	3.0	0.00186	0.0620%	1.30	43.4%
AoS 43	1.1	20	0.00511	0.0255%	1.11	5.53%	40.5	30	0.0204	0.07%	40.52	135%	1.3	3.0	0.00102	0.0340%	1.30	43.4%
AoS 46	1.1	20	0.00507	0.0254%	1.11	5.53%	40.5	30	0.0203	0.07%	40.52	135%	1.3	3.0	0.00101	0.0338%	1.30	43.4%
AoS 52	1.1	20	0.00185	0.00927%	1.10	5.51%	40.5	30	0.00742	0.02%	40.51	135%	1.3	3.0	0.000371	0.0124%	1.30	43.3%
AoS 54	1.1	20	0.00218	0.0109%	1.10	5.51%	40.5	30	0.00876	0.03%	40.51	135%	1.3	3.0	0.000436	0.0145%	1.30	43.3%
AoS 57	1.1	20	0.00244	0.0122%	1.10	5.51%	40.5	30	0.00976	0.03%	40.51	135%	1.3	3.0	0.000488	0.0163%	1.30	43.3%
AoS 07	1.1	20	0.00416	0.0208%	1.10	5.52%	40.5	30	0.0167	0.055%	40.5	135%	1.3	3.0	0.000833	0.0278%	1.30	43.4%
AoS 08	1.1	20	0.00413	0.0207%	1.10	5.52%	40.5	30	0.0165	0.055%	40.5	135%	1.3	3.0	0.000826	0.0275%	1.30	43.4%

Table B3.2 Phase 1 - Contribution to Deposition effects at Fens Pools against Critical Loads

	Acid Deposition (keq $ha^{-1}\ yr^{-1}$)					Nutrient Nitrogen Deposition (kg N $ha^{-1}\ yr^{-1}$)					
	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL
AoS 02	1.87	2.05	0.000627	0.0306%	1.87	91.3%	18.1	10	0.00635	0.0635%	18.1	181%
AoS 03	1.87	2.05	0.000669	0.0326%	1.87	91.3%	18.1	10	0.00677	0.0677%	18.1	181%
AoS 12	1.87	2.05	0.00106	0.0518%	1.87	91.3%	18.1	10	0.0108	0.108%	18.1	181%
AoS 25	1.87	2.05	0.00461	0.225%	1.88	91.4%	18.1	10	0.0467	0.467%	18.2	181%
AoS 41	1.87	2.05	0.00148	0.0723%	1.87	91.3%	18.1	10	0.0152	0.150%	18.1	181%
AoS 43	1.87	2.05	0.000814	0.0397%	1.87	91.3%	18.1	10	0.00825	0.0825%	18.1	181%
AoS 46	1.87	2.05	0.000809	0.0394%	1.87	91.3%	18.1	10	0.00819	0.0819%	18.1	181%
AoS 52	1.87	2.05	0.000296	0.0144%	1.87	91.2%	18.1	10	0.00299	0.0299%	18.1	181%
AoS 54	1.87	2.05	0.000347	0.0169%	1.87	91.2%	18.1	10	0.00352	0.0352%	18.1	181%
AoS 57	1.87	2.05	0.000389	0.0189%	1.87	91.2%	18.1	10	0.00394	0.0394%	18.1	181%
AoS 07	1.87	2.05	0.00066	0.0324%	1.87	91.3%	18.1	10	0.00672	0.0672%	18.1	181%
AoS 08	1.87	2.05	0.000658	0.0321%	1.87	91.3%	18.1	10	0.00667	0.0667%	18.1	181%

Table B3.3 Phase 1 - Contribution to direct toxic effects at Lyppard Grange Ponds against Critical Levels

	SO_2 ($\mu g\ m^{-3}$)						NO_X ($\mu g\ m^{-3}$)						NH_3 ($\mu g\ m^{-3}$)					
	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL
AoS 02	1.0	20	0.0677	0.338%	1.07	5.34%	27.1	30	0.271	0.902%	27.4	91.2%	2.1	3.0	0.0135	0.451%	2.11	70.5%
AoS 03	1.0	20	0.106	0.528%	1.11	5.53%	**27.1**	**30**	**0.422**	**1.41%**	**27.5**	**91.7%**	2.1	3.0	0.0211	0.704%	2.12	70.7%
AoS 12	1.0	20	0.0170	0.0852%	1.02	5.09%	27.1	30	0.0682	0.227%	27.2	90.6%	2.1	3.0	0.00341	0.114%	2.10	70.1%
AoS 25	1.0	20	0.00579	0.0289%	1.01	5.03%	27.1	30	0.0232	0.0772%	27.1	90.4%	2.1	3.0	0.00116	0.0386%	2.10	70.0%
AoS 41	1.0	20	0.00452	0.0226%	1.00	5.02%	27.1	30	0.0181	0.0603%	27.1	90.4%	2.1	3.0	0.000904	0.0301%	2.10	70.0%
AoS 43	1.0	20	0.0134	0.0672%	1.01	5.07%	27.1	30	0.0537	0.179%	27.2	90.5%	2.1	3.0	0.00269	0.0895%	2.10	70.1%
AoS 46	1.0	20	0.0259	0.129%	1.03	5.13%	27.1	30	0.103	0.345%	27.2	90.7%	2.1	3.0	0.00517	0.172%	2.11	70.2%
AoS 52	1.0	20	0.00354	0.0177%	1.00	5.02%	27.1	30	0.0142	0.0473%	27.1	90.4%	2.1	3.0	0.000709	0.0236%	2.10	70.0%
AoS 54	1.0	20	0.00891	0.0446%	1.01	5.04%	27.1	30	0.0356	0.119%	27.1	90.5%	2.1	3.0	0.00178	0.0594%	2.10	70.1%
AoS 57	1.0	20	0.0107	0.0533%	1.01	5.05%	27.1	30	0.0427	0.142%	27.1	90.5%	2.1	3.0	0.00213	0.0711%	2.10	70.1%
AoS 07	1.0	20	0.0875	0.438%	1.09	5.44%	**27.1**	**30**	**0.350**	**1.17%**	**27.5**	**91.5%**	2.1	3.0	0.0175	0.583%	2.12	70.6%
AoS 08	1.0	20	0.100	0.500%	1.10	5.50%	**27.1**	**30**	**0.400**	**1.33%**	**27.5**	**91.7%**	2.1	3.0	0.0200	0.667%	2.12	70.7%

Table B3.4 Phase 1 - Contribution to Deposition effects at Lyppard Grange Ponds against Critical Loads

	Acid Deposition (keq $ha^{-1}\ yr^{-1}$)						**Nutrient Nitrogen Deposition (kg N $ha^{-1}\ yr^{-1}$)**					
	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL
AoS 02	1.47	4.73	0.0108	0.228%	1.48	31.3%	19.9	20	0.109	0.546%	20.0	100%
AoS 03	1.47	4.73	0.0168	0.356%	1.49	31.4%	19.9	20	0.171	0.853%	20.1	100%
AoS 12	1.47	4.73	0.00272	0.0574%	1.47	31.1%	19.9	20	0.0275	0.138%	19.9	99.6%
AoS 25	1.47	4.73	0.000923	0.0195%	1.47	31.1%	19.9	20	0.00935	0.0467%	19.9	99.6%
AoS 41	1.47	4.73	0.000721	0.0152%	1.47	31.1%	19.9	20	0.00730	0.0365%	19.9	99.5%
AoS 43	1.47	4.73	0.00214	0.0453%	1.47	31.1%	19.9	20	0.0217	0.108%	19.9	99.6%
AoS 46	1.47	4.73	0.00412	0.0871%	1.47	31.2%	19.9	20	0.0418	0.209%	19.9	99.7%
AoS 52	1.47	4.73	0.000565	0.0119%	1.47	31.1%	19.9	20	0.00572	0.0286%	19.9	99.5%
AoS 54	1.47	4.73	0.00142	0.0300%	1.47	31.1%	19.9	20	0.0144	0.0720%	19.9	99.6%
AoS 57	1.47	4.73	0.00170	0.0359%	1.47	31.1%	19.9	20	0.0172	0.0861%	19.9	99.6%
AoS 07	1.47	4.73	0.0140	0.295%	1.48	31.4%	19.9	20	0.141	0.707%	20.0	100%
AoS 08	1.47	4.73	0.0160	0.337%	1.49	31.4%	19.9	20	0.162	0.808%	20.1	100%

Table B3.5 Phase 1 - Contribution to direct toxic effects at Bredon Hill against Critical Levels

	SO_2 ($\mu g\ m^{-3}$)						NO_X ($\mu g\ m^{-3}$)						NH_3 ($\mu g\ m^{-3}$)					
	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL
AoS 02	1.0	20	0.00836	0.0418%	1.01	5.04%	13.2	30	0.0334	0.111%	13.2	44.1%	1.70	1.0	0.00167	0.167%	1.70	170%
AoS 03	1.0	20	0.00833	0.0416%	1.01	5.04%	13.2	30	0.0333	0.111%	13.2	44.1%	1.70	1.0	0.00167	0.167%	1.70	170%
AoS 12	1.0	20	0.00572	0.0286%	1.01	5.03%	13.2	30	0.0229	0.0763%	13.2	44.1%	1.70	1.0	0.00114	0.114%	1.70	170%
AoS 25	1.0	20	0.00322	0.0161%	1.00	5.02%	13.2	30	0.0129	0.0429%	13.2	44.0%	1.70	1.0	0.000644	0.0644%	1.70	170%
AoS 41	1.0	20	0.00332	0.0166%	1.00	5.02%	13.2	30	0.0133	0.0442%	13.2	44.0%	1.70	1.0	0.000663	0.0663%	1.70	170%
AoS 43	1.0	20	0.00559	0.0280%	1.01	5.03%	13.2	30	0.0224	0.0746%	13.2	44.1%	1.70	1.0	0.00112	0.112%	1.70	170%
AoS 46	1.0	20	0.00556	0.0278%	1.01	5.03%	13.2	30	0.0222	0.0742%	13.2	44.1%	1.70	1.0	0.00111	0.111%	1.70	170%
AoS 52	1.0	20	0.0257	0.128%	1.03	5.13%	13.2	30	0.103	0.342%	13.3	44.3%	1.70	1.0	0.00513	0.513%	1.71	171%
AoS 54	1.0	20	0.0261	0.130%	1.03	5.13%	13.2	30	0.104	0.347%	13.3	44.4%	1.70	1.0	0.00521	0.521%	1.71	171%
AoS 57	1.0	20	0.0217	0.108%	1.02	5.11%	13.2	30	0.0866	0.290%	13.3	44.3%	1.70	1.0	0.00433	0.433%	1.70	170%
AoS 07	1.0	20	0.00833	0.0416%	1.01	5.04%	13.2	30	0.0333	0.111%	13.2	44.1%	1.70	1.0	0.00167	0.167%	1.70	170%
AoS 08	1.0	20	0.00846	0.0423%	1.01	5.04%	13.2	30	0.0338	0.113%	13.2	44.1%	1.70	1.0	0.00169	0.169%	1.70	170%

Table B3.6 Phase 1 - Contribution to Deposition effects at Bredon Hill against Critical Loads

	Acid Deposition ($keq\ ha^{-1}\ yr^{-1}$)						Nutrient Nitrogen Deposition ($kg\ N\ ha^{-1}\ yr^{-1}$)					
	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL
AoS 02	1.79	2.55	0.00266	0.105%	1.79	70.3%	32.30	10	0.0227	0.227%	32.3	323%
AoS 03	1.79	2.55	0.00265	0.104%	1.79	70.3%	32.30	10	0.0226	0.226%	32.3	323%
AoS 12	1.79	2.55	0.00183	0.0716%	1.79	70.3%	32.30	10	0.0155	0.155%	32.3	323%
AoS 25	1.79	2.55	0.00103	0.0403%	1.79	70.2%	32.30	10	0.00873	0.0873%	32.3	323%
AoS 41	1.79	2.55	0.00106	0.0415%	1.79	70.2%	32.30	10	0.00899	0.0899%	32.3	323%
AoS 43	1.79	2.55	0.00178	0.0699%	1.79	70.3%	32.30	10	0.0152	0.152%	32.3	323%
AoS 46	1.79	2.55	0.00177	0.0695%	1.79	70.3%	32.30	10	0.0151	0.151%	32.3	323%
AoS 52	1.79	2.55	0.00818	0.321%	1.80	70.5%	32.30	10	0.0695	0.695%	32.4	324%
AoS 54	1.79	2.55	0.00831	0.326%	1.80	70.5%	32.30	10	0.0670	0.670%	32.4	324%
AoS 57	1.79	2.55	0.00691	0.271%	1.80	70.5%	32.30	10	0.0587	0.587%	32.4	324%
AoS 07	1.79	2.55	0.00265	0.104%	1.79	70.3%	32.30	10	0.0226	0.226%	32.3	323%
AoS 08	1.79	2.55	0.00270	0.106%	1.79	70.3%	32.30	10	0.0229	0.229%	32.3	323%

Table B3.7 Phase 1 - Contribution to direct toxic effects at Dixton Wood against Critical Levels

	SO_2 ($\mu g\ m^{-3}$)						NO_X ($\mu g\ m^{-3}$)						NH_3 ($\mu g\ m^{-3}$)					
	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL
AoS 02	1.0	20	0.00693	0.0346%	1.01	5.03%	14.8	30	0.0277	0.0924%	14.8	49.4%	2.1	1.0	0.00139	0.139%	2.10	210%
AoS 03	1.0	20	0.00572	0.0286%	1.01	5.03%	14.8	30	0.0229	0.0763%	14.8	49.4%	2.1	1.0	0.00114	0.114%	2.10	210%
AoS 12	1.0	20	0.00436	0.0218%	1.00	5.02%	14.8	30	0.0174	0.0581%	14.8	49.4%	2.1	1.0	0.000872	0.0872%	2.10	210%
AoS 25	1.0	20	0.00319	0.0159%	1.00	5.02%	14.8	30	0.0127	0.0425%	14.8	49.4%	2.1	1.0	0.000637	0.0637%	2.10	210%
AoS 41	1.0	20	0.00335	0.0168%	1.00	5.02%	14.8	30	0.0134	0.0447%	14.8	49.4%	2.1	1.0	0.000670	0.0770%	2.10	210%
AoS 43	1.0	20	0.00550	0.0275%	1.01	5.03%	14.8	30	0.0220	0.0733%	14.8	49.4%	2.1	1.0	0.00110	0.110%	2.10	210%
AoS 46	1.0	20	0.00488	0.0244%	1.00	5.02%	14.8	30	0.0195	0.0650%	14.8	49.4%	2.1	1.0	0.000976	0.0976%	2.10	210%
AoS 52	1.0	20	0.0255	0.127%	1.03	5.13%	14.8	30	0.102	0.340%	14.9	49.7%	2.1	1.0	0.00510	0.510%	2.11	211%
AoS 54	1.0	20	0.0234	0.118%	1.02	5.12%	14.8	30	0.0942	0.314%	14.9	49.7%	2.1	1.0	0.00471	0.471%	2.10	210%
AoS 57	1.0	20	0.0133	0.0663%	1.01	5.07%	14.8	30	0.0531	0.177%	14.9	49.5%	2.1	1.0	0.00265	0.265%	2.10	210%
AoS 07	1.0	20	0.00494	0.0247%	1.00	5.02%	14.8	30.0	0.0198	0.0659%	14.8	49.4%	2.1	1.0	0.00099	0.0989%	2.10	210%
AoS 08	1.0	20	0.00498	0.0249%	1.00	5.02%	14.8	30.0	0.0199	0.0663%	14.8	49.4%	2.1	1.0	0.00100	0.0995%	2.10	210%

Table B3.8 Phase 1 - Contribution to Deposition effects at Dixton Wood against Critical Loads

	Acid Deposition ($keq\ ha^{-1}\ yr^{-1}$)						Nutrient Nitrogen Deposition ($kg\ N\ ha^{-1}\ yr^{-1}$)					
	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL
AoS 02	1.93	2.58	0.00221	0.0856%	1.93	74.9%	36.4	10	0.0188	0.188%	36.4	364%
AoS 03	1.93	2.58	0.00183	0.0707%	1.93	74.9%	36.4	10	0.0155	0.155%	36.4	364%
AoS 12	1.93	2.58	0.00140	0.0539%	1.93	74.9%	36.4	10	0.0118	0.118%	36.4	364%
AoS 25	1.93	2.58	0.00102	0.0394%	1.93	74.9%	36.4	10	0.00864	0.0864%	36.4	364%
AoS 41	1.93	2.58	0.00107	0.0414%	1.93	74.9%	36.4	10	0.00908	0.0908%	36.4	364%
AoS 43	1.93	2.58	0.00175	0.0679%	1.93	74.9%	36.4	10	0.0149	0.149%	36.4	364%
AoS 46	1.93	2.58	0.00156	0.0603%	1.93	74.9%	36.4	10	0.0132	0.132%	36.4	364%
AoS 52	1.93	2.58	0.00813	0.315%	1.94	75.1%	36.4	10	0.0691	0.691%	36.5	365%
AoS 54	1.93	2.58	0.00751	0.291%	1.94	75.1%	36.4	10	0.0638	0.638%	36.5	365%
AoS 57	1.93	2.58	0.00423	0.164%	1.93	75.0%	36.4	10	0.0360	0.360%	36.4	364%
AoS 07	1.93	2.58	0.00158	0.0611%	1.93	74.9%	36.4	10	0.0134	0.134%	36.4	364%
AoS 08	1.93	2.58	0.00159	0.0615%	1.93	74.9%	36.4	10	0.0135	0.135%	36.4	364%

B3.3 FURTHER MODELLING RESULTS

The predicted impacts for Areas of Search 03, 07 and 08 at Lyppard Grange Ponds are shown to be significant for NO_x concentrations, as highlighted in *Table B3.3*. As described in *Section B2.5*, further modelling has been completed, in three phases. Phase 2 modelling assumes an increased stack height of 100 m, Phase 3 assumes a decreased throughput of 150 ktpa, and Phase 4 assumes both an increased stack height and reduced throughput.

Table B3.9 Phase 2 - Contribution to direct toxic effects against Critical Levels

	SO_2 (µg m^{-3})						NO_X (µg m^{-3})						NH_3 (µg m^{-3})					
	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL
Fens pools																		
AoS 03	1.1	20	0.00400	0.020%	1.10	5.52%	40.5	30	0.0160	0.053%	40.5	135%	1.30	3.0	0.000800	0.027%	1.30	43%
AoS 07	1.1	20	0.00397	0.020%	1.10	5.52%	40.5	30	0.0159	0.053%	40.5	135%	1.30	3.0	0.000794	0.026%	1.30	43%
AoS 08	1.1	20	0.00394	0.020%	1.10	5.52%	40.5	30	0.0157	0.052%	40.5	135%	1.30	3.0	0.000787	0.026%	1.30	43%
Lyppard GP																		
AoS 03	1.0	20	0.0877	0.44%	1.09	5.44%	27.1	30	0.351	1.17%	27.5	92%	2.10	3.0	0.0175	0.58%	2.12	71%
AoS 07	1.0	20	0.0734	0.37%	1.07	5.37%	27.1	30	0.294	0.98%	27.4	91%	2.10	3.0	0.0147	0.49%	2.11	70%
AoS 08	1.0	20	0.0831	0.42%	1.08	5.42%	27.1	30	0.333	1.11%	27.4	91%	2.10	3.0	0.0166	0.55%	2.12	71%
Bredon Hill																		
AoS 03	1.0	20	0.00797	0.040%	1.01	5.04%	13.2	30	0.0319	0.11%	13.2	44%	1.70	1.0	0.00159	0.16%	1.70	170%
AoS 07	1.0	20	0.00794	0.040%	1.01	5.04%	13.2	30	0.0317	0.11%	13.2	44%	1.70	2.0	0.00159	0.079%	1.70	85%
AoS 08	1.0	20	0.00810	0.040%	1.01	5.04%	13.2	30	0.0324	0.11%	13.2	44%	1.70	3.0	0.00162	0.054%	1.70	57%
Dixton Wood																		
AoS 03	1.0	20	0.00546	0.027%	1.01	5.03%	14.8	30	0.0219	0.073%	14.8	49%	2.10	1.0	0.00109	0.11%	2.10	210%
AoS 07	1.0	20	0.00472	0.024%	1.00	5.02%	14.8	30	0.0189	0.063%	14.8	49%	2.10	2.0	0.000943	0.047%	2.10	105%
AoS 08	1.0	20	0.00478	0.024%	1.00	5.02%	14.8	30	0.0191	0.064%	14.8	49%	2.10	3.0	0.000956	0.032%	2.10	70%

Table B3.10 Phase 2- Contribution to Deposition effects against Critical Levels

	Acid Deposition (keq ha^{-1} yr^{-1})						Nutrient Nitrogen Deposition (kg N ha^{-1} yr^{-1})					
	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL
Fens pools												
AoS 03	18.1	10	0.00646	0.065%	18.1	181%	1.87	2.05	0.000638	0.031%	1.87	91%
AoS 07	18.1	10	0.00641	0.064%	18.1	181%	1.87	2.05	0.000633	0.031%	1.87	91%
AoS 08	18.1	10	0.00635	0.064%	18.1	181%	1.87	2.05	0.000627	0.031%	1.87	91%
Lyppard GP												
AoS 03	19.90	20	0.142	0.71%	20.0	100%	1.47	4.73	0.0140	0.30%	1.48	31%
AoS 07	19.90	20	0.119	0.59%	20.0	100%	1.47	4.73	0.0117	0.25%	1.48	31%

AoS 08	19.90	20	0.134	0.67%	20.0	100%	1.47	4.73	0.0133	0.28%	1.48	31%
Bredon Hill												
AoS 03	32.30	10	0.0216	0.22%	32.3	323%	1.79	2.55	0.00254	0.10%	1.79	70%
AoS 07	32.30	10	0.0215	0.22%	32.3	323%	1.79	2.55	0.00253	0.10%	1.79	70%
AoS 08	32.30	10	0.0219	0.22%	32.3	323%	1.79	2.55	0.00258	0.10%	1.79	70%
Dixton Wood												
AoS 03	36.40	10	0.0128	0.13%	36.4	364%	1.93	2.58	0.00150	0.058%	1.93	75%
AoS 07	36.40	10	0.0130	0.13%	36.4	364%	1.93	2.58	0.00152	0.059%	1.93	75%
AoS 08	36.40	10	0.00646	0.065%	18.1	181%	1.87	2.05	0.000638	0.031%	1.87	91%

Table B3.11 Phase 3- Contribution to direct toxic effects against Critical Levels

	SO_2 ($\mu g\ m^{-3}$)						**NO_X ($\mu g\ m^{-3}$)**						**NH_3 ($\mu g\ m^{-3}$)**					
	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL
Fens pools																		
AoS 03	1.1	20	0.00265	0.013%	1.10	5.51%	40.50	30	0.0106	0.035%	40.5	135%	1.3	3	0.000531	0.018%	1.30	43.4%
AoS 07	1.1	20	0.00265	0.013%	1.10	5.51%	40.5	30	0.0106	0.035%	40.5	135%	1.3	3	0.000531	0.018%	1.30	43.4%
AoS 08	1.1	20	0.00261	0.013%	1.10	5.51%	40.5	30	0.0105	0.035%	40.5	135%	1.3	3	0.000523	0.017%	1.30	43.4%
Lyppard GP																		
AoS 03	1.0	20	0.0737	0.37%	1.07	5.37%	27.1	30	0.295	0.98%	27.4	91.3%	2.1	3	0.0147	0.49%	2.11	70.5%
AoS 07	1.0	20	0.0617	0.31%	1.06	5.31%	27.1	30	0.247	0.82%	27.3	91.2%	2.1	3	0.0123	0.41%	2.11	70.4%
AoS 08	1.0	20	0.0705	0.35%	1.07	5.35%	27.1	30	0.282	0.94%	27.4	91.3%	2.1	3	0.0141	0.47%	2.11	70.5%
Bredon Hill																		
AoS 03	1.0	20	0.00529	0.026%	1.01	5.03%	13.2	30	0.0212	0.071%	13.2	44.1%	1.7	1	0.00106	0.11%	1.70	170%
AoS 07	1.0	20	0.00529	0.026%	1.01	5.03%	13.2	30	0.0212	0.071%	13.2	44.1%	1.7	2	0.00106	0.053%	1.70	85.1%
AoS 08	1.0	20	0.00539	0.027%	1.01	5.03%	13.2	30	0.0215	0.072%	13.2	44.1%	1.7	3	0.00108	0.036%	1.70	56.7%
Dixton Wood																		
AoS 03	1.0	20	0.00318	0.016%	1.00	5.02%	14.8	30	0.0127	0.042%	14.8	49.4%	2.1	1	0.000636	0.064%	2.10	210%
AoS 07	1.0	20	0.00320	0.016%	1.00	5.02%	14.8	30	0.0128	0.043%	14.8	49.4%	2.1	2	0.000640	0.032%	2.10	105%
AoS 08	1.0	20	0.00322	0.016%	1.00	5.02%	14.8	30	0.0129	0.043%	14.8	49.4%	2.1	3	0.000644	0.021%	2.10	70.0%

Table B3.12 Phase 3- Contribution to Deposition effects against Critical Levels

	Acid Deposition (keq ha^{-1} yr^{-1})						**Nutrient Nitrogen Deposition (kg N ha^{-1} yr^{-1})**					
	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL
Fens pools												
AoS 03	1.87	2.05	0.000423	0.0206%	1.87	91.2%	18.1	10	0.00429	0.043%	18.1	181%
AoS 07	1.87	2.05	0.000423	0.0206%	1.87	91.2%	18.1	10	0.00429	0.043%	18.1	181%
AoS 08	1.87	2.05	0.000417	0.0203%	1.87	91.2%	18.1	10	0.00422	0.042%	18.1	181%
Lyppard GP												
AoS 03	1.47	4.73	0.0117	0.248%	1.48	31.3%	19.9	20	0.119	0.60%	20.0	100%
AoS 07	1.47	4.73	0.00983	0.208%	1.48	31.3%	19.9	20	0.0996	0.50%	20.0	100%
AoS 08	1.47	4.73	0.0112	0.238%	1.48	31.3%	19.9	20	0.114	0.57%	20.0	100%
Bredon Hill												
AoS 03	1.79	2.55	0.00169	0.0661%	1.79	70.3%	32.3	10	0.0143	0.14%	32.3	323%
AoS 07	1.79	2.55	0.00169	0.0661%	1.79	70.3%	32.3	10	0.0143	0.14%	32.3	323%
AoS 08	1.79	2.55	0.00172	0.0673%	1.79	70.3%	32.3	10	0.0146	0.15%	32.3	323%
Dixton Wood												
AoS 03	1.93	2.58	0.00101	0.0393%	1.93	74.8%	36.4	10	0.00862	0.086%	36.4	364%
AoS 07	1.93	2.58	0.00102	0.0395%	1.93	74.8%	36.4	10	0.00867	0.087%	36.4	364%
AoS 08	1.93	2.58	0.00103	0.0398%	1.93	74.8%	36.4	10	0.00873	0.087%	36.4	364%

Table B3.13 Phase 4- Contribution to direct toxic effects against Critical Levels

	SO_2 (µg m^{-3})						**NO_X (µg m^{-3})**						**NH_3 (µg m^{-3})**					
	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL
Fens pools																		
AoS 03	1.1	20	0.00252	0.013%	1.10	5.51%	40.5	30	0.0101	0.034%	40.5	135%	1.3	3	0.000503	0.017%	1.30	43.4%
AoS 07	1.1	20	0.00250	0.012%	1.10	5.51%	40.5	30	0.0100	0.033%	40.5	135%	1.3	3	0.000500	0.017%	1.30	43.3%
AoS 08	1.1	20	0.00248	0.012%	1.10	5.51%	40.5	30	0.00991	0.033%	40.5	135%	1.3	3	0.000496	0.017%	1.30	43.3%
Lyppard GP																		
AoS 03	1.0	20	0.0603	0.30%	1.06	5.30%	27.1	30	0.241	0.80%	27.3	91.1%	2.1	3	0.0121	0.40%	2.11	70.4%
AoS 07	1.0	20	0.0508	0.25%	1.05	5.25%	27.1	30	0.203	0.68%	27.3	91.0%	2.1	3	0.0102	0.34%	2.11	70.3%

	SO_2 ($\mu g\ m^{-3}$)						NO_X ($\mu g\ m^{-3}$)						NH_3 ($\mu g\ m^{-3}$)				
AoS 08	1.0	20	0.0574	0.29%	1.06	5.29%	27.1	30	0.230	0.77%	27.3	91.1%	2.1	3	0.0115	0.38%	2.11	70.4%
Bredon Hill																		
AoS 03	1.0	20	0.00505	0.025%	1.01	5.03%	13.2	30	0.0202	0.067%	13.2	44.1%	1.7	1	0.00101	0.10%	1.70	170%
AoS 07	1.0	20	0.00503	0.025%	1.01	5.03%	13.2	30	0.0201	0.067%	13.2	44.1%	1.7	1	0.00101	0.10%	1.70	170%
AoS 08	1.0	20	0.00513	0.026%	1.01	5.03%	13.2	30	0.0205	0.068%	13.2	44.1%	1.7	1	0.00103	0.10%	1.70	170%
Dixton Wood																		
AoS 03	1.0	20	0.00297	0.015%	1.00	5.01%	14.8	30	0.0139	0.046%	14.8	49.4%	2.1	1	0.000695	0.069%	2.10	210%
AoS 07	1.0	20	0.00299	0.015%	1.00	5.01%	14.8	30	0.0134	0.045%	14.8	49.4%	2.1	1	0.000671	0.067%	2.10	210%
AoS 08	1.0	20	0.00301	0.015%	1.00	5.02%	14.8	30	0.0139	0.046%	14.8	49.4%	2.1	1	0.000695	0.069%	2.10	210%

Table B3.14 Contribution to Deposition effects against Critical Levels

	Acid Deposition (keq $ha^{-1}\ yr^{-1}$)						**Nutrient Nitrogen Deposition (kg N $ha^{-1}\ yr^{-1}$)**					
	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL	Baseline Conditions	CL	PC	PC/CL	PEC	PEC/CL
Fens pools												
AoS 03	1.87	2.05	0.00040	0.0196%	1.87	91.2%	18.1	10	0.00406	0.041%	18.1	181%
AoS 07	1.87	2.05	0.00040	0.0194%	1.87	91.2%	18.1	10	0.00403	0.040%	18.1	181%
AoS 08	1.87	2.05	0.00040	0.0193%	1.87	91.2%	18.1	10	0.00400	0.040%	18.1	181%
Lyppard GP												
AoS 03	1.47	4.73	0.0096	0.203%	1.48	31.3%	19.9	20	0.0974	0.49%	20.0	100%
AoS 07	1.47	4.73	0.0081	0.171%	1.48	31.2%	19.9	20	0.0820	0.41%	20.0	99.9%
AoS 08	1.47	4.73	0.0092	0.194%	1.48	31.3%	19.9	20	0.0928	0.46%	20.0	100%
Bredon Hill												
AoS 03	1.79	2.55	0.0016	0.0632%	1.79	70.3%	32.3	10	0.0137	0.14%	32.3	323%
AoS 07	1.79	2.55	0.0016	0.0629%	1.79	70.3%	32.3	10	0.0136	0.14%	32.3	323%
AoS 08	1.79	2.55	0.0016	0.0642%	1.79	70.3%	32.3	10	0.0139	0.14%	32.3	323%
Dixton Wood												
AoS 03	1.93	2.58	0.0011	0.0429%	1.93	74.8%	36.4	10	0.00941	0.094%	36.4	364%
AoS 07	1.93	2.58	0.0011	0.0415%	1.93	74.8%	36.4	10	0.00910	0.091%	36.4	364%
AoS 08	1.93	2.58	0.0011	0.0429%	1.93	74.8%	36.4	10	0.00941	0.094%	36.4	364%

The outcome of the dispersion modelling exercise is a means of evaluating the suitability of the Areas of Search in terms of their *potential* for causing an impact on the European designated sites for nature conservation. It is very important that these results are seen in their proper context; that is, the result of a modelling process and assessment procedure in which the outcomes are dependent on the assumptions and criteria used. Whilst it is very easy to take quantitative results and use them to draw hard conclusions, any judgement on the suitability of individual Areas of Search must be made in the full knowledge of the extent to which the results could be altered by adopting a different set of criteria or assessment methods.

In forming a judgement on the significance of potential effects on any interest feature of a European site, the particular vulnerability of the interest feature and its habitat needs to be accounted for. In this case, the assessment has revealed that the additional NO_x concentrations would be above 1% of the critical level at Lyppard Grange Ponds. Since the critical level for NO_x relates principally to phytotoxic effects on plants, the important question to be addressed is, implication of this for the newt habitat. The newt habitat comprises primarily the pond water and any atmospheric influence is probably limited to the deposition of nitrogen or acid and the consequence this might have for the water pH or the vegetation, particularly algae. In fact, APIS does not give any site relevant critical load for deposition of either acid or nitrogen at Lyppard Grange Ponds. On balance, it is highly likely that the critical level for NO_x, applicable generically to vegetation, is not especially meaningful in this case.

The modelling has been completed in four phases; the first includes 10 Areas of Search initially, and subsequently an additional 2 Areas of Search, as selected in *Section B2.2.2*, and assumes a stack height of 80 m with an annual throughput of 250 ktpa. Phase 1 of modelling shows PCs to be less than 1% of the Critical Load or Level for all Areas of Search except for 03, 07 and 08, where the PC NO_x are shown to be >1% at Lyppard Grange Ponds SAC, and the PEC is greater than 70%.

Phase 2 of modelling was undertaken only for Areas of Search 03, 07 and 08 and used an increased stack height of 100 m, while maintaining all other input parameters the same as in Phase 1. For this model setup, the PC for NO_x concentrations is still >1% at Lyppard Grange Ponds SAC for Areas of Search 03 and 08. For Area of Search 07, the PC for NO_x is <1%.

Phase 3 of modelling used a stack height of 80 m as in Phase 1, but a lower throughput of 150 ktpa. The results show that for Areas of Search 03 and 08 the PC for NO_x concentrations falls below 1% of the Critical Level for Lyppard Grange Ponds SAC.

Phase 4 of modelling used an increased stack height of 100 m and a reduced throughput of 150 ktpa. The PC for NO_x concentrations from Area of Search 03 and 08 remain below 1% of the Critical Level at Lyppard Grange Ponds SAC under these assumptions.

Based on the results presented, a 'likely significant effect ' from air pollution on Lyppard Grange Ponds SAC cannot be ruled out in the case of the development of a generic thermal treatment facility at Areas of Search 03 and 08 for a 250ktpa facility, however 'no likely significant effect' can be concluded for a 150ktpa facility. For Area of Search 07 a 250ktpa facility would have 'no likely significant effect', albeit with a 100m stack. For the other Areas of Search included in Phase 1 modelling, it is concluded that there are no likely significant effects from adverse air pollution for a 250ktpa facility with an 80m stack.

The results of the four phases of modelling for the areas of search 03, 07 and 08 have been summarised in *Table B4.2* using the colour key presented in *Table B4.1*.

Table B4.1 Key for Table B4.2

Colour	Definition
	PC ≤1% of critical level/critical load
	PC >1% but PEC ≤70% of critical level/critical load
	PC > 1% and PEC > 70% of critical level/critical load

Table B4.2 Summary of NOx impacts on SACs from Areas of Search 03, 07 and 08

	Stack Height (m)	Throughput (ktpa)	Fens Pools	Lyppard GP	Bredon Hill	Dixton Wood
AoS 03						
Phase 1	80	250				
Phase 2	100	250				
Phase 3	80	150				
Phase 4	100	150				
AoS 07						
Phase 1	80	250				
Phase 2	100	250				
Phase 3	80	150				
Phase 4	100	150				
AoS 08						
Phase 1	80	250				
Phase 2	100	250				
Phase 3	80	150				
Phase 4	100	150				

Table B4.4 sets out a summary of those Areas of Search where development of a 250ktpa facility with a 80m stack is likely to be acceptable; development of a 250ktpa facility with a 100m stack is likely to be acceptable; and those where development of a 150ktpa facility is likely to be acceptable. *Table B4.4* is colour coded using the key set out in *Table B4.3*.

In summary, extrapolating the results produces the following summary:

- 250ktpa facility with 80m stack predicted to have 'no likely significant effect': Areas of Search 01, 02, 04, 05, and 09-65 inclusive;

- 250ktpa facility with 100m stack predicted to have 'no likely significant effect': Area of Search 07; and

- 150ktpa facility predicted to have 'no likely significant effect': Areas of Search 03, 06 and 08.

Table B4.3 Key for Table B4.4

Colour	Operating parameters at which the site is likely to be acceptable for development
	250ktpa and 80m stack
	250ktpa and 100m stack
	150ktpa and 80 m stack

Table B4.4 Summary of operating parameters at all Areas of Search likely to be acceptable for development

Area of Search	Fens Pools	Lyppard Grange Ponds	Bredon Hill	Dixton Wood
01		✓		
02		✓		
03		✓		
04		✓		
05		✓		
06		✓		
07		✓		
08		✓		
09		✓		
10		✓		
11		✓		
12		✓		
13		✓		
14		✓		
15		✓		
16		✓		
17				
18				
19				
20				
21				
22				
23				
24				
25	✓			
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				

Area of Search	Fens Pools	Lyppard Grange Ponds	Bredon Hill	Dixton Wood
36		✓		
37		✓		
38				
39				
40	✓			
41	✓			
42		✓		
43		✓		
44		✓		
45		✓		
46		✓		
47		✓		
48		✓		
49		✓	✓	
50			✓	
51			✓	✓
52			✓	✓
53		✓	✓	✓
54		✓	✓	✓
55		✓	✓	✓
56		✓	✓	✓
57			✓	✓
58				
59				
60				
61		✓		
62		✓		
63		✓		
64			✓	
65			✓	

Note: ticks denote Area of Search with European site within 15km radius

Annex C

Consideration of In-Combination Effects

ANNEX C – CONSIDERATION OF IN-COMBINATION EFFECTS

Table C1.1 Consideration of In Combination Effects

European site	**cSAC designated interest features**	**Vulnerabilities and potential adverse effects related to the conservation objectives for the site**	**Potential impacts upon qualifying features arising from local plans and projects**	**Broad urban areas with possible in combination effects from housing growth * (proposed house numbers are in brackets)**	**Can the likelihood of a significant effect resulting from other plans and projects be ruled out at this stage?**	**Is there a risk of in-combination effects?**
Lyppard Grange Ponds SAC (1.09 ha)	Great Crested Newt population. *Associated BAP habitat categories:* Lowland Ponds and Neutral grassland/parkland.	• Water quality - eutrophication is a threat from surface run-off or groundwater pollution and atmospheric deposition. • Water levels – a high and stable water table is fundamental, any further nearby development could threaten this. • Introduction of fish, threats from adjacent residential area. • Scrub or tree encroachment (leading to shading, nutrient and hydrological effects). • Spread of introduced non-native species. • Recreational pressure /	Relevant local plans and projects: • Bosch development, relocation of premises to Worcester Industrial Park off J6 of the M6 – Increase in traffic pollution. Phase 1 of the development could start in 2012. • Football Stadium and mixed development, St Modwen Developments Ltd to the east of Nunnery Way next to the M5. Disturbance Effects: Impacts could potentially arise from direct disturbance as a result of	Worcester • Central (3,200) • Outskirts (3,500) • Adjacent to Kilbury Drive (300) • St Peters (300) Fernhill Heath (500) Droitwich Spa (1,200) Malvern • Newland (1,100) • Central Malvern (500) • Upton upon Severn (50) • Tunnel Hill (50) Pershore • North of Station Road (400) • North east of Wyre	No	Yes

European site	cSAC designated interest features	Vulnerabilities and potential adverse effects related to the conservation objectives for the site	Potential impacts upon qualifying features arising from local plans and projects	Broad urban areas with possible in combination effects from housing growth * (proposed house numbers are in brackets)	Can the likelihood of a significant effect resulting from other plans and projects be ruled out at this stage?	Is there a risk of in-combination effects?
		disturbance. • Development pressure. • Diffuse air pollution.	increase human presence following residential expansion from the proposals listed above. Air Dispersion Effects: Possible impacts could also arise from air pollution dispersion effects on woodland habitat communities for which the violet click beetle is directly dependent	Road (400) • Three Springs Road (150) Bromsgrove • Bromsgrove District Council (2,100) • Longbridge Area Action Plan - min. of 700 homes Redditch • Redditch District Council (6,600)- town centre 3300, north of centre 3300		
Bredon Hill SAC (359.86)	*Limoniscus violaceus* (Violet Click Beetle) - ancient ash pollards (for breeding) *Associated BAP habitat:* Broadleaved, mixed and yew woodland and lowland parkland and wood pasture.	• Integrity depends primarily on appropriate woodland management to maintain sufficient proportion of mature trees and decaying wood for the violet click beetle. • Atmospheric pollution (nutrient deposition and acidification, potential for successional habitat change	Relevant local plans and projects: • 'Middle Quinton' Ecotown – possible increase in recreational pressure. Disturbance Effects: Impacts could potentially arise from direct disturbance as a result of	Evesham • Offenham Road – 1,500 • Hampton – 800 • Proposed New Eco - Town Site Pershore • North of Station Road (400) • North east of Wyre Road (400)	No	Yes

European site	cSAC designated interest features	Vulnerabilities and potential adverse effects related to the conservation objectives for the site	Potential impacts upon qualifying features arising from local plans and projects	Broad urban areas with possible in combination effects from housing growth * (proposed house numbers are in brackets)	Can the likelihood of a significant effect resulting from other plans and projects be ruled out at this stage?	Is there a risk of in-combination effects?
		and deterioration and reduction in number of suitable pollards. • Water level – maintenance of water table potential draining of damp habitat affecting quality of woodland and pollards. • Heavy recreational pressure – increased disturbance to key invertebrate habitat. • Development pressure– increased disturbance to key invertebrate habitat. • Scrub encroachment – swamping key invertebrate habitat and change in habitat structure.	increase human presence following residential expansion from the proposals listed above. Air Dispersion Effects: Possible impacts could also arise from air pollution dispersion effects on woodland habitat communities for which the violet click beetle is directly dependent. However, no significant proposals for industrial development involving emitting stacks are promoted in Worcestershire and in combination effects from air dispersion are considered unlikely.	• Three Springs Road (150) Malvern • Newland (1,100) • Central Malvern (500) • Upton upon Severn (50) • Tunnel Hill (50) Direct disturbance from any expansion of these areas is possible.		
Dixton Wood SAC (13.14 ha)	*Limoniscus violaceus* (Violet Click Beetle)	• Integrity depends primarily on appropriate woodland management to maintain sufficient proportion of mature trees and decaying wood for the violet click beetle.	Relevant local plans and projects: • 'Middle Quinton' Ecotown – possible increase in recreational pressure.	Evesham • Offenham Road – 1,500 • Hampton - 800 • Proposed New Eco - Town Site	No	Yes

European site	cSAC designated interest features	Vulnerabilities and potential adverse effects related to the conservation objectives for the site	Potential impacts upon qualifying features arising from local plans and projects	Broad urban areas with possible in combination effects from housing growth * (proposed house numbers are in brackets)	Can the likelihood of a significant effect resulting from other plans and projects be ruled out at this stage?	Is there a risk of in-combination effects?
		• Atmospheric pollution (nutrient deposition and acidification, potential for successional habitat change and deterioration and reduction in number of suitable pollards. • Water level – maintenance of water table potential draining of damp habitat affecting quality of woodland and pollards. • Heavy recreational pressure – increased disturbance to key invertebrate habitat. • Development pressure– increased disturbance to key invertebrate habitat. • Scrub encroachment – swamping key invertebrate habitat and change in habitat structure.	Disturbance Effects: Impacts could potentially arise from direct disturbance as a result of increase human presence following residential expansion from the proposals listed above. Air Dispersion Effects: Possible impacts could also arise from air pollution dispersion effects on woodland habitat communities for which the violet click beetle is directly dependent. However, no significant proposals for industrial development involving emitting stacks are promoted in Worcestershire and in combination effects from air dispersion are considered unlikely.	Direct disturbance from any expansion of these areas is possible.		
Fens Pools	Great Crested Newt	• Water quality - eutrophication	Direct Disturbance Effects:	Kidderminster:	Yes	No

European site	cSAC designated interest features	Vulnerabilities and potential adverse effects related to the conservation objectives for the site	Potential impacts upon qualifying features arising from local plans and projects	Broad urban areas with possible in combination effects from housing growth * (proposed house numbers are in brackets)	Can the likelihood of a significant effect resulting from other plans and projects be ruled out at this stage?	Is there a risk of in-combination effects?
SAC (20.4 ha)	population. *Associated BAP habitat categories:* Lowland Ponds and Neutral grassland/parkland.	is a threat from surface run-off or groundwater pollution and atmospheric deposition. • Water levels – a high and stable water table is fundamental, any further nearby development could threaten this. • Introduction of fish, threats from adjacent residential area. • Scrub or tree encroachment (leading to shading, nutrient and hydrological effects). • Spread of introduced non-native species. • Recreational pressure / disturbance. • Development pressure. • Diffuse air pollution.	No direct disturbance impacts to the hydrology of the SAC or to the populations of great crested newt are likely to arise from local plans and projects. Air Dispersion Effects: The only possible impacts will arise from air pollution dispersion effects on riparian habitat communities, however these habitats are not part of the reasons for SAC designation. Furthermore, no significant proposals for industrial development involving emitting stacks are promoted in Worcestershire and therefore in combination effects from air dispersion are considered unlikely.	• Wyre Forest District Council - 3,400 housing growth • West Hagley Direct disturbance from any expansion of these areas is unlikely.		

* See *District Core Strategy Preferred Options for Housing Growth for 2006 -2026 Map*

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