Defra project AQ0834 - Identification of Potential "Remedies" for Air Pollution (nitrogen) Impacts on Designated Sites (R.A.P.I.D.S.)

Appendix 10 - Guidance for producing action plans on atmospheric N pollution for individual nature conservation sites

Ed Carnell, Ulli Dragosits, Mark Sutton (CEH Edinburgh) & Carly Stevens (University of Lancaster)

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Summary

- This document provides a step-by-step guidance framework for identifying and quantifying sources of atmospheric N pollution to sensitive habitats and species at a specific location (e.g. designated nature conservation sites).
- The framework consists of three stages:
  1. Initial identification of main N sources or threats at sites, using source attribution data and other relevant national scale information and tools (national scale assessment)
  2. Detailed assessment of dominant N sources for each designated site (local assessment)
  3. Identification of suitable measures to remedy atmospheric N pollution affecting designated sites (local assessment)

1. Introduction

Pollution sources contributing to the atmospheric nitrogen (N) input at individual nature conservation sites (or habitats more generally) may be located in the immediate vicinity or a considerable distance away, potentially arriving from other countries (transboundary pollution). This document focuses on providing guidance for identifying and quantifying sources of atmospheric N pollution, which may pose a threat to sensitive habitats and species at a specific location (e.g. nature conservation site or habitat). The N threats may originate from gaseous concentrations (NO_x, NH_3) or atmospheric deposition of different forms of N, the latter by either wet or dry deposition[1]. This identification of sources and quantification of their contributions ('*source attribution*') can then inform remedial action choices to protect the sites in question, and the appropriate targeting of mitigation measures.

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[1] Dry deposition is the transfer of gases and particulates to surface vegetation. Wet deposition is the transfer of materials from the atmosphere to the ground through precipitation events (rain, snow, cloud and fog droplets).

2. Recommended Approach for identifying and quantifying N sources

2.1. Overview

While conservation agency staff may be fully familiar with their sites' designated features and associated on-site management, they are unlikely to be experts at identifying and quantifying local/regional N threats. It is therefore important that straightforward step-by-step guidance is provided to enable consistent assessment of all designated sites across the country, allowing conservation agency staff to consider a) atmospheric N deposition and gaseous concentrations at designated sites in more detail and b) what contribution different atmospheric N sources make, using a range of national datasets and tools. Such assessments can then inform the targeting of actions.

For this purpose, a set of five scenarios of contrasting N source attribution has been developed in consultation with the RAPIDS Steering Group (StG), to illustrate the key nitrogen (N) threats to designated sites across the UK. In short, the following distinct categories (referred to here as 'Scenarios') have been defined (for details see separate short report on Definition of Scenarios, ***Appendix 1***):

1. Lowland agriculture (many diffuse sources)
2. Agricultural point source(s)
3. Non-agricultural (point) source(s)
4. Roads
5. Remote (mainly upland) sites affected by long-range N input

In reality, many designated sites are influenced by more than one type of atmospheric N threat, i.e. a mix of sources, such as diffuse and point source agriculture, or diffuse agriculture and roads. This needs to be catered for and built into the framework for identifying both key threats and potential measures[2].

One of the aims of the simple five-scenario approach was that conservation agency staff familiar with the surroundings of a designated site should be able to recognise and typify the relevant Scenario (or mix of Scenarios) very quickly, from well illustrated short descriptions, without specialist knowledge of N sources and atmospheric modelling/chemistry. However, in practice, such a 'bottom-up' approach may not be a feasible solution for classifying a large number of sites consistently across the country. It is also not straightforward for emission sources which may not be visible, such as long-range N input.

Therefore the framework introduced below has been developed, aiming for an evaluation/pre-screening based on relevant national datasets, e.g. at agency head offices, followed by more detailed assessments in a second stage. This 'top-down' approach allows for a more quantitative assessment that is consistent across all sites, to understand the contribution of different emission sources to the N threat to the site.

2.2. Detailed approach

Following in-depth discussions with the Steering Group, and Natural England in particular, the following three-stage approach was developed for identifying and quantifying key N threats at designated sites:

- **Stage 1** – Initial identification of Scenarios relevant to designated sites (national assessment)
- **Stage 2** – Detailed assessment of dominant N sources at each designated site (local assessment)
- **Stage 3** - Identification of suitable measures to remedy N pollution affecting designated sites (local assessment)

These stages are summarised in Figure 1 and explained in more detail below.

[2] The remit of the RAPIDS project is atmospheric N, but other N threats (e.g. nitrate leaching, N flow through catchments) should not be forgotten when identifying N input sources and measures for reducing N input. Information on co-benefits and trade-offs of potential measures is included in the main report and Appendix 3.

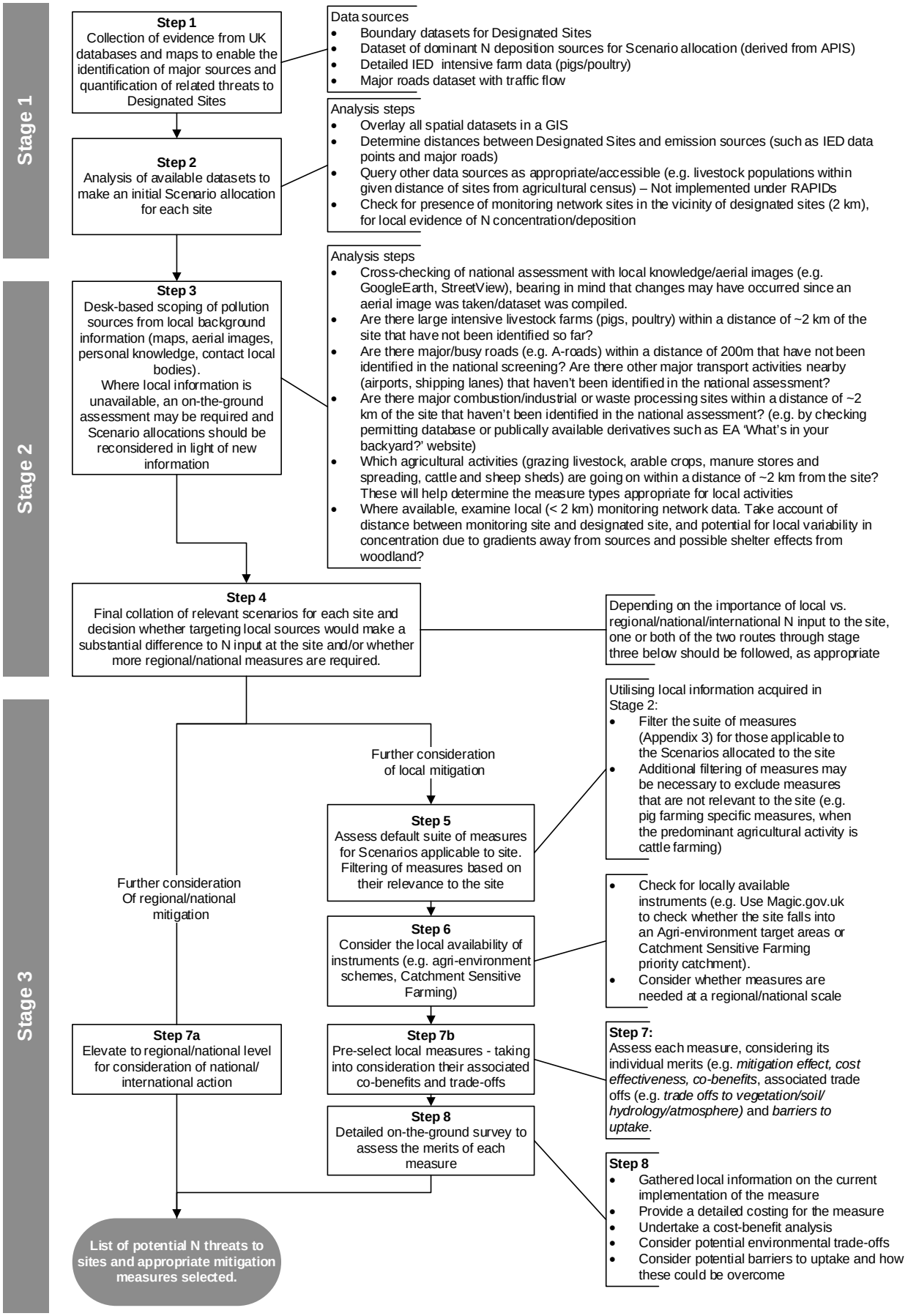

Figure 1 – Summary of draft framework for establishing site action plans

Stage 1 – Initial identification of scenarios relevant to designated sites (national assessment)

Illustrated in Figure 2

Step 1 - Collection of evidence from UK national-scale databases and maps

The main datasets required for this initial step, which have been collated under the RAPIDS project, ready for use, are:

- The UK source attribution dataset for N deposition at a 5 km grid resolution (most recent available year: 2005); this dataset has been processed to enable an initial allocation of the five RAPIDS Scenarios to all UK sites.
- SAC and A/SSSI boundary datasets (GIS)
- IED pig and poultry farm locations and pig/bird populations (if available)
- Ordnance Survey OpenData ('Strategi' GIS data) of motorways, primary roads and A roads

The APIS source attribution data has been summarised into four categories, with one category corresponding to each Scenario (N.B. The two agricultural scenarios cannot be distinguished using the APIS source attribution dataset. For further details on the allocation of sources to the RAPIDS scenarios and how the data were processed, see **Appendix 5, Table 1**). As the source attribution data are at a relatively coarse spatial resolution (5 km grid squares), additional data are required to identify local threats from agricultural point sources (Scenario 2) and major roads (Scenario 4). The data are used (in **Step 2**) to provide each designated site with an initial allocation of Scenarios (defined in **Appendix 1**)**.**

Step 2 – Initial allocation of Scenarios

Using the categorised source attribution data (prepared in **Step 1**), each designated site is assessed for dominant N deposition sources and allocated relevant Scenarios in an automated process. **Figure 2** outlines the criteria used to make this initial assessment. As already mentioned under **Step 1**, additional datasets are required to distinguish between Scenarios 1 and 2, and confirm whether major roads are sufficiently close to a site to pose a major N threat.

For distinguishing between the agricultural scenarios (diffuse and point sources), designated sites with substantial N deposition from agricultural activities (> 20 % of total N deposition, Scenario 1) are screened for the presence of intensive IED pig and poultry farms within a 2 km radius. Sites that meet this condition are allocated to Scenario 2, indicating a threat from a specific agricultural point source or sources.

Given that NO_x and NH_3 emissions from road transport are estimated to attenuate to background levels within 200 m from the roadside verge (Cape et al., 2004), threats from road transport are only considered significant when > 10% of the total N deposition is estimated to be due to road transport and a major road is within 200 m of the site boundary.

This step also provides information on input of N from sources not immediately visible/obvious by local or even regional assessments on the ground, such as long-range transport from elsewhere in the UK or further afield. To assess the threat from long-range N input, the fraction of total N deposited as wet deposition is used. It should be noted that all emission sources (in the source attribution dataset, these include e.g. agriculture, transport, industry etc.) contributing to 'wet deposition' are used here to make this assessment, therefore these sources may also be flagged up separately through other Scenarios, as they may contribute through both wet and dry deposited N. However, substantial wet N deposition normally indicates atmospheric transport from further afield.

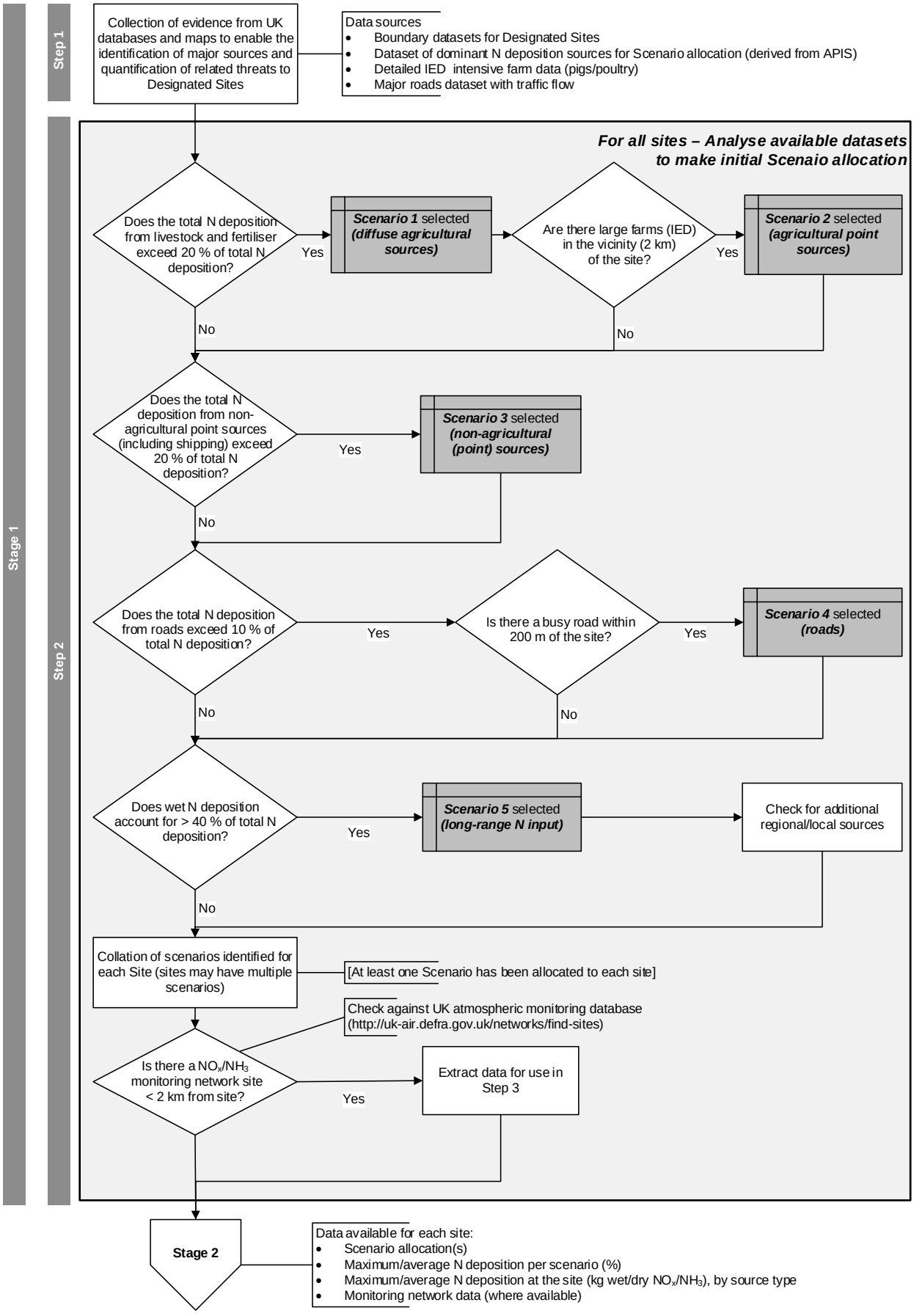

Figure 2 – Stage 1 - Data collection and Scenario allocation workflow

If a designated site is within 2 km of a UK atmospheric monitoring network (including e.g. the Natural England monitoring network[3] implemented during the last few years), these data should be extracted. While these data will not be used directly in the current step, they are extracted automatically at this stage of national data screening. They are used in more detailed desk-based assessments (**Step 3**) to help identify locally elevated NH_3 concentrations.

Stage 2 - Detailed Assessment of dominant N sources for each designated site (Local Assessment)

Illustrated in Figure 3

Step 3 - Desk-based scoping of pollution sources from local background information.

The following useful sources of information should be consulted in this step

- High resolution maps and aerial images (e.g. GoogleEarth, StreetView, which allow quick scanning of land use)
- Personal knowledge of the local area
- Local bodies and organisations

Following the initial Scenario allocation (**Stage 1**), a more detailed assessment should be carried out to confirm that the initial Scenarios allocated to each site are valid and cover the main potential threats from atmospheric N to the site.

High resolution maps/imagery of the area surrounding the site (2 km radius) should be used to identify potential sources and activities contributing to the atmospheric N threat of the site. A checklist of activities and sources that should be noted is presented for guidance in **Table 1**, alongside a minimum distance from a site at which they may pose a risk (and therefore need to be considered).

Table 1 – Potential local sources of atmospheric N to note in the desk-based survey (for guidance purposes only, additional sources should also be considered).

Scenario	Local sources to note	Distance from site to consider (m)
1 & 2	- Livestock houses - Grazing livestock types - Land spreading (indicated by manure/slurry stores) - Improved grassland and arable crops (indicating potential fertiliser and manure spreading in the vicinity) - Intensive farms, which postdate the IED dataset used	< 2,000
3	- Industrial buildings - Waste processing plants (inc. composting, anaerobic digestion) - Airports/docks/railway lines and stations - Combustion sources - Refineries - Urban areas	< 2,000
4	- Motorways - Primary roads - A-roads - Large car parks and associated busy local traffic	< 200
5	N/A (sources are further afield)	N/A

Local or regulatory bodies should also be contacted at this stage to confirm that there have been no new large developments in the surrounding area which may contribute to the N deposition of the site

[3] Long-term Monitoring Network http://www.naturalengland.org.uk/ourwork/evidence/register/ltmn.aspx, with further sites under the Environmental Change Biodiversity Network managed by NRW

(e.g. a new bypass may have been built, which postdates the OS 'Strategi' road data used). Local bodies may also be able to provide more detail on sources (e.g. livestock density).

If an atmospheric N monitoring site (NH_3 or NO_x concentration or wet deposition) was flagged in the vicinity of a designated site in Step 2, the data should be examined at this stage. These data can be used to cross-check with average modelled concentrations for the wider (5 km grid) area and to assess local variability. This is especially important for NH_3, which is very spatially variable over short distances, and highly dependent on local sources and sinks. Given this high spatial variability of NH_3, the distance and the spatial location of the monitoring site should be considered carefully, as this may affect the suitability of the data. For example, an atmospheric NH_3 concentration measurement sheltered from local emission sources by woodland is likely to show lower concentrations than one that is in an exposed location near emission sources.

Step 3a - On-the-ground assessment (where necessary)

An on-the-ground assessment should be carried out by the organisation in charge of overall site assessment for each DA (e.g. NE for England, SNH for Scotland) in collaboration with site officer(s), when there are gaps in the data used in **Step 3** and/or questions which remain unanswered. At this stage, it may also be appropriate to use a screening tool such as SCAIL to check which large pig/poultry farms (inc. related farm activities) or combustion processes are close enough to pose a direct threat to the site (if detailed information on the impact of the sources on nearby designated sites is not already available as part of a previous modelling for planning or environmental permit application).

It may also be beneficial to conduct detailed modelling of local sources and related farm activities (e.g. pig/poultry houses, manure stores and manure spreading), using detailed local atmospheric dispersion models such as ADMS and AERMOD. However, these models would need detailed input data, potentially from the operator of a point source, and/or local knowledge of other emitting activities in the area and additional information provided by site officers. Any potential anomalies in prevailing winds (if appropriate) can also be taken into account when evaluating local N threats at this scale and level of detail. This will allow a more detailed quantification of the N threat from the specific source(s) modelled, however this level of modelling is unlikely to be necessary for each designated site.

Step 4 - Final collation of relevant Scenarios for each site

Each site may be allocated a single Scenario or a mixed case, with more than one relevant Scenario representing the N threats present at a site (see Appendix 5 for the distribution of the numbers and types of Scenarios allocated to UK designated sites). For each Scenario allocated to a site, details of local sources/source types should have been identified (such as livestock houses, arable agriculture, busy roads/car parks in the immediate vicinity etc.) during **Step 3**.

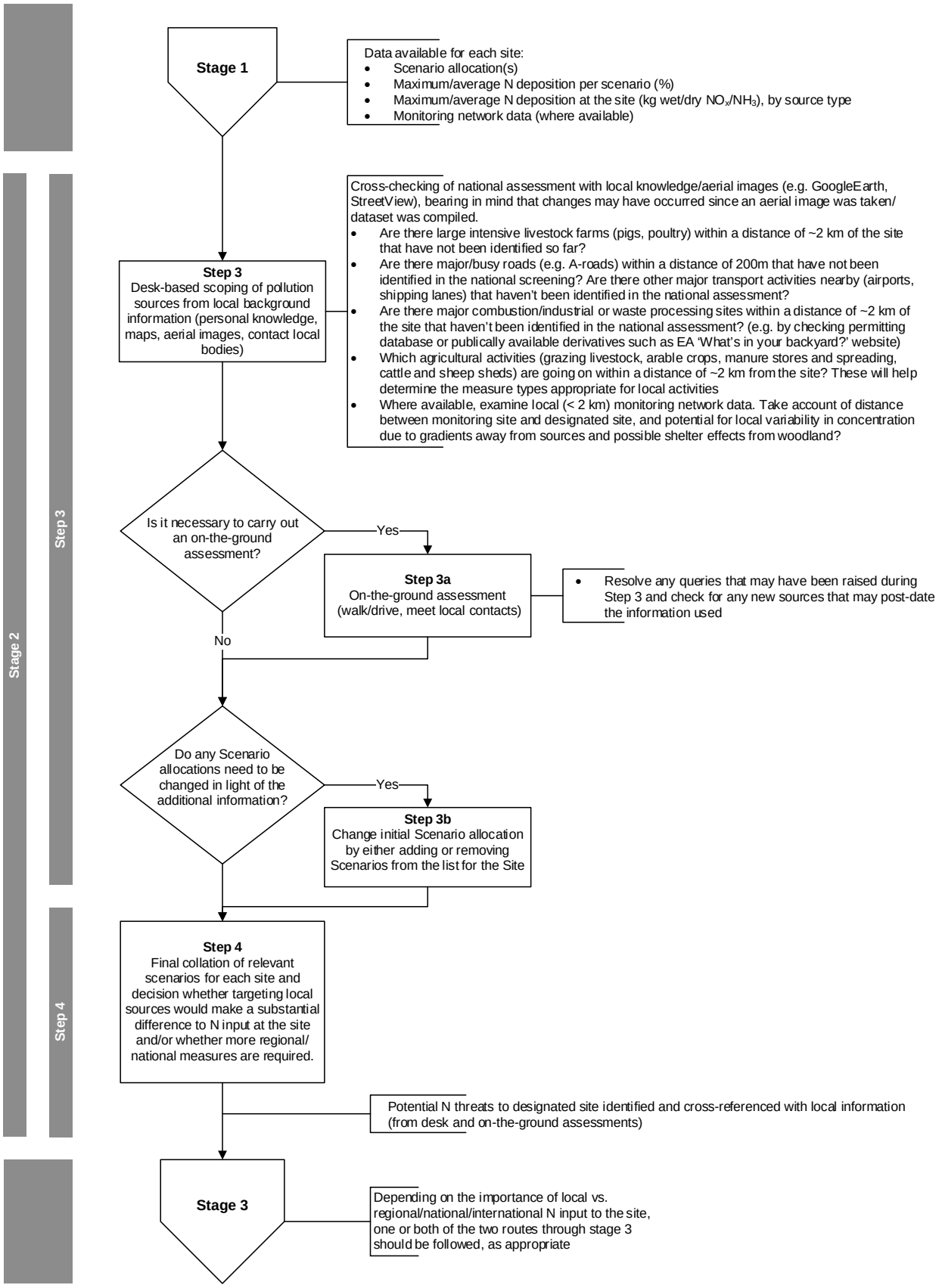

Figure 3 – Work flow of detailed desktop and on-the-ground assessments

Stage 3 - Identification of suitable measures to remedy atmospheric N pollution at designated sites (local Assessment)

Illustrated in Figure 4

Step 5 - Assess default suite of measures for Scenarios applicable to site

With dominant threats to the designated sites identified and verified with detailed assessments, site relevant mitigation measures should now be identified. The suite of potential measures (**Appendix 3**) can be filtered to exclude measures which are not relevant to the Scenarios allocated to the site. Additional filtering should also be carried out at this stage to exclude measures that are not relevant to the area surrounding the site (e.g. pig farming specific measures would not be relevant if there are no pig farms present in the surrounding area). The subsequent steps are designed to help in the prioritisation of these measures, therefore all relevant Scenarios should be considered at this stage.

Step 6 – Assessing the availability of instruments at local/national level

Following the selection of relevant N mitigation measures for the designated site, appropriate delivery mechanisms should be considered. **Appendix 4** provides a summary of mechanisms and incentive-based schemes to consider. On-line sources such as Magic.gov.uk (for Great Britain) should also be used to establish which local instruments (e.g. agri-environment schemes, woodland grant schemes, and capital grant schemes) are available in the surrounding area.

It is also necessary at this stage to assess whether potential locally targeted measures offer sufficient NO_x/NH_3 abatement to reduce N impacts at the designated, or whether wider regional, national or even international measures should be examined to offer an overall reduction in N deposition to the wider area. For example, if a site is mainly affected by long-range N input, measures applied to smaller local sources may not reduce overall atmospheric N input substantially. If wider intervention is required, the body responsible for the designated site should be informed that there is a need to take higher level action.

Step 7a – Assessment of national/international scale measures

The body responsible for the designated site should decide whether national or international scale measures should be put in place to reduce N concentrations and deposition to the wider area.

Step 7b – Pre-selection of local measures

An assessment should be carried out to establish which of the measures identified in **Step 5** are most applicable for the vicinity of the designated site. Using **Appendix 3** as a guide, factors such as the mitigation effect and barriers to uptake should be considered in order to further pre-select appropriate measures. An initial cost estimate may also be made at this stage, factoring in any incentive schemes that are in place to promote measures, such as Catchment Sensitive Farming Capital Grant schemes. For sites which are principally affected by a specific emission source (e.g. IED pig/poultry farms), measures which specifically target these sources should be included in this pre-selection.

Step 8 – Detailed on-the-ground assessment of mitigation measures

The local measures selected in **Step 7** need to be assessed in greater detail using local information. This stage should consist of the following:

- An assessment of the current implementation of the measure. Using the covering of slurry lagoons as an example, it would be necessary to consider how many active slurry lagoons there are in the area and establish to what extent covers have already been fitted (or alternative measures for slurry storage mitigation measures applied). Other factors which may affect the effectiveness of the measure should also be explored, for example, crusts may form naturally on the surface of a slurry lagoon and reduce emissions without fitting a cover.
- A comprehensive estimate of how much it would cost to implement the measure.

- An assessment of any potential environmental trade-offs that may be experienced as a consequence of the measure being implemented. Any potential barriers to uptake should also be assessed and solutions established on how these may be overcome.

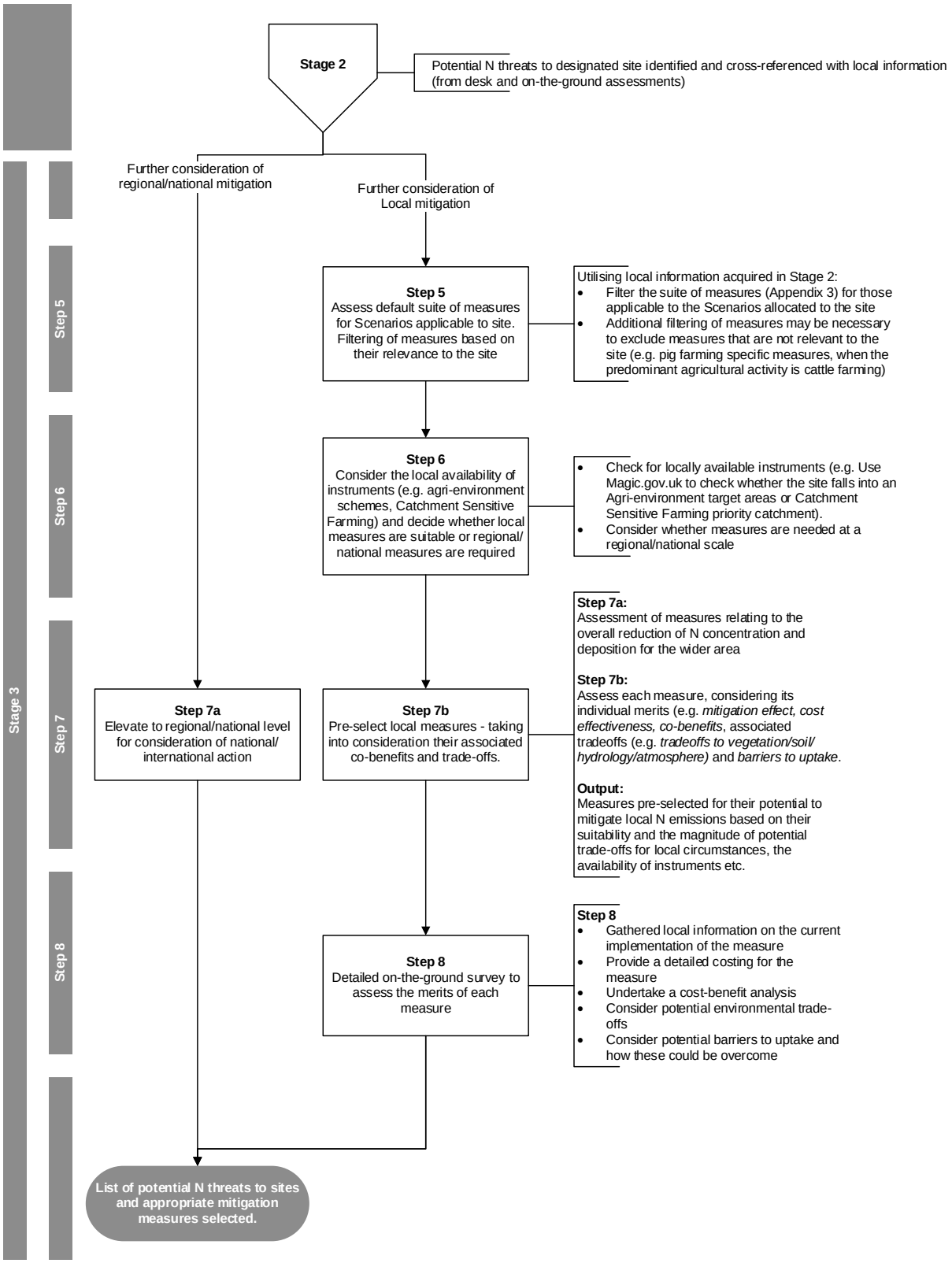

Figure 4 - Proposed workflow for identification of suitable measures of key N pollution sources affecting Designated Sites