Local Geological Site Guidelines for Greater Lincolnshire

3rd edition

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GREATER LINCOLNSHIRE NATURE PARTNERSHIP

Acknowledgements

The first draft of criteria for the identification of Local Geological Sites in Greater Lincolnshire was developed by the Lincolnshire Biodiversity Partnership in 2009. These criteria were field tested by North East Lincolnshire Council who assisted in their development.

In December 2008, the Local Geological Sites Panel met for the first time as a sub group of the Lincolnshire Geodiversity Group. The members were:

Lincolnshire Biodiversity Partnership (LBP)	Margaret Haggerty
Lincolnshire Biodiversity Partnership (LBP)	Katie Milburn
Lincolnshire Wolds Countryside Service	Helen Gamble (Chair)
North East Lincolnshire Council (NELC)	Helen Jenkins
North Lincolnshire Council (NLC)	Andrew Taylor
Volunteer RIGS Officer	Tim Langdale-Smith
Volunteer RIGS Officer	John Aram

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Jon Watson from Lincolnshire County Council provided additional advice, support and attended further meetings. Responses to the original draft documents were received from the following: Keith Ambrose (British Geological Survey), David Pocklington (East Lindsey District Council), Tom Richards (Herefordshire and Worcestershire Earth Heritage Trust), Caroline Steel (Lincolnshire Wildlife Trust) and Tim Kohler (Natural England).

The document was been reviewed and revised as the 2nd edition by the LGS Panel (and GLNP Team) which included:

Independent	Paul Hildreth
Lincolnshire Wolds Countryside Service	Helen Gamble
Natural England	Delphine Suty
Independent	Jon Watson
Independent Geology Consultant	Tim Langdale-Smith
Lincolnshire Wildlife Trust	Sarah Jane Smith

These guidelines were written in a manner to ensure consistency between the guidelines for governing the selection of geological sites and those for the selection of wildlife sites in Greater Lincolnshire. Where relevant and up to date, information from the GLNP's 3rd edition of the Local Wildlife Site Guidelines for Greater Lincolnshire (2013) was incorporated into the document.

The document was been reviewed and revised as the 3rd edition by the LGS Panel (and GLNP Team) which included:

Independent	Michael Ashton
Independent	Paul Hildreth
Lincolnshire Wolds Countryside Service	Helen Gamble
Independent	Jon Watson

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The Local Geological Site system in Greater Lincolnshire

1.1 Overview

1.1.1 The geodiversity of Greater Lincolnshire is described in a variety of documents, particularly the Geodiversity Strategy 2022-2026 (GLNP, 2022). These should be consulted for more information on the rocks and formations of the area and their conservation value.

1.1.2 The Local Geological Site (LGS) system and these guidelines cover Greater Lincolnshire, in line with the Greater Lincolnshire Nature Partnership (GLNP) remit. This term will be used throughout this document to include the administrative areas of Lincolnshire, North Lincolnshire and North East Lincolnshire.

1.1.3 These guidelines have been developed by the LGS Panel, a working group of the GLNP, and are published by the GLNP. The document is available on the GLNP website (www.glnp.org.uk).

1.1.4 This guidance is consistent with Local Sites – Guidance on their Identification, Selection and Management (Defra, 2006) and should be read in conjunction with that publication.

1.1.5 The Defra guidance recognises two equivalent designations within the umbrella term Local Sites; these are LGSs and Local Wildlife Sites (LWSs). The latter replace Sites of Nature Conservation Importance (SNCIs) and guidelines for their selection, produced by the LWS Panel in 2013, can be found on the GLNP website (www.glnp.org.uk).

1.1.6 Similarly, LGSs supersede Regionally Important Geological and Geomorphological Sites (RIGSs), which were identified on the basis of local knowledge and were selected without consideration of any formal criteria. In Greater Lincolnshire, the GLNP aims to assess all existing RIGSs using the criteria outlined in this document. To avoid confusion, until sites have been assessed against formal criteria they retain their RIGS status.

1.1.7 The RIGSs, and any newly identified sites, that satisfy these criteria and are selected by the GLNP are termed Local Geological Sites (LGSs). In addition, sites that have not been through the full selection procedure may be referred to as candidate LGSs (cLGSs). The use of these selection criteria will give confidence that those sites which satisfy the criteria have substantive geodiversity conservation value and are of a measurable and comparable standard.

1.1.8 Until recently there was no national consensus over nomenclature of Local Site systems. Consequently a variety of terms are used for these sites throughout England, and even within Greater Lincolnshire. See the Glossary for definitions of many of these terms.

1.2 Local Geological Sites and their purpose

1.2.1 Natural England's geological Sites of Special Scientific Interest (SSSI) series provides a nationally representative suite of geological and geomorphological features (JNCC, 1988). LGSs add to this, linking an understanding of geodiversity together through the further learning opportunities that they provide. The GLNP seek to identify every site that satisfies the selection criteria presented in Part 3 of this document, thus recognising a comprehensive suite of sites. In this way LGSs may be recognised and designated locally but they may be far more important.

1.2.2 The vision for the Local Sites system in Greater Lincolnshire is:

"To establish an up to date comprehensive suite of sites of substantive wildlife and geological value."

1.2.3 Considering the vision, the potential to understand and learn more about the geodiversity and landscapes around us is considered a fundamental part of the system. It is for this reason that only exposures of key geological features are designated rather than the known extent of geological formations under the ground. It is appreciated that many designated sites are not publicly accessible; however the potential for lifelong learning still exists.

1.2.4 Although a non-statutory designation, LGSs are often referred to within statutory documents and guidance aimed at protecting local geodiversity (see Section 1.3).

1.2.5 The identification and selection of Local Sites has most impact and implications within the planning system (see Section 1.3). Identification and selection of LGSs establishes their geological value, ensuring that they are recognised and appropriately surveyed and mitigated for within development plans.

1.2.6 The LGS system helps to compile data on the condition and conservation management status of geological interest in the wider countryside, outside of statutorily protected sites. Local authorities are required to report on indicators of local geodiversity as a means of assessing the effectiveness of their planning systems (see Section 1.3).

1.2.7 In prioritising allocation of funds, agencies are potentially able to target grants towards LGSs. Other bodies may be able to channel resources to provide advice and practical assistance with management of these important sites.

1.2.8 The Lincolnshire Geodiversity Strategy identifies the priorities for geodiversity conservation and enhancement within Greater Lincolnshire and sets targets for achievement. The condition of LGSs provides a measure of Geodiversity Strategy achievements at local and national levels.

1.2.9 LGS selection provides owners/managers with information that can result in positive outcomes for geodiversity. One example of a positive outcome is the already

sympathetic owner/manager, who will view the site selection as recognition of their past and present management, and who will therefore continue on that path. Other owners/managers with less prior knowledge of the geodiversity on their land may be encouraged to improve their management or may make a conscious decision not to begin activities that might be harmful.

1.3 National context

Biodiversity Duty

1.3.1 All Public Authorities have a duty to conserve and enhance biodiversity under Section 40 of the Natural Environment and Rural Communities Act 2006 as amended by Section 102 of the Environment Act 2021. It requires them to consider actions they can take, consistent with their function, that will further the biodiversity objective.

Protection within planning

1.3.2 Locally designated sites including Local Geological Sites are protecting within planning through the National Planning Policy Framework (NPPF).

1.3.3 Paragraph 181 of the NPPF requires that Local Plans "distinguish between the hierarchy of international, national and locally designated sites [and] allocate land with the least environmental or amenity value".

1.3.4 Paragraph 185a of the NPPF (2023) requires that "To protect and enhance biodiversity and geodiversity" Local Plans "should identify, map and safeguard components of local wildlife-rich habitats and wider ecological networks, including the hierarchy of international, national and locally designated sites of importance for biodiversity". It refers to Circular 06/2005 for further information, which notifies the intention of DEFRA to produce further guidance on Local Sites.

1.3.5 Defra produced local site guidance in 2006, though archived in 2013 it is still referred to in Official Statistics Nature conservation: Local Sites in positive conservation management in England, 2008-09 to 2021-22 (July 2023).

1.3.6 Paragraph 11 of Government planning guidance includes locally designated sites in its list of relevant evidence for identifying and mapping local ecological networks.

Paragraph 13 of Government planning guidance states that "National planning policy expects plans to identify and map these sites, and to include policies that not only secure their protection from harm or loss but also help to enhance them and their connection to wider ecological networks."

Monitoring and reporting

1.3.7 In 2011, the 'Single Data List' replaced the 'New Performance Framework for Local Authorities and Local Authority Partnerships: Single Set of National Indicators'. National Indicator 197 was replaced by the equivalent Indicator 160-00: Proportion of Local Sites where positive conservation management is being achieved. It states that "Local authorities have an important role in delivering the UK's international and EU targets to halt the loss of biodiversity. Data on effectiveness of local delivery is essential. More than 42,000 LWSs exist, covering over 5% of England and containing many important priority habitats. Their

effective conservation is key to meeting national and international objectives for biodiversity." (DCLG, 2012b).

In Greater Lincolnshire, the County Council and the two unitary authorities are expected to report to central government on this measure of performance on local biodiversity annually. The local authorities responsible for each district within the County Council's area should be able to provide their share of the total figures.

Data provided should be no more than five years old. If necessary a desk-based study could provide recent evidence of a positive conservation management status, especially where surveys are restricted by financial constraints.

Duty to cooperate

1.3.8 Local planning authorities are bound by a duty to cooperate under Section 33A of the Planning and Compulsory Purchase Act 2004. Local Nature Partnerships are included on the list of bodies with which they should cooperate as prescribed by Section 4 of The Town and Country Planning (Local Planning) (England) Regulations 2012.

1.4 The GLNP and Geological Site Panel

1.4.1 Defra guidance on Local Sites recommends the formation of a Local Sites partnership. In Greater Lincolnshire the GLNP has taken on this role. The LGS Panel is a working group of the GLNP and does the majority of the work on the LGS system, but all recommendations must be formally endorsed by the GLNP Steering Group (GLNP SG). The LGS Panel will hereafter be referred to as the Panel.

1.4.2 The role of the Local Sites partnership in Greater Lincolnshire has been agreed as:

- Develop and document selection criteria and guidelines;
- Review and revise the selection criteria, guidelines and system regularly;
- Assess candidate sites against the criteria;
- Be responsible for site selection;
- Record the reasons for selection or rejection of each site;
- Allow site owners/managers the opportunity to comment;
- Establish a process for recording and monitoring the condition of selected sites;
- Recommend de-selection of sites that no longer qualify.

1.4.3 The Panel meets as necessary to assess sites against the agreed selection criteria. Meetings may also be scheduled to consider individual owner/manager comments, changes to the conservation management status of sites, or any other issues relevant to the LGS system. Alternatively, information may be circulated by email and votes made remotely.

1.4.4 The decision making process is well-documented, transparent and consistent; details are given in Section 2.4. Following assessment against the criteria, the Panel makes one of the following recommendations for endorsement by the GLNP SG:

- To select the site as a LGS (and to de-select the site as a RIGS if applicable);
- To reject the site as a LGS (and to de-select the site as a RIGS if applicable);
- To defer the decision in order to gain additional information;
- To deselect a LGS or RIGS.

1.4.5 The Chair of the Panel is nominated and elected annually. New Panel members can be nominated by the Panel at any time. These nominations are taken to the next GLNP SG meeting for endorsement. Members are drawn mostly from statutory agencies, geodiversity conservation organisations and local/unitary authorities; they must all have geological expertise, or possess adequate technical or local knowledge.

1.4.6 Local authorities are invited to nominate a representative to attend Panel meetings when sites in their authority area are being considered. It is expected that the site surveyors will also attend relevant meetings. The Panel may occasionally seek the opinion of additional geological experts or other relevant organisations.

1.5 Data management and system review

1.5.1 Data relating to sites (whether selected as LGSs or not) is held by LERC on behalf of the GLNP. All records undergo a validation procedure, as described in the LERC Policies and Forms guidance.

1.5.2 The GLNP Team provides the secretariat and administrative support for the LGS system and Panel. Information on surveys, the selection process, owner/manager feedback, correspondence and decision making for each site is stored and maintained by the GLNP Team in its purpose built database.

1.5.3 Defra recommends that "*locational details should be sent to relevant decision-makers with further information on the site's features and interest as appropriate*" (Defra, 2006, Paragraph 71). In Greater Lincolnshire this is achieved through Service Level Agreements (SLAs) with the GLNP (see Paragraph 2.4.11).

1.5.4 As recommended by Defra (2006), the Panel and GLNP regularly review these guidelines and assess whether:

- The system is operating in the most efficient way to achieve its aims;
- The sites selected represent an adequate selection of sites of geodiversity conservation value in Greater Lincolnshire;
- There is sufficient information on the condition of LGSs;
- Measures for LGS conservation and management are effective.

1.5.5 If the selection criteria are changed following a review, sites are not normally reassessed until they are revisited as part of the 5-10 year rolling monitoring programme.

1.5.6 The revision led to the 2nd Edition of this document involved the inevitable content and policy updates, clarification on national guidance in regards to assessing conservation management statuses, a review of the selection criteria to deliver a more informative structure to the data obtained, a review of the survey forms, and the inclusion of template letters to landowners during the obtaining survey permission and consultation processes.

1.5.7 This 3rd edition has been updated to reflect any further changes in content and policy updates, along with revisions to the site assessment and monitoring forms following ground-truthing the use of them in relation to sites. In addition to the above, additions have been made in relation to calcareous tufa deposits and modifications to the selection criteria on text changes only.

2 System procedure

2.1 Overview

2.1.1 In the early 1990s a series of RIGSs became established, stimulated by the Nature Conservancy Council's publication *Earth Science Conservation in Great Britain – A Strategy (1990)*. The Lincolnshire Wildlife Trust formed a RIGS Group whose remit covered Greater Lincolnshire, producing a list of RIGS to be incorporated in spatial planning. The designation of SSSIs has helped to conserve the very best of these sites. Such sites are now relatively well protected from damaging activities; the selection of LGSs places much more emphasis on geodiversity in the largely unprotected landscape.

2.1.2 In most cases, LGSs do not overlap with sites of SSSI status. The SSSI designation provides protection for nationally important sites whose interest may be biological, geological, and geomorphological or any combination of these. Where a SSSI contains geological features of local significance that are not part of its national conservation objectives, these may be considered for LGS selection. Wildlife SSSIs are considered for LGS selection. Consideration is also given to selecting sites receiving other protection, such as Local Nature Reserves (LNRs) and nature reserves managed by voluntary bodies. (add link to list of GL Geological SSSI?)

2.1.3 Where geodiversity and biodiversity interests coincide on a site, it is selected as both a LGS and a LWS. The Panel and GLNP Steering Group agreed this approach because the conservation management statuses of the geological interest and the wildlife interest have a likelihood of contradicting each other. In order to make an appropriate positive or negative conservation management status decision for every Local Site, they are considered as individual sites sharing the same location.

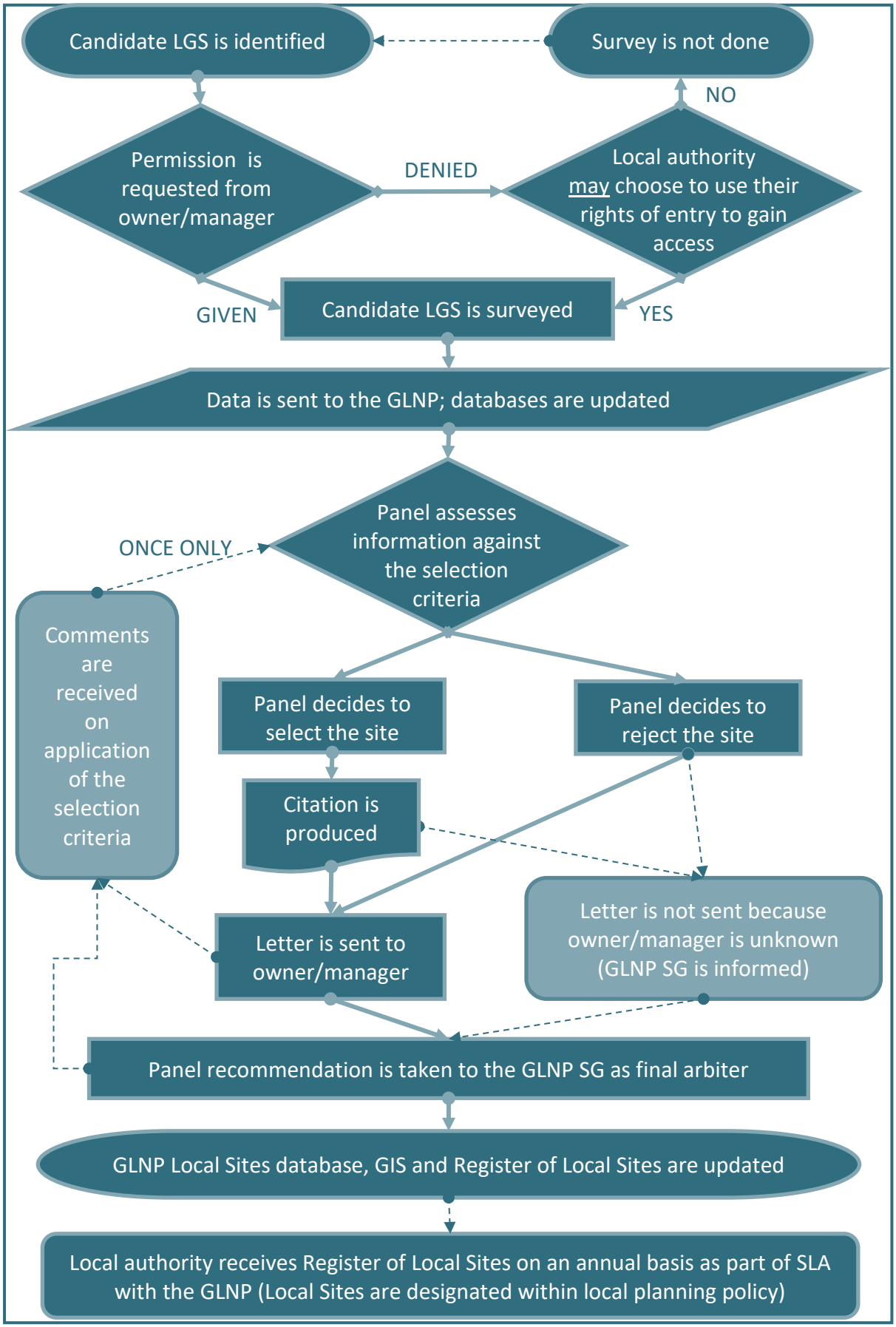
2.1.4 Candidate LGSs can potentially be brought to the attention of the GLNP by anyone, but are most often identified by the local authority or GLNP Partners. Site surveys are then undertaken and the data is given to the GLNP for analysis and storage.

2.1.5 Sites are recommended for selection (or not) by the GLNP using a four-stage process whereby the Panel is presented with the survey data from which they make a decision entirely based on the geological and conservation value of the site. The owner/manager is then consulted and given a chance to comment on the application of the selection criteria. In order to conclude the selection process, the recommendation of the Panel is presented to the GLNP Steering Group for endorsement (or not).

2.1.6 In the final fourth stage, the GLNP notifies each local authority (that it has a SLA with) of the sites selected within their area. Sites are designated within the planning system and Local Plan, and most systems afford some (non-statutory) protection of Local Sites as defined by a robust evidence base and agreed selection criteria.

2.1.7 Figure 1 fully illustrates the LGS system process.

Figure 1: LGS system process for Greater Lincolnshire



2.2 Development of the selection criteria in Greater Lincolnshire

2.2.1 In 2001, a standardised recording, assessing, designating and notification procedure was developed on behalf of UKRIGS with support from English Nature (now Natural England) and numerous RIGS member groups (Reynolds, 2001). The criteria and processes were developed with regard to existing and similar systems to ensure consistency in standards and transparency wherever possible. These selection criteria have been acknowledged by Natural England as the foundation on which to lay the important local aspects of substantive geodiversity value in the Greater Lincolnshire context. LGSs are selected on a local basis using the four nationally agreed criteria (Defra, 2006, paragraph 52):

- Value of the site for educational purposes in life-long learning;
- Value of the site for study by both professional and amateur Earth scientists;
- Historic value of a site in terms of important advances in geodiversity knowledge, events or human exploitation;
- Aesthetic value of a site in the landscape, particularly in relation to promoting public awareness and appreciation of geodiversity.

Criteria were scored from 0 to 10. The range of scores to describe each criterion is:

0 No interest or feature;
1-2 Present but no learning potential;
3-4 Very limited learning potential;
5-6 Acceptable for limited learning;
7-8 Good learning potential;
9-10 Excellent learning potential.

2.2.2 The 0 to 10 scoring system takes into account the national and local importance of a geological or geomorphological feature. For example, if a feature is locally rare but nationally abundant and of at least reasonable quality it would score highly due to being an important learning opportunity for local communities. Alternatively features that are nationally rare but locally abundant could equally score highly but consideration should be given to which present the best opportunities.

An example of a locally abundant but nationally rare feature is Red Chalk. It tells a story particular to Greater Lincolnshire and the stratigraphy of the east coast, within the wider geological history of the British Isles.

2.2.3 In 2009, the LGS Panel drafted the first criteria for the selection of Local Geological Sites in consultation with local experts and based to a significant extent on similar documents that had been produced in other counties. The draft guidelines and criteria were field tested in North and North East Lincolnshire during 2009 and then work began to produce the final version. The LGS Panel was set up to carry out this task, under the auspices of the Lincolnshire Biodiversity Partnership (now the GLNP). The first published guidelines and criteria appeared towards the end of 2009.

2.2.4 The LGS Panel consulted widely in developing the criteria to gain a consensus on the definition of 'substantive' geodiversity value in the Greater Lincolnshire context. This consultation was particularly important in setting thresholds.

2.2.5 In 2017, the GLNP with the support of the Geodiversity Group began work on revising the guidelines, producing the 2nd Edition. The format and background information on Local Sites largely derives from the 3rd Edition of the Local Wildlife Sites guidelines published in 2013 and adapted where appropriate.

This major revision saw the restructuring of the selection criteria. The aim of this was to be clearer as to why a site has been selected and its importance in a national and local context. It is also designed to give a baseline for understanding Greater Lincolnshire's geodiversity as well as direction to further information such as the Geodiversity Strategy.

Educational and cultural importance is now only considered once a geological or geomorphological criterion is met, and hence cannot contribute to selection through a combination of criteria. This information is listed in Section 4.

Educational information has been restructured to define the target audience for whom the site provides learning and/or research opportunities. It is recognised that most if not all sites possess educational value if they have geological importance but not all are practicably suitable for teaching.

Access and safety as a separate set of criteria were removed from the guidelines as it is deemed that the geological interest of a site needs to, with limited exception, be physically observable to be considered as a LGS, but most LGSs are privately owned and cannot be assumed to be publicly accessible. An element of assessing the accessibility and safety of sites is retained when considering target audiences as detailed in the educational and cultural criteria.

Greater clarification has also been given to define site boundaries, in particular for dynamic or landscape scale sites.

Due to their importance locally and nationally submerged forests along the Greater Lincolnshire coast have been given exceptional consideration. The difficulties in defining submerged forests as site-based designations within the LGS system means they have been given a unique mechanism for their recognition in local planning.

Survey forms have seen a complete redraft condensing the three original forms into one double sided form covering geodiversity interest and condition assessment.

Template landowner permission and consultation letters have been appended to the document following the format of the current LWS guidelines. As the majority of RIGSs have now been investigated, a letter specifically to landowners of newly identified sites has been included.

2.2.6 In 2023, the GLNP with the support of the Geodiversity Group began work on revising the guidelines, producing the 3rd Edition. Slight changes have been made to text and addition of calcareous tufa deposits., etc.

2.3 Site identification and data requirements

2.3.1 The majority of RIGSs already referred to in local planning policies are quite likely to satisfy one or more LGS criteria. In the past therefore, existing RIGSs have been used as the starting point for the selection of LGSs. However, most of these have now been considered for LGS designation and there are many other sites of considerable geological interest that may not have been identified as RIGSs, or may be created in the future. Therefore a positive effort is being made to identify and assess such sites in order to provide satisfactory LGS coverage. These new candidate sites can be proposed by anyone at any time, by contacting the GLNP Team.

2.3.2 Useful information about a site can be obtained remotely through aerial photography, but a field visit is essential for an adequate evaluation.

2.3.3 It is very important to use recent data for LGS assessment because changes to the exposure of geological features and their condition can occur relatively quickly. LGS survey data should be less than 10 years old, but ideally no more than five years old.

2.3.4 Site owners and managers are contacted beforehand and asked for permission to access and survey the site (see Appendices 5, 6 and 7). However, Defra guidance states that all sites that satisfy the criteria should be selected (Defra, 2006, Paragraph 54). There will be times when a survey is needed and the owner/manager has refused permission to enter the site.

In such cases the local authority may choose to use their rights of entry to gain access to the land; the owner/manager is always informed if this course of action is taken. This right is outlined in Sections 324 and 325 of the Town and Country Planning Act 1990, and states that "*Any person duly authorised…… by a local planning authority may at any reasonable time enter any land for the purpose of surveying it in connection with the preparation, revision, adoption or approval of a local development document……*" (Anon, 1990), and is used entirely at the discretion of the local authority involved.

2.3.5 Surveys are carried out by competent geologists who are able to record all of the information required to make an assessment, as described in Appendices 2 and 3. Surveyors should be able to provide the Panel with evidence of their skills and experience.

2.3.6 The main objective of the baseline survey is to carry out a geological survey and record the scientific interest and site features that are present using the standard site assessment form provided (see Appendix 1). The use of tick boxes and 1 to 10 scoring should prompt appropriate investigation whilst in the field, and make

recording as swift, comprehensive and consistent as possible. Appendix 2 provides an outline of the baseline survey procedure and the data that should be provided.

2.3.7 Monitoring of the condition and management of LGSs is required as an on-going process within the Local Site system. Defra guidance states that "*Monitoring is a quantity or quality based measurement of the features for which the sites were selected with reference to desired target levels……as a minimum, to maintain the features for which the site was selected*." (Defra, 2006, Paragraph 82). For large administrative areas a 5-10 year rolling programme is recommended to keep data current. The monitoring survey procedure and data requirements are outlined in Appendix 3 and discussed in Paragraphs 2.4.14-20.

2.3.8 Previously, existing external data may have been used as additional information when assessing LGSs, but this information was seldom used in isolation. However, given the increased pressure to assess sites against the criteria and possible decreased access to funding within local authorities, there may now be a justification for greater use of existing data from external sources. Such external data must adhere to the strict data requirements of the Panel; these are laid out in Appendix 10. Use of existing data to assess a site as a LGS does not occur without the owner/manager's knowledge.

2.3.9 With the appropriate permissions, data collected for other purposes can be used for LGS assessment. Examples include data submitted as part of an Environmental Statement or a planning application, or data acquired by local authorities using their rights to enter land (see Paragraph 2.3.4).

2.3.10 In general the GLNP prefers electronic data provision. Site boundaries can be supplied as GIS layers; these can be viewed within GIS and automatically imported into the LERC database.

2.4 Decision making and site selection

2.4.1 Following site surveys, the data is submitted to the GLNP and presented to the Panel for consideration. The Panel's decisions are based on the guidelines laid out in this document and impartial use of professional judgement, to ensure consistency.

2.4.2 The decision making process begins when a list of candidate LGSs is sent to the Panel by a member of the GLNP Team; ideally this happens at least one week before each meeting to allow enough time to consider the information. A GIS layer showing the proposed site boundaries is available upon request and is on display in the Panel meeting. Site descriptions and full survey information are also made available during the meeting.

2.4.3 During assessment the Panel decides whether or not the site satisfies at least one of the selection criteria. Sites that satisfy one or more criteria are normally selected by the Panel, providing members have confidence in the site data, the proposed boundary and other relevant factors. The Panel also considers relevant supplementary information, such as the importance of any geological interest in a Greater Lincolnshire context, public access and existing or potential value for appreciation of geodiversity or learning.

2.4.4 The Panel considers the boundary that has been proposed by the surveyor, together with other information if necessary, and agrees the most suitable boundary for the site. If the majority of the area within the boundary proposed by the surveyor includes geomorphology or other geological features relevant to the main interest of the site, then selection of the entire area as a LGS is likely to be acceptable. Guidance for deciding boundaries during survey can be found in Section 2.5 and Appendix 2: Baseline survey guidance.

Where sites extend beyond the GLNP boundary the site boundary is drawn around the interest within Greater Lincolnshire only. Neighbouring Local Site partnerships are notified of the importance of the site in their area.

2.4.5 All proposed LGSs are assessed for their current conservation management status. The Panel makes a decision on the appropriateness of documented management evidence (see Paragraph 1.3.6) for a site’s qualifying features to determine a positive or negative management status. The condition status documented by the surveyor is then factored in (see Table 17) to produce the conservation management status to be used for reporting purposes.

2.4.6 The rationale for individual decisions made by the Panel is recorded, showing the geological features judged to be of substantive value and how they were assessed against the criteria. Information on all decisions made by the Panel is clearly documented and held by the GLNP. The basis for site selection or rejection is transparent.

2.4.7 Sites that fail to satisfy any of the criteria are not necessarily rejected. If insufficient information is available for an assessment to be made the Panel may defer their decision and request further information. Once these requests have been satisfied, the new data is submitted to the Panel for consideration.

2.4.8 The Panel only rejects a site as a LGS (and if applicable de-selects it as a RIGS) if it considers that an adequate recent survey has taken place and other relevant factors have been considered. Reasons for rejection might include failure to satisfy the selection criteria, development of land or the impediment to observe the geological interest, for example, due to infilling.

2.4.9 A site may be reassessed at any time after selection or rejection if its condition changes, or if new information becomes available.

2.4.10 Site owners/managers are informed of the outcome of the Panel assessment as soon as possible after the Panel meeting and are given the opportunity to make observations on factors relating directly to the application of the selection criteria. At this stage site owners/managers are also sent a citation, which includes a site description and boundary map.

2.4.11 The GLNP Steering Group considers the recommendations of the Panel and is the final arbiter on LGS selection. Sites are only selected (or de-selected) once the recommendation has been endorsed by the GLNP Steering Group.

2.4.12 As recommended, "*sites which are selected by the Partnership must be submitted to the local authority for inclusion within their Local Development Frameworks at the earliest opportunity"* (Defra, 2006, Paragraph 24). Local Site updates, which include a Register of Local Sites together with their conservation management status and boundaries as GIS layers, are sent to local authorities annually as part of their Service Level Agreements with the GLNP (see also Paragraph 1.5.3).

Local authorities are formally notified in their role as the planning authority and also to assist with reporting against Single Data List Indicator 160-00. If the GLNP's recommendations are agreed by the local authority, LGSs are subsequently designated through inclusion in local planning policy and Local Plans.

2.4.13 If the owner/manager chooses to comment, the site is reassessed by the Panel when they next meet. If the Panel still consider the site to have substantive geodiversity conservation value and that the comments made do not affect the application of the selection criteria, then the selection of the site is recommended to be upheld. If the comments affect the application of the selection criteria then the Panel may recommend that the GLNP do not select the site after all. The local authority is notified as usual, drawing particular attention to the owners/managers comments.

2.4.14 If for any reason the owner/manager of the site is unknown, but the geodiversity conservation value is considered high enough by the Panel, the GLNP may still choose to select the site and make the recommendation that the local authority

designates it. The GLNP Steering Group is informed of the unknown owner/manager status when it makes its decision, as is the local authority.

2.4.15 After the baseline survey, LGSs are monitored every 5-10 years, or more frequently if necessary (see Paragraph 2.3.7). Where site condition is unchanged, or improves, a three-part cycle is followed. This involves a maximum of two monitoring visits (see Appendix 3), followed by another baseline survey.

2.4.16 The site monitoring cycle is illustrated in Figure 2; at each survey stage the decision making procedure outlined earlier in Figure 1 is followed.

2.4.17 Data from every monitoring survey is considered by the Panel, which assesses if the site condition is unchanged, improved or degraded and whether the site still satisfies the selection criteria. If the site is unchanged or has improved it is most often retained as a LGS. If evidence from the monitoring survey suggests that the site is degraded or features are no longer exposed, and no longer satisfies the selection criteria, the Panel recommend de-selecting the site.

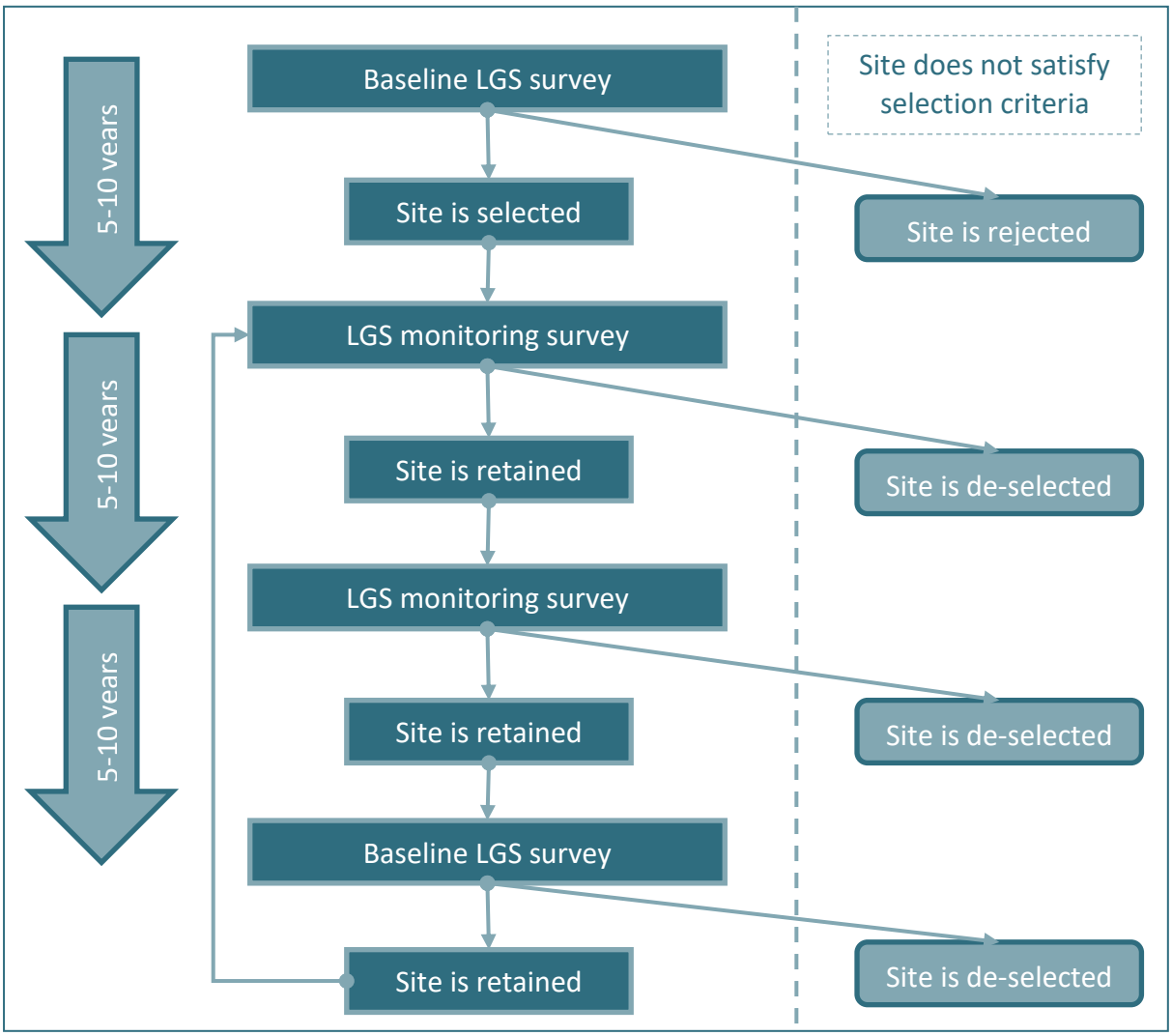
2.4.18 If de-selection of the site is contested by the owner/manager or another interested party, the Panel may request a full resurvey. Defra guidance on Local Sites says, "*In considering whether to de-select a site, the partnership should consider any implications for the provision of contact with nature and the availability of sites for educational use. The potential for restoring the site's features of interest should also be a consideration. This is particularly relevant where a site has been deliberately damaged, or degraded through neglect or inappropriate management*." (Defra, 2006, Paragraph 37).

2.4.19 All site information must be robust enough for local authority decision making. Where site information is absent or out of date the integrity of the entire LGS system must be taken into account. Where it is not possible to gain up to date information the site will be reassessed by the Panel and considered for de-designation.

2.4.19 Recent appropriate evidence (five years old or less) showing that a site is in positive conservation management can be supplied to the Panel without a revisit to ensure the site is not assigned a negative conservation management status (see Paragraph 1.3.5).

2.4.20 Any material changes to site information are approved by the Panel. This includes more relevant site names supplied by owners/managers, boundary amendments based on more recent data, or changes to conservation management statuses resulting from the submission of new evidence.

Figure 2: LGS survey cycle



2.5 Guidance on determining site boundary

2.5.1 There is no minimum or maximum site size. Sites can vary from an individual boulder to an entire landscape formation.

2.5.2 Potential site boundaries can be researched using current and historical maps, aerial photography and any other data held by the GLNP including citations of past designations such as RIGSs.

2.5.3 At the start of surveying, no firm decisions should be made about the boundaries of the site unless there are distinct definitions. All areas of potential importance should be surveyed. The boundary should be defined after a survey of all potential areas.

It is acceptable to devise boundaries that ensure that all the areas of geological interest are included within the boundary, as well as considering factors such as land tenure and management practice. The 'boundary' should define and enclose the area of interest.

However, boundaries should not be drawn to include significant areas of land outside of the geodiversity interest. Areas of lesser geodiversity value should be justified to add a significant value to the main features to be included within the designation.

2.5.4 For quarry sites, active or disused, it is usual practice to include the quarry floor within a proposed designation. Providing that no unearthed features are present on the quarry floor it should be noted that the site's main features are held within exposed faces as to provide more targeted information to potential developments or use as storage within the quarry floor. Any significant development present on the quarry floor should be omitted from the designation boundary.

2.5.5 Dynamic systems such as rivers or coastal areas such as sand dunes should be defined to their maximum extent within reason. The dynamic nature of the site should be noted in the description and the extent of the features at the time of assessment also documented in detail.

2.5.6 Submerged forests (see criterion Fo6 in Section 3.4) are difficult to define in the context of observable learning opportunities as coastal processes result in periodic but usually unpredictable exposure. The scarcity of these features nationally and their continued potential for study of both ancient sea-level and topography changes and of fluctuations to flora in response to changing climates makes them an exceptionally important feature.

As such a single designation will cover the entire extent of the submerged forests on the Greater Lincolnshire coastline regardless of current or historic exposure. Areas are added to this designation where they have been evidenced through other means than the standard LGS surveying protocol and it is at the Panel's discretion to assess the collection method and reliability of all evidence supplied.

2.6 Guidance on assessing geodiversity interest

2.6.1 Background research of the history and significance of the site or any geological features found there should be performed to give an impression of the degree of their national and local importance, as well as the scope of the site for further primary study.

Part 3 of these guidelines provides a contextual background on the importance of geological and geomorphological features within Greater Lincolnshire, and the Geodiversity Strategy should also be utilised for more detailed information.

2.6.2 Samples should not be taken from a site without landowner's permission and only if they are required for further in depth study.

2.6.3 Photographic evidence should be taken of geological features of interest. This should be accompanied by information on the location and direction from which photographs were taken. A scale should also be provided for reference.

2.6.4 A graphic log should be created to collect field data of rocks and their succession. All discrete faces and exposures should be documented this way as to highlight any lateral variation and variation in the condition of exposures found at the site.

2.6.5 Geodiversity interest is ultimately qualitative and could change over time due to sites being lost or new ones being discovered. The selection criteria in Part 3 presents a generalised impression of some of the important geological and geomorphological features, however justification for the selection (or not) of any site should be as detailed and clear as possible.

3 Selection criteria

3.1 Overview

3.1.1 The selection criteria forms Part 3 of this document and comprises eight sections. There is some variation in approach, but each section contains between one and twelve criteria. The data for each site is assessed against the criteria to determine geodiversity conservation value and the importance and quality of the features present.

3.1.2 The Geodiversity Strategy outlines geological features important to Greater Lincolnshire in more depth and can be used to supplement details provided in this part of the document.

3.1.3 A quick reference guide to these criteria has been included at the end of the document in Appendix 11.

3.1.4 The criteria outlined here are used at the Panel's discretion; sites with little or no geodiversity value are not selected. The Panel uses its best judgement when resolving issues, which may include:

- Inclusion of buffer land (or land of less geological value) within site boundaries;
- Maximum site size;
- Division of larger landscape features into individual sites dependent on management, ownership or interest (for administration only; in landscape-scale terms the sites can be considered together).

Standardised guidance has not been produced for these issues because each individual case will have different factors and information to consider.

3.1.5 Each section is introduced by a description of the geological and geomorphological features, and their importance in Greater Lincolnshire. Individual criteria are accompanied by a brief justification and/or guidance for use.

3.1.6 A site is scored against each criterion following the 0-10 system outlined in Section 2.2.1.

3.1.7 A site must score 9-10 (i.e. very good or excellent) for it to be selected for a single criterion.

3.1.8 A site can be considered for selection through a combination of features (see Section 3.8) if scores of 9-10 are not met.

3.1.9 Features of particular importance in Greater Lincolnshire under each criterion are denoted where appropriate, although this may not be exhaustive. If found, these features should be reflected in higher scoring and will therefore likely meet the score to be selected through this criterion alone.

3.1.10 Additional or newly discovered features considered to be of greater importance can be identified by the surveyor and argued as such to the LGS Panel, who will consider this against their own local knowledge and research.

3.1.11 Fossils (see Section 3.4) are denoted by their relative occurrence in Greater Lincolnshire as being either; abundant, common, uncommon or sparse and rare and scoring should reflect this. Additionally, specimens or features of particular importance within more abundant groups are detailed and if found will likely justify selection of the site through this criterion alone.

3.1.12 Early human history (see criterion Fo12 in Section 3.4) assesses evidence of human presence and their impact on the environment up to the beginning of the Holocene, the current geological period that began approximately 11,650 years before present after the last glacial period when humans started to permanently settle in the area.

3.2 Past and active surface processes

Surface processes mould the Earth's form. This is achieved by the weathering and erosion of surface materials to produce superficial materials, the transportation of these materials and their eventual deposition.

Greater Lincolnshire's relatively subdued topography and Pleistocene history of fluctuating climatic conditions provide excellent study and learning opportunities for many of these processes.

For each criterion the score should be determined from the following characteristics:

Condition of eroded structures	Extent of erosion or deposition	Condition of depositional materials

SP1 Aeolian weathering, transportation and deposition

Wind has a significant impact on sculpting the landscape. Sandy materials are more readily affected than coarser ones; meaning that areas with a more abundant supply of these materials, such as the coast or dry areas, see greater aeolian activity.

The Quaternary Period has seen sea level changes, glaciation and tundra climates which have created ideal conditions for interesting morphology to be created by the wind.

Table 1: Aeolian processes and features of higher value in Greater Lincolnshire

Process or feature	Notes
Coversands	Trapped by the northern end of the Lincolnshire Edge and the Wolds' escarpment, this sediment was eroded and transported by winds during post-glacial periods.

SP2 Fluvial erosion, transportation and deposition

Surface flow of water as rivers and streams carve and mould the landscape in probably the most observable way.

Rivers have meandered through Greater Lincolnshire navigating their way to the North Sea. Changing sea-levels and glacial ice in particular have heavily influenced the courses they have taken. The Lincoln and Ancaster Gaps are the result of the rivers once carving through the bedrock.

Table 2: Fluvial processes and features of higher value in Greater Lincolnshire

Process or feature	Notes
Palaeochannels	Remnant carvings of now inactive rivers that have since been filled with younger sediment.

SP3 Coastal and marine erosion, transportation and deposition

Coastal and marine processes sculpt the landscape through the movement of waves, currents and changing sea-levels.

Today the coastal balance is that of net landmass gain as sediments eroded from the coast north of the Humber and the floor of the North Sea are being deposited on Greater Lincolnshire's beaches.

Table 3: Coastal and marine processes and features of higher value in Greater Lincolnshire

Feature	Notes
Sand dunes	Mounds or hills of loose sediment created and sculpted by coastal processes.
Marine alluvium	Loose, unconsolidated silts, clays and peats which have been shaped and deposited by marine processes.

SP4 Glacial erosion, transportation and deposition

Glaciers have been one of the greatest influencers of the current landscape morphology of Greater Lincolnshire. The movement of large masses of ice results in the abrasion, grinding and plucking of underlying bedrock. Materials from these processes are deposited and build up as glacial moraines.

It is theorised that there were two advances of Devensian glacial ice from the North Sea onto the Wolds. The earlier of which advanced further as evidenced by the Stickney and Kirmington moraines.

Table 4: Glacial processes and features of higher value in Greater Lincolnshire

Feature	Notes
Proglacial lakes	Landscape carved out by temporary and short lived lakes that formed from glacial meltwater being trapped by 'ice dams'.
Dry valleys	Valley systems carved by glacial meltwater that no longer regularly sustain surface water flow.

SP5 Periglacial weathering, transportation and deposition

Freezing and thawing through the cycling of seasons and variable climatic conditions contributes to the breakdown and displacement of surface materials.

The retreat of the Devensian ice sheet around 14,500 years ago resulted in widespread permafrost conditions across Greater Lincolnshire. Cryoturbation and casts of ice-wedges can be found in sand and gravel from this time and the accumulation of solifluction materials (head deposits) can be found at the base of steeper slopes.

SP6 Landscape morphology created through hydrogeological processes

Much like surface water, ground water also carves through the bedrocks creating interesting features such as karsts. How rocks retain and permit the flow of water also has consequences on surface landscape morphology.

Structural weaknesses of the Wolds' underlying chalk and limestone allow these to act as important reservoir rocks, comprising a series of aquifers separated by impermeable beds. Many blow wells can be found amongst this landscape, and are the result of pressured water escaping from these underground reservoirs.

Table 5: Hydrogeological processes and features of higher value in Greater Lincolnshire

Process or feature	Notes
Blow wells	Largely unique to North East Lincolnshire they are formed when the pressure of overlying clay forces water, flowing through the permeable underground chalk, to the surface.

3.3 Sedimentary rock

Sedimentary rocks are one of the three main rock groups and are formed by the deposition and cementation of mineral and organic particles in layers known as strata. The most common of these types of rocks include sandstones, limestones and mudstones. Exposed examples of sedimentary rock are almost entirely dependent on humans, as most of Greater Lincolnshire is covered in sediment and sands of a more recent age. Exposures are usually achieved by quarrying but also due to road, railway and drain cuttings.

For more detail on sedimentary rocks in Greater Lincolnshire see the Geodiversity Strategy.

For each criterion the score should be determined from the following characteristics:

Extent of exposure **Condition of exposure** **Stratification**

Depositional structures **Stratigraphic significance**

SR1 Chalk

The Chalk of Greater Lincolnshire consists of four formations: Hunstanton, Ferriby, Welton and Burnham. Chalk occurs extensively in Greater Lincolnshire as it does in most of eastern and southern England but it is of Northern Province affinity.

Table 6: Chalk formations and features of higher value in Greater Lincolnshire

Formation or feature	Notes
Burnham Formation 92-88Ma BP 135-140m thick	The youngest chalk formation exposed in Lincolnshire characterised by hard chalk beds with significant marl seamss up to 15cm thick and the first appearance of tabular flints.
Welton Formation 94-92Ma BP c.50m thick	Chalk with marl seams and bands of mainly tubular or burrow-form flints. Basal 5m is flint-free and rich in inoceramid bivalve material.
Black Band Member	Mudstone and silty chalk units that together indicate an environmental change and mark the base of the Welton Formation. It represents a phase of stagnant water conditions that led to a minor extinction event (OAE2).
Ferriby Formation 100-92Ma BP 26m thick	Generally greyish chalk with thin marl bands but no flints. There are two pink bands which are particularly well-developed south of Louth.
Hunstanton Formation 110-100Ma BP c.3m thick	Rubbly to massive chalks with marl bands, typically pink to brick-red (due to disseminated haematite), but locally the upper part is grey due to secondary alteration of the iron minerals.

SR2 Sandstone

The dominant sandstone formation of Greater Lincolnshire is the lime-rich Spilsby Sandstone which has been used extensively as a local building stone. The distinctive green colouration is attributed to the weathering of the iron mineral glauconite.

Table 7: Sandstone formations and features of higher value in Greater Lincolnshire

Formation or feature	Notes
Elsham Sandstone	Extremely localised member situated in the mudstone-dominated Kimmeridge Clay Formation. Unique to Greater Lincolnshire and rarely exposed.

SR3 Limestone

The Lincolnshire Limestone, a Middle Jurassic formation subdivided into an upper and a lower member, separated by the Crossi Bed, provides Greater Lincolnshire's best known building stones, with the iconic Lincoln Cathedral built of Lincoln Stone. Its outcrop follows the Lincoln Edge from the Humber in the north to the southern margins of the county. There are also locally-significant limestone bands in the Lower Jurassic, particularly in the area to the north west of Grantham.

Table 8: Limestone formations and features of higher value in Greater Lincolnshire

Formation or feature	Notes
Tealby Limestone	Found exclusively in Greater Lincolnshire this limestone is usually poorly exposed.
Crossi Bed False Formations	A thin micritic limestone that is distinguishable by its *Acanthothiris crossi* brachiopod fossils. The quarryman term for biostromes that range up to 4m in thickness and occur within the Kirton Shale both at Lincoln and around Kirton-in-Lindsey.
Ancaster Limestone	Regionally famous building stones of Ancaster freestone, Hard White and Rag.

SR4 Ironstone

Ironstone in Greater Lincolnshire consists of three main formations; the Frodingham, Northampton Sand and Claxby ironstones, with other, subsidiary, iron-rich beds such as the Pecten Bed and Marlstone of the Lower Jurassic. All have been extensively used locally as building stones and proved to be economically valuable.

Table 9: Ironstone formations and features of higher value in Greater Lincolnshire

Formation or feature	Notes
Roach	Lower Cretaceous ferruginous sandstone with up to 33% iron content but with limited extent and found almost exclusively in Greater Lincolnshire.
Claxby Ironstone	Lower Cretaceous oolitic ironstone found exclusively in Greater Lincolnshire and usually poorly exposed. Formerly extracted at Claxby and Nettleton, it thins southwards and transitions to the Hundleby Clay south of Horncastle.
Northampton Sand Ironstone	Up to 8m thick, this Middle Jurassic ironstone is an important economic resource that has been worked in Colsterworth, Harlaxton, Leadenham and Greetwell (Lincoln) and in the neighbouring counties of Rutland/Northamptonshire, where it was the source material for the Corby Iron and Steel works.
Frodingham Ironstone	A Lower Jurassic ore, incredibly important in the development of the steel-making industry at Scunthorpe where it is also a significant building stone. With the decline of the steel industry and use of richer imported ores, many of the gullets where it is exposed are becoming flooded.

SR5 Clay and mudstone

Due to the small size of the particles that make up mudstone, they are deposited in low-energy environments such as in the deep sea. They are often interbedded with limestones and sandstones detailing a cycle of changing sea levels.

Table 10: Clay and mudstone formations and features of higher value in Greater Lincolnshire

Formation or feature	Notes
Ancholme Clay Group	Mudstones of the Kimmeridge, Ampthill and Oxford clay formations that underlie the majority of the land in the Ancholme valley and The Fens and are rarely exposed.
Mercia Mudstone	Of Triassic age and the oldest rocks that can be found exposed in Greater Lincolnshire. Typically red with greenish dolomitic bands
Ripple marks	Sedimentary structures formed by the movement of waves and currents.
Salt Pseudomorphs	Cubes, sometimes intergrown, preserved in mudstones of the Mercia Mudstone Group as halite (rock salt) crystallised on evaporation. The salt has since been dissolved and their crystal shape replaced by mud.

SR6 Tufa

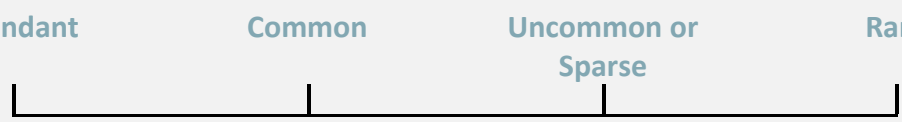
Tufa is a deposit that results after percolating lime-rich groundwater rising from depth, often along joints and fault lines, experiences reduced hydrostatic pressure and causes its less soluble content to precipitate. It commonly coats fault planes in limestones and chalk rocks but the county's prime example is the Dragonby Dragon near Scunthorpe where a narrow, 27 metre-long wall-like outcrop winds down a gentle slope.

3.4 Fossils

Fossils are formed from the remains and impressions of once living organisms which have been preserved by various natural processes.

They provide evidence of ancient life, evolutionary history and past environmental conditions. Fossils can also be used to age the rock and minerals in which they are found. In addition, observations of certain fossils' association with certain rock strata contributed to the recognition of geological timescales.

Each fossil category is denoted by its relative occurrence within Greater Lincolnshire and criterion scoring should reflect this:



For each criterion the score should be determined from the following characteristics:

Condition of specimens	Completeness of specimens	Assemblages of species
Resemble a death event	Found in situ	Sediment preserved in

Fo1 Crustaceans

Rare

This is the second biggest group of arthropods after insects. However, fossils of crustaceans tend to be incomplete and fragmented because of the softer parts of their body which form the joints between the exoskeleton, decomposing quickly.

Fo2 Echinoderms

Uncommon or Sparse

A group of primarily seafloor-dwelling animals, the most abundantly found being echinoids (sea urchins). They inhabit every ocean depth as well as intertidal regions, so they are found in rocks of all ages and sediment types. Echinoderms are easy to spot and identify, generally exhibiting five-fold symmetry and are of stratigraphic importance in the Chalk.

Table 11: Echinoderm fossils and features of higher value in Greater Lincolnshire

Fossil or feature	Notes
Crinoids	A group of marine animals commonly called 'sea lilies' that first appeared in the Middle Cambrian and still exist today. It is a type of echinoderm fossil that usually have segmented stems.
Starfish	These are very rarely found as fossils however Scunthorpe's Frodingham Ironstone is one of the few rocks to preserve them.

Fo3 Molluscs

Abundant

These are an incredibly diversified group of marine and terrestrial invertebrates that have been common throughout much of their 530 million-year existence.

One of the more notable and abundant fossilised remains are provided by the now-extinct ammonites, a rapidly evolving group that serves as an extremely valuable indicator to geologists when dating rocks. Belemnites are probably the most abundantly-found fossils of this group. They occur in Jurassic and Cretaceous rocks but are also washed up on beaches. Unlike ammonites, softer parts of belemnites are sometimes preserved too, but only rarely.

Table 12: Mollusc fossils and features of higher value in Greater Lincolnshire

Fossil or feature	Notes
Fossilobiceras	A recent discovery of a specimen of this ammonite genus confirms a new understanding of the age and internal stratigraphy of the Lincolnshire Limestone.
Rasenia	A genus of ammonite whose name derives from Market Rasen where specimens are commonly found.
Nerinea	An extinct genus of turreted gastropod, cross sections of which, when preserved in calcite, characterise the Silver Beds of the Lincolnshire Limestone.
Inoceramids	A group of bivalves that show clear evolution during the late Cretaceous and are therefore important time indicators in the Chalk.

Fo4 Brachiopods

Common

These are marine animals that possess a shell consisting of a pair of valves. Having existed for around 550 million years they were once the most abundant organism on the sea floor, being a common resident of the earliest reef systems. Their abundance and diversity plummeted significantly during the Permian – Triassic extinction event and never managed to fully recover, although they do still inhabit colder and deeper waters.

Table 13: Brachiopod fossils and features of higher value in Greater Lincolnshire

Fossil or feature	Notes
Moutonithyris	A terebratulid brachiopod that is characteristic of the Red Chalk.

Fo5 Corals

Uncommon or Sparse

Corals are marine invertebrates. Occurring predominantly within shallow, warm and clear seas, the fossilised remains of corals can be found almost exclusively within limestone. Specimens can be found of both solitary corals and as colonies of many identical individual polyps.

Table 14: Coral fossils and features of higher value in Greater Lincolnshire

Fossil or feature	Notes
Patch reefs	As an important reef builder in warmer shallower seas, assemblages of corals can very occasionally be preserved in the communities that they lived.
Knolls	Localised coral colonies, particularly in the Lincolnshire Limestone, that have been recrystallised and stand out as hummocks. In the past some have been mistaken for burial mounds.

Fo6 Sponges

Uncommon

These very simple organisms are rarely preserved in three dimensions, the exception being *Porosphaera* in the Chalk which resemble large mint imperials.

Fo7 Plants

Rare

Plants present valuable information on environmental conditions at intervals throughout geological history.

Quaternary sea-level rises have resulted in mixed broadleaved plantations of oak, birch, alder and lime having been submerged along the coast. Remnant stumps and trunks can periodically be seen uncovered when the sediment is eroded.

Table 15: Plant fossils and features of higher value in Greater Lincolnshire

Fossil or feature	Notes
Submerged forests	The known extent of forests that became submerged by rising Quaternary sea-levels. They provide an excellent example of how the geological record can be built through short-term catastrophic events.

Fo8 Reptiles and amphibians

Rare

These two groups of animals have, at various intervals, dominated both the Earth's lands and seas, yet appear infrequently in the fossil record.

Fossil remains of a marine reptile known as an ichthyosaur can be found in the late Jurassic Kimmeridge Clay and as derived bones and teeth in the overlying early Cretaceous Carstone. More notably, remains have been uncovered in the Lower Spilsby Sandstone close to the Upper Jurassic and Cretaceous boundary, a time when the ichthyosaurs' dominance of the seas began to fade. Recently, an incomplete specimen of a pliosaur was recovered from the Kimmeridge Clay at South Ferriby.

Fo9 Fish

Rare

The appearance, explosion and diversification of fish to resemble what we know of them now occurred mainly in the Devonian period, pre-dating times that are exhibited within Greater Lincolnshire's surface geology.

Complete or extensive specimens of fish are extremely rare as they are unlikely to be left to settle undisturbed within the sediment. Their scales and teeth can be more frequently found.

Fo10 Mammals

Rare

Mammals arrived relatively late in the geological timescale, so most of these fossils can be found in deposits laid down during the Quaternary period, a time that saw extreme variations in climate and periods of widespread glaciation.

Megafauna once roamed the area with Welton-le-Wold providing specimens of straight-tusked elephants, deer and bison. Colder periods would have seen Greater Lincolnshire in the range of species such as woolly mammoth and woolly rhinoceros.

Fo11 Insects

Rare

The rarity of insect fossils is due to the poor preservation potential of insects' exoskeleton and therefore their scarcity within the sedimentary profile. Amber has proven to be a more effective medium in which to preserve insect specimens; however this too is rarely found in Greater Lincolnshire.

Fo12 Trace fossils

Abundant

The fossilised marks left behind by organisms whilst they were alive, the most visually impressive of which are often footprints, but also include more abundant examples of the reworking of soils and sediments known as bioturbation. They represent the behaviourisms of organisms and don't require the preservation of their body parts.

Table 16: Trace fossils and features of higher value in Greater Lincolnshire

Fossil or feature	Notes
Footprints and tracks	Impressions left by either terrestrial or marine organisms on softer substrates.
Burrow and tube flints	Types of flint found in the Welton and Burnham Chalk formations which have clearly formed within a burrow or burrow complex.

Fo13 Early human history

Rare

Humans of later parts of the Pleistocene were attracted to areas of Greater Lincolnshire and the Wolds during warmer interglacial periods for various economic reasons such as the high flint content of the chalk here. Evidence can be found of tools made out of this flint at places such as Welton-le-Wold.

3.5 Tectonic structures

Tectonic structures are deformations of the Earth's crust that can occur at various scales. From these we can deduce the direction and magnitude of forces driving deformation throughout geological history.

Greater Lincolnshire's landscape is not one of obvious tectonic activity with no towering mountain ranges. However tectonic processes have contributed to its morphology and structures on a smaller scale can be found within the rock strata.

For each criterion the score should be determined from the following characteristics:

Clarity of structure **Significant displacement** **Complexity of structure**

Effects on landscape morphology

TS1 Jointing

These are planar discontinuities of rock, where there is often no or limited displacement of adjacent rocks. Jointing in a strata can form after the removal of overlying rocks and sediment reducing the burden placed upon it, causing it to 'decompress' relative to surrounding still burdened rock.

TS2 Faulting

These are structures created by the displacement of adjacent rocks. There are several different types of faults: normal, reverse, transcurrent and slickensides.

TS3 Folding

When earth materials are subjected to compression and tension at depth below the Earth's surface, the greater pressures and temperatures allow the rocks to 'flow' as opposed to shear and break, creating fold structures. These include anticlines, synclines and monoclines.

TS4 Cambering

The process and structures formed by the squeezing of underlying softer rocks by overlying harder rock formations, resulting in the softer rocks bulging out from the sides of slopes and the hard rock sagging down. There are good examples along the Wolds scarp north of Caistor where Chalk directly overlies mudstone of the Ancholme Clay Group.

3.6 Mineralisation

Mineralisation is the formation and/or emplacement of, usually, economically important metals or chemical salts through sedimentary, hydrothermal or weathering processes.

For each criterion the score should be determined from the following characteristics:

Abundance of mineral **Clarity of structure** **Exposure of mineral**

Type of mineral **Form of deposition**

Mi1 Veins

These are crystallised minerals within a rock that are deposited through the precipitation of a fluid flowing through fractures. As a result bands or sheets of these crystallised minerals form.

Mi2 Evaporite

These are water soluble minerals that are concentrated and undergo crystallisation through evaporation of the solvent, usually water. These can be divided up as either marine or non-marine deposits as the composition of minerals between the two varies significantly.

Non-marine deposits, such as halite and gypsum, can be found in the older Triassic rocks of the northwest. These formed in a hot, arid desert that was subject intermittently to flash flooding.

Mi3 Secondary minerals

These are minerals that form through the chemical or physical alteration of existing minerals.

Lincolnshire Limestone's colour and aesthetic appeal as a building material can be contributed to its secondary mineral content, ranging from creamy white to yellow-orange colourations.

Mi4 Pseudomorphs

These are minerals that have replaced an original mineral deposit but have retained its structure and shape.

3.7 Igneous and metamorphic rocks

These are the two other of the main three rock types along with sedimentary; igneous being formed through the cooling and solidification of magma and lava, and metamorphic forming through the physical and chemical transformation of other rock types when subjected to heat and pressure.

There are no igneous or metamorphic rocks occurring *in situ* at the surface within Greater Lincolnshire, however samples of these rocks can be found displaced from areas further afield such as North Yorkshire which have been transported by glacial or fluvial processes.

For each criterion the score should be determined from the following characteristics:

Origin of erratics | **Mode of erosion and transportation** | **Size of erratics**

Abundance of erratics | **Condition of erratics**

IR1 Igneous erratics

There are no known igneous rock sequences in Greater Lincolnshire however dislodged rock or 'erratics' can occasionally be found having being transported by past glacial advances.

MR1 Metamorphic erratics

There are no known metamorphic rock sequences in Greater Lincolnshire however dislodged rock or 'erratics' can occasionally be found having being transported by past glacial advances.

3.8 Combination of features

A site may not possess one single geological or geomorphological feature to justify its selection, but may exhibit multiple complementary features that possess some learning potential. Together, these will tell a story of geological history or geodiversity processes.

Com1 A combination of geological or geomorphological features

These are sites that possess at least two geological or geomorphological features receiving a score of 7-8, or at least three receiving a score of 5-6.

4 Additional information

4.1 Overview

4.1.1 Once a site has been proposed as meeting any selection criteria Educational and Cultural (see Sections 4.2 and 4.3) significance should be considered and explained in full.

4.1.2 The Educational and Cultural sections provide useful information for the intended audience(s), if any, to which the site can provide valuable learning, research and enjoyment opportunities.

4.1.3 When assessing Educational and Cultural value of the site it is important to consider the safety of access of the site for the intended groups.

4.1.4 The Geological period section (see Section 4.4) simply describes the time in the Earth's history to which the site relates. It gives the audience an impression of the wider environmental conditions present at the time the feature was created.

4.2 Educational

This section may require input from qualified teachers, lecturers and field trip leaders to ensure that the correct level is assigned to a site. Most sites will have some educational value.

For each criterion the score should be determined from the following characteristics:

Illustration of processes and products	Potential for further research
Potential for stimulating audiences interest	Interpretation material available
Part of a 'geological trail' of sites	Accessible/can absorb limited damage

Ed1 Suitable for teaching up to A-level

This assesses the suitability of the site to engage with students up to A-level. These groups may typically be larger and require a greater degree of safety considerations.

Ed2 Suitable for teaching at undergraduate level

This assesses the suitability of the site for representing more complex geodiversity processes and features which require a greater level of study. The site may also be a valuable subject for undergraduate self-learning research projects.

Ed3 Suitable for teaching other groups

This assesses the suitability of the site to engage with the wider public to develop an interest for geodiversity in people of all ages as well as lifelong learning potential.

Ed4 Potential for further primary research

This assesses the suitability of the site to be used as a study sample in primary research that may expand our knowledge of geodiversity processes.

4.3 Cultural

Geodiversity has significant societal importance; not only do local communities attach values to particular places, but those places have often provided the raw materials to create those communities and the industries that they depend on.

For each criterion the score should be determined from the following characteristics:

Historical links to communities	Ongoing influence on communities
Ability to capture imagination	Sparks an interest in wider geodiversity

Cu1 Historical associations

This recognises a site or its features' historical associations to archaeology, literature, nationally or locally famous people and events and how it has contributed to the development of our understanding of geodiversity. This may include their associations with earth scientists and their work as well as any major geological references.

Cu2 Local folklore and events

This recognises the connections of the site, its features or morphology to local folklore or religious and archaeological events.

Cu3 Aesthetic enjoyment

This recognises the influence that the aesthetic value of a site within the landscape has on promoting public awareness and appreciation for geodiversity.

Cu4 Economic geology

This recognises and studies how Greater Lincolnshire's geodiversity and resources shape local economy, culture and the towns and cities.

4.4 Geological period

Knowing the geological time period represented by the features at each site is an important part of the process of understanding. It allows sites to be more easily understood by those with limited geodiversity knowledge so they can be placed in context in Greater Lincolnshire and nationally.

Quaternary

Evidence of this period is visible in Greater Lincolnshire's landscape and morphology rather than in the bedrock with over half of the present land surface of the county blanketed with a covering of sands and till that formed during this time.

Late Cretaceous

The youngest bedrock of Greater Lincolnshire formed during this time, creating the Lincolnshire Wolds as a clear ridge of chalk in the east, running north to south.

Early Cretaceous

A transition in depth of sea resulted in Jurassic mudstone being overlain first by sandstones and then by limestone. Natural exposures of this period are rare but there is ample borehole information to demonstrate a thinning of the succession north to Claxby.

Late Jurassic

These very soft and easily eroded rocks have formed the low areas east of the limestone ridge and west of the chalk ridge. Beginning in the north they continue south and form a wide area beneath the younger sediments in The Fens.

Middle Jurassic

The sedimentation in the clear, warm and shallow seas of this time created the thickest stratum of all Lincolnshire's rocks - the Lincolnshire Limestone. This forms a north to south ridge in the west, upon which the City of Lincoln sits.

Early Jurassic

There was great contrast in the depth of seas at this time from the north to the south of Greater Lincolnshire, with the north being much shallower. It was in the north that the iron rich limestone that would become the Frodingham Ironstone formation was laid down.

Triassic

The oldest of Greater Lincolnshire's rocks that can be found at the surface can be seen along the River Trent and on the Isle of Axholme. These were laid down on the coast of a shallow tropical sea when the supercontinent Pangaea, was centralised at the equator.

Glossary

Terms and acronyms

Greater Lincolnshire Nature Partnership (GLNP) - brings together local authorities, statutory agencies, voluntary and not-for-profit organisations with a responsibility for and interest in nature in Greater Lincolnshire. It coordinates action, information and protection, and provides services for Partner organisations. The Partnership is independent of any of its constituent organisations. Partners are listed on the website: www.glnp.org.uk.

Greater Lincolnshire Nature Partnership Steering Group (GLNP Steering Group) - consists of representatives of the GLNP Partner organisations who meet to determine policy and action.

Lincolnshire Biodiversity Partnership (LBP) - see Greater Lincolnshire Nature Partnership, which replaced it in 2012.

Lincolnshire Environmental Records Centre (LERC) - collects, collates, manages and disseminates information relating to the species, habitats and sites of the Greater Lincolnshire, under the auspices of the GLNP.

Local authority - in this document this term is used to describe the two unitary authorities (North Lincolnshire and North East Lincolnshire), Lincolnshire County Council, the five district councils (East Lindsey, North Kesteven, South Holland, South Kesteven and West Lindsey), one borough council (Boston) and one city council (Lincoln).

Local Geological Site (LGS) - are equivalent to LWSs, but are selected for geological or geomorphological interest. Guidelines on their identification and selection can be found on the GLNP website at www.glnp.org.uk.

Local Geological Sites Panel - is a working group of the GLNP. This is the Panel of experts that assess candidate LGSs against the selection criteria and make decisions on their selection (see Section 1.4).

Local Plans - the current spatial planning strategy which was proposed for replacement by Local Development Frameworks (LDFs) in 2004. Local Plans were reinstated by the NPPF in 2012.

Local Site - is the umbrella term advocated by Defra (2006), and often describes LGSs, LWSs, RIGSs, SNCIs and many more. When used in policy or by local authorities it can also include Local Nature Reserves (LNRs).

Local Wildlife Site (LWS) - is the term that has been advocated for general use by Defra in their guidance. The GLNP only considers a site in Greater Lincolnshire to be an LWS when it has selected using the agreed selection criteria.

National Planning Policy Framework (NPPF) - this document, published in 2012 and revised in 2018 set out to simplify the planning system, reduce the number of policy documents and provide guidance for planning authorities. The document can be found at: https://www.gov.uk/government/publications/national-planning-policy-framework--2.

Planning Policy Statement (PPS) - these were published by the Office of the Deputy Prime Minister (ODPM), replacing Planning Policy Guidance. They have now themselves been superseded by the NPPF, though some accompanying Government Circulars are still relevant.

Regionally Important Geological and Geomorphological Site (RIGS/RIGGS) - established in 1990 by the Nature Conservancy Council (NCC), RIGSs were the most important non-statutory geoconservation sites at the time. Selection was based on local knowledge before development of the LGS selection criteria.

Service Level Agreement (SLA) - is the formal definition of services to be provided, in this case between the GLNP and its Partner organisations, for an agreed fee.

Site of Nature Conservation Importance (SNCI) - sites referred to in a Local Plan, selected as being of importance for nature conservation on the basis of local knowledge before development of agreed selection criteria. The term SNCI has been used by East Lindsey District Council, Lincolnshire County Council, North East Lincolnshire Council, South Kesteven District Council and West Lindsey District Council.

Site of Special Scientific Interest (SSSI) - part of the national suite of sites providing statutory protection for the best examples of the UK's flora, fauna, or geological or physiographical features. These sites are also used to underpin other national and international nature conservation designations, and are currently designated under the Wildlife and Countryside Act 1981 (as amended in the Countryside Rights of Way Act 2000). A list of SSSI can be found at: Sites of Special Scientific Interest (SSSIs) in England - NECR414 (naturalengland.org.uk)

Geological terms

Aquifer - an underground layer of permeable rock or unconsolidated materials that is often saturated with water.

Cryoturbation - the mixing of materials from various layers of the soil due to freezing and thawing.

Bedrock - the rock that lies under the loose softer materials of more recent periods.

Flint - a hard rock consisting predominantly of silica, it occurs most commonly as nodules in chalk.

Formation - a group of rock strata that have comparable properties with clearly defined lower and upper boundaries.

Geodiversity - the variety of rocks, minerals, fossils, soils and landscapes, together with the natural processes that form them.

Geological timescale - a system of chronologically dating of strata used to study the timing and relationships between past events.

Geomorphology - the physical features of the surface of the Earth and their relation to its geological structures.

Gypsum - the crystalline form of the hydrated form of the mineral calcium sulphate ($CaSO_4$). The non-hydrated form is called anhydrite. Both are evaporite minerals produced by the gradual drying up of a shallow sea basin or temporary lake.

Holocene - the current geological time period that began approximately 11,650 years before present. It is the more recent of the two time periods forming the Quaternary period.

Member - a distinct rock unit within a formation often of local or regional extent.

Moraine - an accumulation of glacially derived debris that forms laterally or at the foot of a glacier.

Period - within the geological timescale this is a subdivision of an era typically ten to one hundred million years in length.

Permafrost - perennially frozen soil, rock or sediment in areas not covered in ice.

Pleistocene - often referred to as ‘the Ice Age’ as it spans the most recent interval of repeated glaciation. This began at the start of the Quaternary period until it was preceded by the Holocene.

Plucking - the process of rocks becoming frozen to a glacier and then being removed from the bedrock as the glacier moves.

Solifluction - the gradual movement of wet soils and other materials down a slope as a result of freezing and thawing. Permafrost being impermeable to water results in overlain soil becoming saturated allowing it to 'flow' down a gradient.

Stratum - a distinct layer or bed of rock with well-defined boundaries.

Superficial materials - unconsolidated materials typically less than 2.6 million years old.

Tabular - the tendency for the rock or mineral to separate into thin flat pieces. Also used to describe the form of massive sheets of flint.

Tectonic - the processes occurring within the Earth's crust and the structural deformation caused by it.

Topography - the physical appearance of the natural surface features of an area of land.

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Appendix 1: Site assessment form

Guidance

A. This is a double-sided site assessment form. It is intended for use in both baseline surveys and monitoring surveys. One site assessment form must be completed for each site, or for each recording unit/subsite (if relevant). The form should be read in full before the survey begins, and the relevant geodiversity/features/choices scored for each site/recording unit/subsite.

B. All of the boxes in the top section (above 'History and present status') are compulsory, as without them surveys are invalid.
   - Grid references should be either the central grid reference, or start and end grid references for linear sites, and should be to a resolution of at least 100m.
   - Subsite names are not always relevant, but where they are, numbers or letters are adequate. Another example might be "*South east quarry*".
   - Survey type should be known, but consult the party that has commissioned the survey if it is not (or see Paragraph 2.4.15 and Figure 2).

C. The history and present status of a site is to give the Panel any relevant contextual information to assess its relative importance. This will include past and present statutory and other non-statutory designations the site has, its industrial history, the methods via which the features were exposed and its use by the local community.

D. The description of geology/geomorphology section of the form is one of the most important as it tells the Panel for which features the site should be assessed. It is also used as the evidence base to justify the designation and as a reference in future monitoring visits. This section of the form should be completed in as much detail as possible and supplementary evidence and illustrations should be provided. This is also used to justify the proposed site boundary.

E. Geological and geomorphological selection criteria listed on the survey form should then be scored from 1 to 10 where appropriate (see Section 3.1) based on the surveyor's judgement and evidence provided in the site description. The Panel will review these scores against this evidence as well as its own expertise of the geodiversity of Greater Lincolnshire and therefore the scores may be adapted after the survey with the surveyor's consultation.

F. Educational and Cultural options should be ticked and justified in the allocated space. The Panel will review this justification and agree whether or not the selected options are correct.

G. The geological time period(s) that the site's important features exhibit should be selected and justified in the allocated space.

H. Survey constraints should be identified to allow the Panel to review the thoroughness of the survey and evidence provided.

I. Threats and influences to the geodiversity features should be identified and relevant options selected on the form. It should be detailed which features are specifically at threat and the extent of this. Clarification should be made between threats and influences that may be physically damaging to the site's features and those that may affect educational and cultural importance of the site (i.e. the build-up of vegetation may not damage an exposure but will limit the value of the site for use as a learning tool to certain groups).

J. Evidence of management should be looked for and if possible sought from the landowner. The relevant management options should be selected on the form and details supplied. Any additional supplementary evidence such as photographs or management evidence supplied by the landowner should be included.

K. An assessment on whether the site is in a desirable condition for use of its feature(s) should be made by the surveyor and is to be agreed by the Panel. A site should be given a 'yes' when it is clear that it is in a fit state for use of its features (e.g. for educational features via regular school visits) and if the important features are in a desirable condition.

L. Management requirements need to be determined, including assessing the identified threats and influences to the feature(s) and defining what is necessary to negate or reverse their impact.

M. Finally the level of required management (being undertaken, not going to be undertaken etc.) should be filled in after consultation with the landowner. This final stage is the most critical in determining a site's condition and requirements. This enables the conservation management status of the site to be determined by the LGS Panel, as shown in Table 17 below.

Table 17: The deduction of condition and conservation management statuses

Is the site in a desirable condition?	Management status	Condition Status	Conservation management status
Yes	Minimal management (monitoring only)	Good	Positive
Yes	Management required and is being undertaken	Good improving	Positive
Yes	Management required and is going to be undertaken	Good steady	Positive
Yes	Management required and is not going to be undertaken	Good declining	Negative
Yes	Management required but is not possible	Good declining	Negative
Uncertain/No	Management being undertaken	Poor improving	Positive
Uncertain/No	Management going to be undertaken	Poor steady	Negative
Uncertain/No	Management not going to be undertaken	Poor declining	Negative
Uncertain/No	Management not possible	Poor declining or lost	Negative

Figure 3: LGS site assessment form front page

Site name			Grid reference(s)				GLNP GREATER LINCOLNSHIRE NATURE PARTNERSHIP	
Subsite name			**Date visited**					
Surveyor(s)			**Start**		**End**	**Duration**	**Local Geological Site assessment form**	Last updated February 2024
Survey type:	Baseline	Monitoring						

Survey constraints					
Physical accessibility		Weather		Livestock	
Quarrying/works		Other			
Details:					

History and present status (including SSSI, LWS, etc) **including sustainability**

Site grading					
High		Moderate		Low	
Justification:					

Description of geology/geomorphology (boundary map, field sketches, graphic logs and photographs on separate sheets)

Past and active surface processes					(please tick)
Aeolian processes		Fluvial processes		Coastal and marine processes	
Glacial processes		Periglacial processes		Hydrogeological processes	

Stratigraphy of the site							(please tick)
Quaternary		Late Cretaceous		Early Cretaceous		Late Jurassic	
Middle Jurassic		Early Jurassic		Triassic			

Sedimentary rock					(please tick)
Chalk		Sandstone		Limestone	
Ironstone		Clay and mudstone		Tufa	

Fossils					(please tick)
Crustaceans		Echinoderms		Molluscs	
Brachiopods		Corals		Sponges	
Plants		Reptiles and amphibians		Fish	
Mammals		Insects		Trace fossils	
Early human history		Outstanding features:			

Tectonic structures							(please tick)
Jointing		Faulting		Folding		Cambering	

Mineralisation							(please tick)
Veins		Evaporite		Secondary minerals		Pseudomorphs	

Igneous and Metamorphic rocks			(please tick)
Igneous erratics		Metamorphic erratics	

Figure 4: LGS site assessment form back page

Educational					(please tick)
Suitable for teaching up to A-level		Suitable for teaching at undergraduate level			
Suitable for teaching other groups		Potential for further primary research			
Justification:					

Cultural					(please tick)
Historical associations		Local folklore and events		Aesthetic enjoyment	
Economic geology					
Justification:					

Threats and influences to the features					(please tick)
Vegetation		Agricultural practices		Scree/mass movement	
Development		River management		Ground stabilisation	
Water level change		Flooding		Dumping/landfill	
Sea defences		Quarrying/engineer works		Other	
Details:					

Evidence of management					(please tick)
Non-intervention		Removal of scree		Removal of vegetation	
Exposing new faces		Maintaining interpretation boards		Other	
Details:					

Is the site in a desirable condition?					(please tick)
Yes		Uncertain		No	

Management requirements
What management is required (if any) for the feature(s) to reach/maintain a desirable condition?

Is this required management:				(please tick)
Being undertaken		Not going to be undertaken		
Going to be undertaken		Not currently possible		

Appendix 2: Baseline survey guidance

A. Permission for survey should be obtained before the site is visited (see Appendices 5 and 6).

B. The three main aims of the baseline survey are:
   1. To assess if the site qualifies for LGS status against the current selection criteria and determine a suitable boundary.
   2. To document the baseline condition of the site.
   3. To identify the conservation management status of the site.

C. Sites should be surveyed as a whole if they are relatively small and homogeneous. Larger and/or more complex sites should be split into multiple recording units; subdivision should be logical and based on management units, major geological and geomorphological features or variation in the state/value of these features. Generally, all units should be surveyed separately. This approach allows the Panel to assess each subsite on its own merits and prevents the inclusion of areas of less geodiversity interest where they do not add value to the site as a whole.

D. Site and recording unit boundaries must be clearly recorded, ideally on a map or aerial photograph. It is preferable to use boundaries that are obvious both on maps and on the ground, such as fences, hedges, paths and watercourses, so that returning surveyors can repeat the process. If obvious boundaries are not available, care should be taken to describe the boundaries in the site description.

   The surveyor has the responsibility of proposing the best boundary for the Panel to consider, and should divide the site accordingly at survey. Final site boundaries should include the main interest features as well as buffer areas where appropriate. Areas of less interest should still be surveyed, but ideally as easily definable units that can be rejected while the rest of the site is selected.

E. Any relevant information that can be obtained from the owner/manager should be recorded. This includes past and present management, future intentions and changes in geological exposures or site morphology. If such data is not available, then the surveyor should try to infer management issues from site condition and other evidence while on site. This will help the Panel to decide the conservation management status of the site.

F. Time spent on site should be noted, as well as any constraints such as torrential rain or intimidating livestock/dogs. This allows the Panel to assess the degree of thoroughness of each survey, so that failure to satisfy selection criteria can be put into context. If there is only a quick visit, for example, this might result in deferral and a request for further survey under more appropriate circumstances.

G. The surveyor should identify and record as many geological or geomorphological features with which they feel comfortable. This should include a description on how these features have formed and the geological history of the site.

H. Surveyor health and safety is the responsibility of the employing organisation. Surveyors must adhere to their organisation's health and safety guidelines and risk assessment procedures. In addition they should act responsibly and in good faith while representing the party that has commissioned the survey.

Appendix 3: Monitoring survey guidance

A. Monitoring surveys should require only the minimum amount of time on site in order to reduce financial pressure on local authorities and to cause the minimum of inconvenience to the owner/manager. For this reason:
   - Full site description including field sketches and photographs of geodiversity interest are not needed unless significant change has occurred to the site to change its value or reasons for designation. Or alternatively if it is felt that the previous information was false or incomplete.

B. The three main aims of the monitoring survey are:
   1. To check that the site still qualifies as a LGS when assessed against the current selection criteria.
   2. To assess the condition of the site (in comparison to its condition at the previous survey stage), and to record the reasons for any improvement or degradation.
   3. To identify the conservation management status of the site.

C. It is important to note that the monitoring survey procedure outlined here can only be undertaken where the baseline survey data is adequate. The GLNP and the Panel may find it necessary to request that baseline survey procedure is followed in place of the first monitoring survey in some cases.

D. Monitoring surveys provide the opportunity to check that owner/manager contact details and boundaries are still accurate. It should not be assumed that the existing owner/manager information is completely correct or that all of the parties involved in ownership and management are known. Surveyors should always check with the contacts that they have whether anyone else needs to be involved in the consultation process.

E. Permission for monitoring surveys should be obtained before the site is visited, in the same manner as for baseline surveys.

F. Efforts should be made to identify and follow the boundaries used at the baseline (or previous) survey stages(s). Proposals can be made to the Panel to amend boundaries, but the reasons for these changes should be adequately recorded. If boundary changes appear necessary, then baseline survey data (see Appendix 2) is needed for the areas to be added.

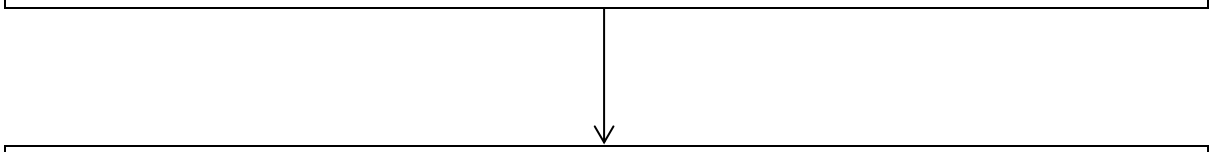
G. If evidence from the monitoring survey suggests that a site is degraded or lost, the surveyor should alert the GLNP who will report this to the local authority.

Appendix 4: Survey procedure

NB. Sites may be considered as a single unit or surveyed as a number of subsites, for ease the description below uses 'recording unit' to cover both of these.

Before visiting

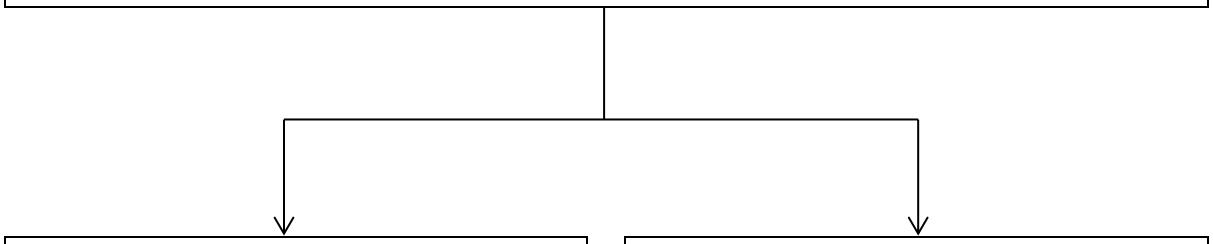
- Identify all owners/managers of the site.
- Initiate contact; ideally in writing, covering the relevant background information, enclosing a map of the area, and outlining the purpose of the survey (see Appendix 5). Follow up, if necessary, by telephone or possibly a face-to-face meeting.
- Request permission to visit.
- If permission is refused, inform the local authority and the GLNP when submitting data.
- If permission is given, agree a visit procedure with the contact(s).
- If it is feasible, discuss management practices and issues with the contact(s).
- Record all the above details for future reference and submission to the GLNP.
- Look at available data about the site and use it as a basis for the forthcoming site visit. This could include citations, previous geodiversity surveys and maps; these can be supplied by the GLNP where they exist.



On site

The following should be taken to the site:

- A copy of any previous boundary maps, field sketches and supporting text (if relevant).
- A blank base map.
- An aerial photograph (optional).
- A 1:25,000 OS map of the area.
- Owner/manager contact details and instructions.
- A supply of survey forms, pencils and paper, a clipboard with a waterproof covering, evidence of identification, appropriate outdoor clothing, binoculars, any additional survey equipment, and a camera.



Baseline survey

- Follow all reasonable requests of the owner, such as meeting beforehand.
- Assess the appropriate approach to the survey, including division into subsites (if relevant).
- For every recording unit:

Monitoring survey

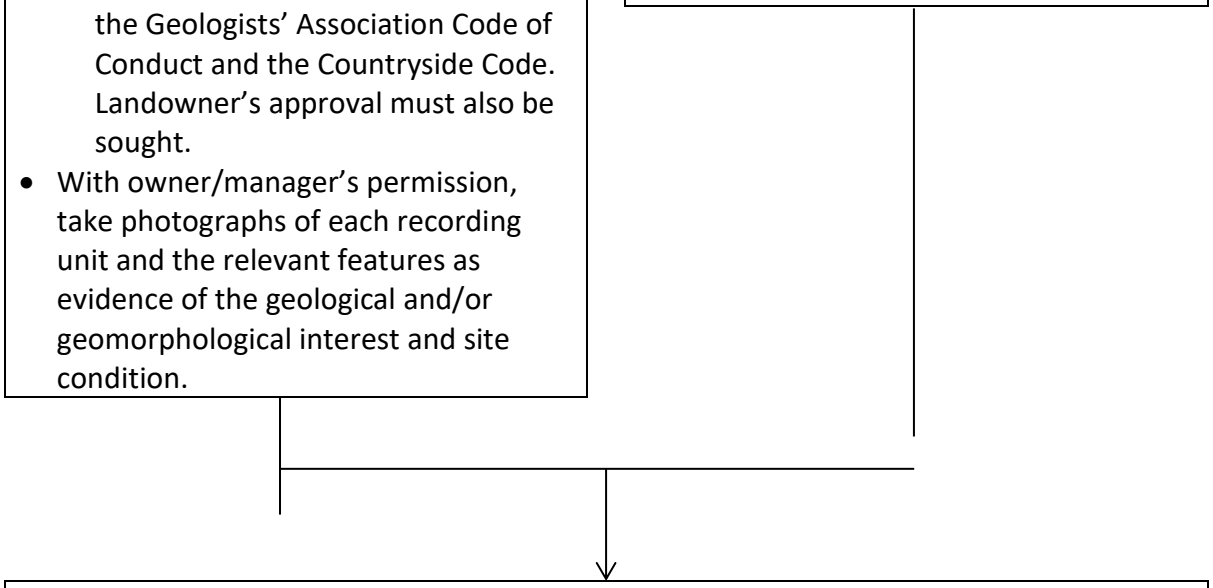
- Follow all reasonable requests of the owner, such as meeting beforehand.
- Assess and repeat (as much as possible) the approach taken for the baseline survey, i.e. the same divisions into recording units (if relevant).
- For every recording unit:

- Complete one site assessment form (see Appendix 1) as fully as possible.
- Give clear and detailed descriptions providing enough supporting evidence and documentation for the LGS Panel to make a correct interpretation and fair assessment.
- Annotate the base map to show boundaries.
- Record a geological face or feature in detail. Measurements are important though not always practical to take; accurate dimensions should be used and the use of a scale where possible.
- Samples and specimens should only be taken if they are required in the context of field recording for the site. All activities should conform to the Geologists' Association Code of Conduct and the Countryside Code. Landowner's approval must also be sought.

• With owner/manager's permission, take photographs of each recording unit and the relevant features as evidence of the geological and/or geomorphological interest and site condition.

- Complete one site assessment form (see Appendix 1) as fully as possible.
- Look for all features previously recorded, scoring their current value as appropriate.
- Note any additional features of interest that may be present.
- Annotate the base map to show any proposed changes to boundaries and complete new field sketches where site morphology has changed significantly.

• With owner/manager's permission, take photographs of each recording unit and the relevant features as evidence of the geological and/or geomorphological interest and site condition.



After the survey

- Provide the GLNP with the following for every site surveyed:
  - A proposed site name.
  - A proposed site boundary map (or boundary on a GIS layer of all sites). This does not have to match the surveyed boundary, but if there is a difference both should be supplied.
  - A map showing fully labelled or numbered recording units/subsites (if relevant).
  - For every recording unit:
    - A completed site assessment form.
    - Details for all site owners/managers contacted including both those that refused and those that gave permission. Copies of letters sent to landowners or dates of conversations are additional information that is incredibly useful but not required.

Appendix 5: LGS assessment using existing external data

Guidance

A. Increasingly, limited resources are affecting the survey and monitoring of LGSs; the 5-10 year monitoring cycle is also proving demanding in an area with so many sites. The following procedure allows the GLNP Team and the Panel to assess candidate LGSs without funding for specific LGS surveys.

B. Data from external sources (i.e. not acquired during a LGS survey) should only be submitted to the GLNP if it is compatible with the following essential requirements:
   - Information on geological features is collected by individuals of proven geological skill and reliability.
   - Data is less than 10 years old, but ideally no more than five years old.
   - The data meets all the requirements described in Section 2.3, or have been approved by the Panel, and permission has been given from the intellectual rights holder(s).
   - The landowner is aware that the site is to be assessed as a LGS.
   - There is a clear indication that LGS selection is a realistic outcome.

C. If assessment against the selection criteria produces a near-miss qualification, it may highlight the importance of commissioning a LGS survey of that site or even a larger area. This may be useful for local authorities looking at future funding and for targeting areas of geodiversity value for conservation action.

D. Submission of data to the GLNP results in that data being made available for LERC purposes, for example for data requests.

Procedure

For the external party submitting the data

1. Site description and relevant supporting evidence needs to be detailed enough to allow the Panel to make an informed assessment on how the site scores against the selection criteria detailed in Section 3 and additional information of Section 4.
2. The following should be supplied for each site:
   - A proposed site name.
   - A proposed site boundary map (or boundary as a GIS layer of all sites). This does not have to match the surveyed boundary, but if there is a difference both should be supplied.
   - A map showing fully labelled or numbered recording units/subunits (if relevant).
   - For sites surveyed as a single unit, or for every recording unit/subsite within a larger site:
     - A completed site assessment form.
     - A completed condition monitoring form.
   - Contact details for all owners/managers that were involved and gave permission for survey. Detailed notes of when and how they were contacted and what they said are also very useful.

Internally

3. Site details are added to the GLNP's Local Sites database.
4. Scores and information are presented to the Panel for consideration.
5. Owner/manager is informed of the Panel's decision and given the opportunity to comment on the application of the selection criteria.
6. GLNP SG is asked for endorsement of the Panel's decision.
7. Local authority is notified of GLNP's recommendation and site is designated within the Local Plan (or not).

Appendix 6: Quick reference - Greater Lincolnshire LGS criteria and additional information

Past and active surface processes	
SP1	Aeolian weathering, transportation and deposition
SP2	Fluvial erosion, transport and deposition
SP3	Coastal and marine erosion, transportation and deposition
SP4	Glacial erosion, transportation and deposition
SP5	Periglacial weathering, transportation and deposition
SP6	Landscape morphology created through Hydrogeological processes

Sedimentary rock	
SR1	Chalk
SR2	Sandstone
SR3	Limestone
SR4	Ironstone
SR5	Clay and mudstone
SR6	Tufa

Fossils	
Fo1	Crustaceans
Fo2	Echinoderms
Fo3	Molluscs
Fo4	Brachiopods
Fo5	Corals
Fo6	Sponges
Fo7	Plants
Fo8	Reptiles and amphibians
Fo9	Fish
Fo10	Mammals
Fo11	Insects
Fo12	Trace fossils
Fo13	Early human history

Tectonic structures	
TS1	Jointing
TS2	Faulting
TS3	Folding
TS4	Cambering

Mineralisation	
Mi1	Veins
Mi2	Evaporite
Mi3	Secondary mineralisation and pseudomorphs

Igneous and metamorphic rocks	
IR1	Igneous erratics
MR1	Metamorphic erratics

Combination of features	
Com1	A combination of geological or geomorphological features

Educational	
Ed1	Suitable for teaching up to A-level
Ed2	Suitable for teaching at undergraduate level
Ed3	Suitable for teaching other groups
Ed4	Potential for further primary research

Cultural	
Cu1	Historical associations
Cu2	Local folklore and events
Cu3	Aesthetic enjoyment
Cu4	Economic geology

Local Geological Site Guidelines for Greater Lincolnshire

Greater Lincolnshire Nature Partnership
Banovallum House
Manor House Street
Horncastle
Lincolnshire
LN9 5HF

Tel: 01507 528398
Email: info@glnp.org.uk
Web: www.glnp.org.uk

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