



Search Area Evaluation Report

**Theddlethorpe GDF Search Area
and the adjacent inshore area**



**Nuclear Waste
Services**

Preface

This report has been developed by Radioactive Waste Management Ltd (RWM), operating as Nuclear Waste Services which is working to identify a suitable site for a Geological Disposal Facility (GDF).

Following initial discussions held between RWM and Lincolnshire County Council, the GDF Team undertook initial evaluation work to understand whether the area identified by Lincolnshire County Council had the potential to host a GDF.

The Initial Evaluation Reportⁱ, concluded that, based on the information considered, there was potential for a GDF to be hosted within the “Theddlethorpe Gas Terminal Site and surrounding area within the East Lindsey Area”.

A Working Group (the ‘Working Group’) subsequently formed as a consequence of the initial discussions with RWM and the initial evaluation work undertaken. In line with the UK Government’s Working with Communities Policyⁱⁱ, the Working Group has identified a Search Area – referred to and defined in this report as the ‘Theddlethorpe GDF Search Area’.

This Search Area Evaluation report relates to the Theddlethorpe GDF Search Area and the inshore area adjacent to East Lindsey District.

The Search Area is the initial geographical area within which the GDF Team will seek to eventually identify potentially suitable sites to host a GDF. Defining the boundaries of the Search Area is important in order to help inform appropriate membership of a Community Partnership. As the GDF Team undertakes further, more detailed studies and investigations the Community Partnership may review and amend the Search Area to make it larger or smaller.

The Search Area that has been identified is derived from the area first put forward and considered as part of the GDF Team’s initial evaluation work. This high level Search Area Evaluation Report is intended to compliment the conclusions of this initial evaluation work, whilst maintaining a focus on the identified electoral wards which encompass the Theddlethorpe GDF Search Area and the inshore area adjacent to East Lindsey District.

This report is supported by information which has been collated from readily available sources such as: RWM National Geological Screening (NGS), Office for National Statistics, Natural England, Lincolnshire County Council and East Lindsey District Council. It is envisaged that if a Community Partnership were to form then a further review of available information will be conducted as part of the GDF Team’s investigation works.

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Executive Summary

The Theddlethorpe GDF Working Group (the 'Working Group') has been formed in accordance with the requirements set out in the UK Government's Working with Communities policy¹ (the 'Policy') and has begun to raise the awareness of the GDF Siting Process within the local community.

Radioactive Waste Management (RWM) has previously carried out an initial evaluation into the Theddlethorpe Gas Terminal Site and the surrounding area within the East Lindsey Area and has determined that the area has potential to host a Geological Disposal Facility (GDF).

The Working Group has identified a Search Area in accordance with the requirements set out in the Policy. The Search Area is the geographical area encompassing all the electoral wards within which the GDF Team will search for potential sites. The geographical boundaries of the Search Area are likely to change as the search for potential location for the surface and underground facilities progresses and more is understood about the area. The Search Area includes the two East Lindsey District Council electoral wards of Withern & Theddlethorpe (one ward) and Mablethorpe. The inshore area adjacent to the East Lindsey District also remains under consideration².

This Search Area Evaluation Report follows the same approach as RWM's initial evaluation work and focuses on the identified electoral wards which encompass the Theddlethorpe GDF Search Area and inshore area adjacent to East Lindsey District.

The evaluation of this area has been based on the six 'siting factors' of Safety and Security, Community, Environment, Engineering Feasibility, Transport and Value for Money. More information on the siting factors can be found in the published document 'Site Evaluation – how we will evaluate sites in England'ⁱⁱⁱ.

Based upon work in the UK and overseas the GDF Team have identified three broad types of potential host rock for a GDF. These are Lower Strength Sedimentary Rocks (LSSR), Evaporite and Higher Strength Rocks (HSR). Existing geological Information, as compiled in the National Geological Screening (NGS), shows that only LSSRs are present in this area and the adjacent inshore area within the depth range of interest³ (200 – 1,000 metres below the NGS datum⁴).

1 *Implementing Geological Disposal – Working with Communities. An updated framework for the long-term management of higher-activity radioactive waste*, HM Department for Business, Energy and Industrial Strategy, December 2018.

2 The inshore region is defined as the UK Territorial Waters which extend up to 12 nautical miles (22.2 km) from the Mean Low Water Mark.

3 The depth range of interest for a GDF is 200 metres to 1,000 metres below the NGS datum (see the [NGS web page](#)). Although screening has focused on the 200 to 1,000 metres depth range, which is consistent with Government Policy and the National Geological Screening Guidance, the GDF Team recognises that some rock types may be suitable as host rocks where they occur at depths greater than 1,000 metres.

4 NGS datum is a level that has been used to enable the production of maps showing the rock types of interests at depths of 200 metres to 1,000 metres below the surface. In flat lying areas the use of the lands surface is fine, however in mountainous and hilly areas this can be misleading. This is because there could be potentially suitable host rocks that appear to be more than 200 metres below the surface, but they are actually higher than, or level with, nearby valleys. To avoid this, a model was developed that consists of flat surfaces between the bases of valleys. This is to ensure that rocks identified as potentially suitable will be below nearby valleys.

The GDF Team have considered the safety and security relating to construction, operation and post-closure aspects of a GDF in the Theddlethorpe GDF Search Area and adjacent inshore area and no fundamental constraints have been identified at this stage. A number of characteristics have been identified for early consideration and investigation including ground conditions, access to potential underground environments from possible locations for a surface facility, flooding, climate change, presence of faults & aquifers and any implications related to historical exploitation of resources and related activities.

The community aspects of delivering a GDF in the Search Area have been considered. A GDF is expected to bring substantial benefits to the community which hosts it and the wider area. As a major infrastructure project, it could also generate hundreds of well-paid jobs each year, for over 100 years, in construction, engineering, administration, safety operations and project management. There is also a significant opportunity for skills to be developed by people within the community and for the jobs to be undertaken by them. This could help to address the current demographic trends within the Search Area in terms of the outward migration of younger people and an ageing population profile.

The hosting of a GDF is likely to have the potential to deliver a transformational effect to both the local and regional economy that would align with existing policies and strategic economic objectives. This could enhance the existing dominant sectors of the economy, namely agri-food, manufacturing and engineering, the low carbon sector and tourism. The existing tourism/visitor economy accounts for £132 million (2017) worth of income to East Lindsey district, hence it is highly valued, and it would be important to ensure that the natural, heritage and cultural features and assets that support and drive this economy are treated sensitively. There may be an opportunity to create a GDF/scientific centre of excellence, which itself could generate significant additional visitor traffic and even become a tourism point of interest alongside the existing assets.

With respect to the environment siting factor, parts of the Theddlethorpe GDF Search Area and adjacent inshore area off the coast are designated due to their nature conservation and heritage interests. The GDF Team understands and fully supports the priority given to respecting these protected areas. At this early stage in the siting process, a detailed assessment of potential sites for the surface facilities of a GDF has not been undertaken. As such, it is not possible to assess the specific potential impacts of delivering a GDF on the environment.

A number of key environmental constraints have nonetheless been identified in the Theddlethorpe GDF Search Area and adjacent inshore area. Three of these are particularly noteworthy at this stage in the siting process, namely: the ecological designated sites, the landscape designations, and flood risk. If the Theddlethorpe GDF Search Area progresses through the siting process, the GDF Team will work with the community and other relevant stakeholders to understand

the natural environment and constraints identified in greater detail when considering the implications of delivering a GDF in the Theddlethorpe Search Area on protected areas and the natural environment.

With respect to engineering feasibility, there may be some flexibility in terms of where the surface facilities of a GDF could be located, and the GDF Team would work collaboratively to develop safe and secure designs of the surface facilities and identify a potential location for a GDF that responds to local priorities and the natural environment. Matters such as flood risk, the underlying chalk aquifer, ground stability and associated engineering aspects would need to be considered in greater detail should the area progress to identifying siting options and the GDF Team would want to ensure sustainability and good design practices.

A GDF could provide an opportunity to support solutions to existing coastal challenges around fluvial / coastal flood risk and potential climate change effects. A GDF, and its related infrastructure, could provide some local solutions, as flood risk mitigation measures may be needed for the construction and operation of a GDF. Also, wider mitigation measures could potentially be delivered from the significant additional investment which will be available to a community that eventually hosts a GDF.

The transport aspects of delivering a GDF in the Search Area have been considered. The transport provisions to the wider East Lindsey and surrounding areas are suitable for the implementation of a GDF, however the transport provisions to the Theddlethorpe GDF Search Area are currently limited. The Theddlethorpe GDF Search Area is not served with roads that are part of the Strategic Network; the use of local roads would currently be required to access the Search Area, while the wider area would also be sensitive to increased traffic requirements. Whilst the county of Lincolnshire has excellent rail links that provide a good alternative to road transport, the distance from the Theddlethorpe GDF Search Area to the current rail network would require significant works to re-connect the area. To support the development of a GDF in the Theddlethorpe GDF Search Area, it is likely that there would be a need for new or improved transport infrastructure for movement of construction materials, personnel, related tunnelling arisings and the waste inventory. The GDF Team will work with the community and other relevant stakeholders to understand the current constraints and the benefits infrastructure improvements could bring to the local community. This could provide for increased tourists, business growth (both existing and new), increased employment, commuter services, and lead to making the area more attractive for development and inward investment.

At a regional level, there are a number of existing ports that could be suitable for the transportation of bulk aggregates and construction materials, as well as radioactive waste transport. The inter-modal connection of these ports (either by road, rail or as a marine staging point) needs to be explored further. The Search

Area has a coastline and it may therefore be possible to transport freight to the area via sea, although the shallow waters and environmental designations on this stretch of coastline could make this challenging. If sea transport were to be utilised there may be additional benefits related to other potential uses of the associated infrastructure.

In terms of value for money, given the early stage in the siting process, there are many uncertainties that could influence the overall programme cost and delivery schedule. However, nothing has been identified at this early stage which suggests that a GDF could not be delivered in the Theddlethorpe GDF Search Area and adjacent inshore area in a way which secures value for money.

Based on a review of readily available information relevant to each of the six siting factors, initial findings indicate that the Theddlethorpe GDF Search Area and the inshore area adjacent to East Lindsey District have the potential to host a GDF.

This evaluation work, using readily available information, has not confirmed that the Theddlethorpe GDF Search Area and adjacent inshore area is suitable to host a GDF. Rather it has developed an understanding of whether the area holds any potential to host a GDF, together with early identification of known constraints and uncertainties.

Should the Theddlethorpe GDF Search Area and adjacent inshore area be considered further in the siting process, then further investigations and analysis, drawing on additional sources of information and data will be required to enhance the understanding of the implications of delivering a GDF in the area. The GDF Team will work collaboratively with communities to understand what is important to them and feed this into assessments and evaluations relating to potential for areas and sites to host a GDF.

1. Introduction

Introduction

This report has been prepared by Radioactive Waste Management Ltd (RWM) operating as Nuclear Waste Services as part of the process to identify a suitable site for a Geological Disposal Facility (GDF) within a willing host community.

Prior to the formation of the Working Group, initial discussions were held between RWM and Lincolnshire County Council, the Interested Party. As part of these initial discussions, the GDF Team undertook initial evaluation work to understand whether the area identified by the Interested Party had the potential to host a GDF. The GDF Team's Initial Evaluation Report concluded that, based on the information considered, there was potential for a GDF to be hosted within the area identified, namely the Theddlethorpe Gas Terminal Site and surrounding area within the East Lindsey Area.

These discussions resulted in the establishment of the Theddlethorpe GDF Working Group (the 'Working Group') to start initial engagement and identify a Search Area.

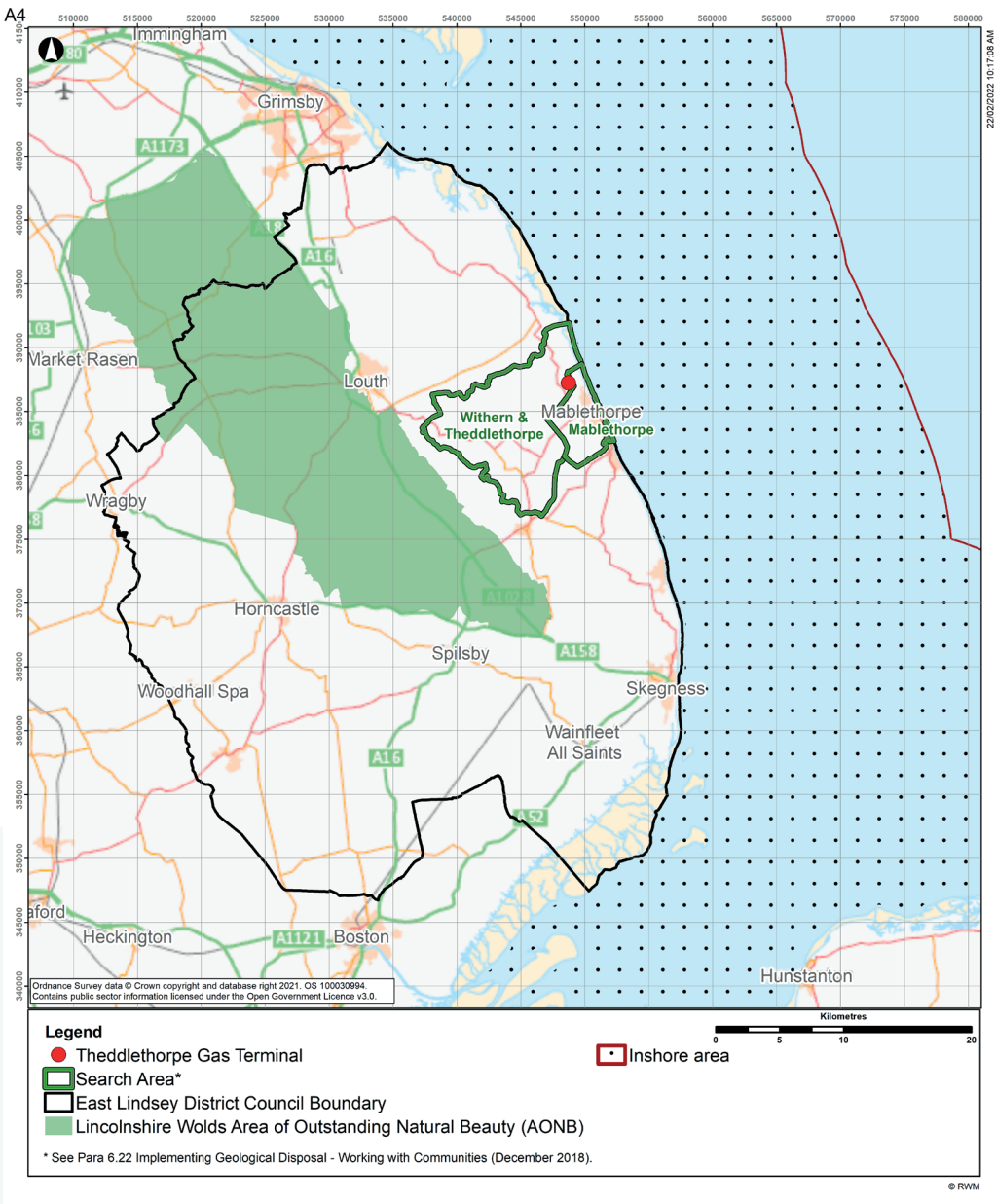
In line with the UK Government's Working with Communities Policy (the 'Policy'), the Working Group has identified and proposed a Search Area from the area first put forward for consideration.

If the identified Theddlethorpe GDF Search Area continues in the siting process a Community Partnership will be set up as the main enduring vehicle for community dialogue with the GDF Team.

This Search Area Evaluation Report relates to the 'Theddlethorpe GDF Search Area', which comprises the two East Lindsey District Council electoral wards of Withern & Theddlethorpe (one ward) and Mablethorpe. The inshore area adjacent to the East Lindsey District coastline is also included within the scope of this report.

Figure 1 below shows the electoral wards which encompass the Theddlethorpe GDF Search Area, and the adjacent inshore area.

Figure 1: Theddlethorpe GDF Search Area within East Lindsey District and adjacent inshore area.



The Policy provides that the Search Area is the geographical area within which the GDF Team will seek to identify potentially suitable sites to host a GDF. In addition, definition of the boundary of the Search Area is an important factor in identification of appropriate membership for the Community Partnership.

Paragraphs 6.21 and 6.22 of the Policy state that:

6.21. *“An early task for the Working Group will be to identify a Search Area. The Search Area is the geographical area within which RWM will seek to identify potentially suitable sites to host a GDF.”*

6.22. *“The Search Area will be derived from the area first put forward for consideration by the interested party and will be defined using district or unitary council electoral ward boundaries, depending on the administrative arrangements in place for the particular area. The Search Area will, therefore, encompass all the electoral wards within which the GDF Team will be able to consider potential sites. For areas which include potential for development under the sea bed, the Search Area will comprise only that area on land.”*

The geographical boundaries of a Search Area may change as the search for a potential location for the surface and underground facilities progresses and more is understood about the area. It is possible that the Theddlethorpe GDF Search Area may be amended over time by a future Community Partnership.

The Theddlethorpe GDF Search Area that has been identified is derived from the area first put forward and considered as part of the GDF Team's initial evaluation work. This further high level Search Area Evaluation Report is intended to support the conclusions of RWM's initial evaluation work to confirm whether the Search Area has potential to host a GDF, whilst maintaining a focus on the identified electoral wards which encompass the Search Area and adjacent inshore area.

This report is underpinned by information which has been collated from readily available sources such as the RWM National Geological Screening (NGS), Office for National Statistics, Natural England, Lincolnshire County Council and East Lindsey District Council. It is envisaged that if a Community Partnership were to form then a further review of available information would be conducted as part of the GDF Team's investigation works.

The evaluation work is not designed to confirm whether or not the Theddlethorpe GDF Search Area is suitable to host a GDF but rather whether it has any potential. Identifying a suitable site will take several years due to the need to properly identify, investigate, and assess potential GDF host sites and ensure that communities involved in the siting process have a full understanding of how the GDF project may affect them.

2. Search Area

2.1 Search Area Purpose

The purpose of the Search Area is defined in the Policy. It is the geographical area on land (based on district or unitary authority electoral ward boundaries) within which the GDF Team will seek to identify potentially suitable sites to host a GDF. Defining the boundaries of the Search Area is also important in order to help inform appropriate membership for a Community Partnership.

The Search Area may evolve over time. If the Search Area progresses through the siting process, any Community Partnership that is formed may review and amend the Search Area as the GDF Team completes its investigations. The Search Area would also reflect any future changes to electoral ward boundaries.

In some cases, to understand the implications of delivering a GDF, studies may need to be undertaken outside of the Search Area, for example, to assess any potential impact that the construction or operation of a GDF may have on the wider area.

Eventually the Search Area will be narrowed down until the Community Partnership identifies a specific site and the community that will be directly affected by the facility being on that site. This will be referred to as the Potential Host Community and would include all of the wards in which the following would be located:

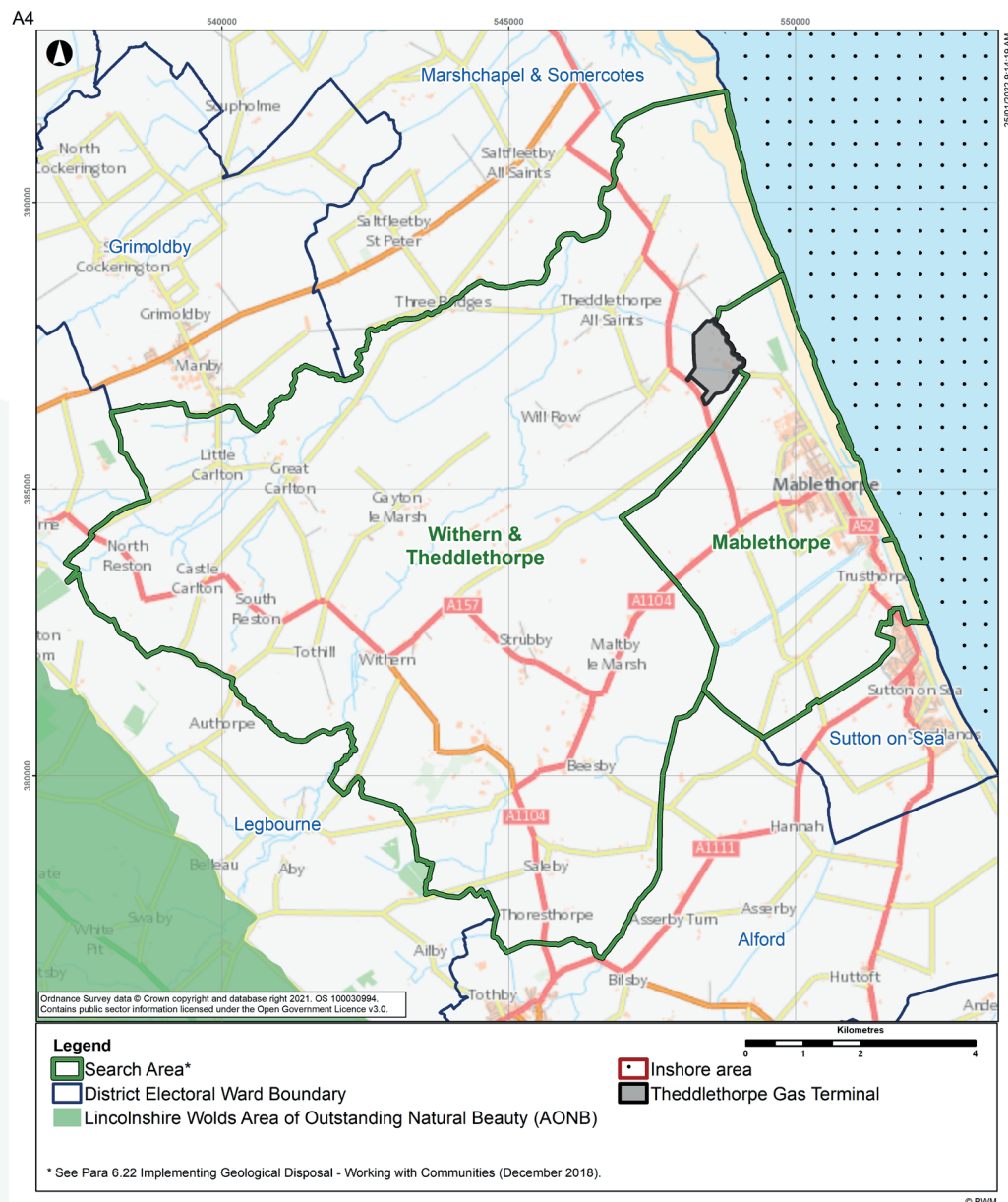
- proposed surface and underground elements of a GDF;
- any associated development (as defined under the Planning Act 2008 in England) and any land required to mitigate impacts;
- transport links/routes from the GDF site to the nearest port, railhead or primary road network (i.e. out to where minor roads meet the nearest A roads); and
- direct physical impacts associated with underground investigations, construction and operation of the GDF (identified through environmental impact assessment work carried out to support the GDF Team's engagement with communities and its development consent applications).

2.2 Theddlethorpe GDF Search Area

The Working Group has identified a Search Area from the area first put forward following initial discussions between RWM and Lincolnshire County Council, the Interested Party. The Search Area comprises the two East Lindsey District Council electoral wards of Withern & Theddlethorpe and Mablethorpe (the 'Theddlethorpe GDF Search Area'). The inshore area adjacent to the East Lindsey District also remains under consideration.

The Theddlethorpe GDF Search Area is shown in Figure 2 below.

Figure 2: Theddlethorpe GDF Search Area.



The Search Area considered in this report was identified by the Working Group through a workshop where relevant attributes and features of the area were presented, discussed and considered. The matters considered included relevant environmental, geological, community and other factors and included information on features such as landscape designations, heritage assets, ecological designations, transport and flooding risk.

The Working Group also considered feedback received during its early engagements with the public and stakeholders in the local community. This included feedback relating to community factors, environmental and landscape impacts, community wellbeing, socio-economic data and safety.

The settlements within the Theddlethorpe GDF Search Area are comprised of several small villages including Theddlethorpe and Theddlethorpe All-Saints with the seaside town of Mablethorpe located in the east of the Search Area. The population of the Search Area is 10,309; 76% of whom live in Mablethorpe. The Search Area lies within the administrative areas of East Lindsey District Council and Lincolnshire County Council.

The Policy requires that a Search Area must be defined using the existing district or unitary authority electoral ward boundaries on land. The geology below the adjacent inshore area off the coast, accessible from a surface site on land, is also available for consideration for underground facilities and the Working Group is interested in understanding the potential for the subsurface elements of a GDF to be hosted in the deep geology beyond the coastline. As such the inshore area adjacent to the East Lindsey District is considered in this report.

3. RWM Evaluation Process

3.1 Evaluation Approach

The GDF Team's approach to evaluation follows the intent set out in the Policy. There are many requirements derived from legislation, certain policy documents and guidance that RWM will need to satisfy to successfully investigate potential areas and sites, and to subsequently construct, operate and close a GDF. Equally there are many requirements that relate to the period after closure. These requirements are discussed in RWM's report 'Site Evaluation – How we will evaluate sites in England' which describes the approach in more detail.

The GDF Team looked at international GDF projects and UK infrastructure projects of similar size and complexity, to identify a series of Siting Factors. The six Siting Factors we have selected set out the broad topic areas that we will need to consider throughout the siting process as we assess and evaluate areas and sites. These Siting Factors are:

- Safety and Security
- Community
- Environment
- Engineering Feasibility
- Transport
- Value for Money

The Siting Factors are underpinned by more detailed 'Evaluation Considerations' which will be used to guide the evaluations and discussions with communities. These are presented in 'Site Evaluation – How we will evaluate sites in England', a published document with examples of typical matters that the GDF Team assesses under each Evaluation Consideration provided in Annex B of the published Site Evaluation document.

A key focus of this Search Area Evaluation has been on the geological context of the Theddlethorpe GDF Search Area and adjacent inshore area and to explore further the conclusions reached in the initial evaluations in order to better understand the potential to host a GDF.

At this early stage in the siting process the GDF Team has drawn upon existing readily available information to inform a desktop study by its technical specialists.

4. Initial Search Area Evaluation

4.1 Safety and Security

Based on the review of readily available information relating to the Safety and Security Siting Factor, RWM has concluded that the Theddlethorpe GDF Search Area and the adjacent inshore area have potential to host a GDF.

Safety after Closure – geological understanding

It is essential that a GDF remains safe both during the period in which it is constructed and operated and for hundreds of thousands of years after it has been closed and sealed. Safety after closure is often referred to as ‘long-term safety’ or ‘post-closure safety’.

Safety is of paramount importance to the GDF Team. The consent based, flexible approach to finding and identifying a suitable site for a GDF with a willing community is designed to ensure, above all, that the site which is selected is safe and secure for people and the environment, now and in the future.

A GDF will use a multi-barrier system in which engineered barriers work together with natural barriers provided by the geology to isolate and contain wastes for the time required for the radioactivity associated with them to naturally reduce and to prevent any harmful levels of radioactivity returning to the surface.

The geological environment makes an important contribution to safety after closure as man-made engineered barriers work together with the geology to provide this protection. Placing radioactive waste deep underground puts it far beyond people’s reach, so that it is safe and secure.

Post-closure safety assessment requires detailed examination of the geological environment to understand if a GDF could be designed to provide the required high level of safety through the combined use of engineered barriers and the geological environment.

At this early stage, the geological information that has informed this evaluation work was obtained from the NGS exercise and also includes, but is not limited to, local borehole data, petroleum exploration boreholes within the adjacent inshore area, geophysical surveys, historical mining records and local geological information.

Key aspects of the geology that relate to safety after closure are the rock type, rock structure, groundwater, natural processes and resources. More detailed work that looks at and acquires additional sources of information and data would be undertaken in due course, if the Theddlethorpe GDF Search Area and adjacent inshore area were to be considered further in the siting process.

Rock type

Based upon work in the UK and overseas the GDF Team has identified three broad types of potential host rock for a GDF.

- Lower Strength Sedimentary Rocks (LSSR), like clay and mudstones;
- Evaporites, such as rock salt; and
- Higher Strength Rocks (HSR), like granites and slates.

Of these three potential host rocks, only LSSRs are present in the Theddlethorpe GDF Search Area (See Figure 3) and the adjacent inshore within the depth range of interest (200-1,000 metres below the NGS datum).

There are well developed, internationally recognised, disposal concepts⁵ for the potential host rock type found in the Theddlethorpe GDF Search Area and adjacent inshore area. Based on its own work and similar work carried out overseas, the GDF Team has confidence that a GDF design could be developed which would provide the required high level of safety. This would be presented in safety cases which would be assessed by the UK's independent regulators.

Lower Strength Sedimentary Rocks (LSSR)

LSSR, or clay-rich rocks, are internationally recognised as potentially suitable for hosting a GDF. This is because these rocks are rich in very small clay particles, which only allow water to pass through them very slowly. In addition, the high clay content means that any cracks that form in these rocks are likely to reseal, particularly under the weight of hundreds of metres of overlying rock. As a result, there is often almost no groundwater movement through these rocks. These attributes, together with the engineered barrier system⁶, would contribute to a situation where radionuclides and other non-radioactive materials are suitably contained for hundreds of thousands of years.

There are several types of LSSRs in the Theddlethorpe Search Area between 200 and 1000 metres that could act as potential host rocks for a GDF. These rocks range in age from Cretaceous to Triassic.

The Tealby Formation is a potential rock-type of interest near the base of the Cretaceous sequence of rocks comprised of mudstones with a sandy limestone

⁵ A high level description of the engineered and natural barriers required to ensure that the radioactivity in the wastes is sufficiently contained so that it will not be released back to the surface in unacceptable amounts that may cause harm to people and the environment.

⁶ The combination of the man-made engineered components of a disposal facility, including the waste packages / disposal containers, buffer, backfills and seals.

band within the centre of the formation with a thickness of around 25 metres. The LSSR within the Search Area dip gently from west to east at an angle of 1-2 degrees, such that they are shallowest further inland and get deeper towards and away from the coast (Figure 4). Hence, to the west of the Search Area the Tealby formation is likely to be too shallow to occur in the depth range of interest. In parts of the inshore area, it may occur below 200 metres depth. While it is unlikely that the mudstones that form part of the Tealby Formation will form continuous layers thick enough to host a GDF, where they appear in the depth range of interest, mudstone layers may provide an effective barrier to movement of groundwater from depth towards the surface if a GDF were to be placed in deeper rocks.

The Jurassic aged Ancholme Group is a sequence of rock formations that includes several potential LSSR layers. In this area, these include the Kimmeridge Clay Formation, the Ampthill Clay Formation, and the Oxford Clay Formation. This group is within the depth range of interest across both the onshore and inshore area. There could be potential host rocks within the Ancholme Group which are suitable for development of a GDF. As in the case of the Tealby formation, the Ancholme Group are shallowest furthest inland and get deeper towards and away from the coast.

Information from boreholes that encounter these formations and the underlying Lias and Mercia Mudstone Groups is available for onshore locations at Keddington and Saltfleetby, and offshore approximately 22km off the coast. These boreholes (Keddington 1, Saltfleetby 3, and 47/18-1) are shown on Figure 3 below.

Table 1 below provides information on the depths and thickness of the Ancholme Group formation.

Table 1: Showing borehole data for the top of the Kimmeridge Clay Formation and the base of the Oxford Clay Formation, metres below ground level (mbgl) to indicate the thickness of the Ancholme Group.

Formation	Keddington 1 Borehole	Saltfleetby 3 Borehole	47/18-1 Borehole
Top Kimmeridge Clay	110mbgl	200mbgl	510mbgl
Base Oxford Clay	450mbgl	520mbgl	820mbgl
Thickness of Ancholme Group	340m	320m	310m

The Jurassic Lias Group and Triassic Mercia Mudstone Group appear in the depth range of interest across some of this area. They are within the depth range of interest across most of the onshore area and deepen until they are outside the depth range of interest in parts of the inshore area.

The Jurassic Lias Group (200-250 metres thick) contains some mudstone dominated formations (Whitby and Charmouth Lower Lias Mudstone Formations) that may be potential host rocks for a GDF. They appear within the depth range of interest across all of the onshore area, however in the inshore area, near to the UK Territorial Waters limit, borehole data suggests that only part of the Lias Group are present within the depth range of interest.

The same boreholes, as referred to above, indicate the following depths to the top of the Lias Group:

Table 2: Showing borehole data for the top of the Lias Formation (metres below ground level).

Formation	Keddington 1 Borehole	Saltfleetby 3 Borehole	47/18-1 Borehole
Lias	520mbgl	600mbgl	980mbgl

In offshore borehole (47/18-1), at the limit of UK Territorial Waters, the top of the Lias Group is approaching the limit of the depth range of interest at 980 metres. In the inshore area closer to the coast, more of the Lias Group is likely to be within the depth range of interest.

The Mercia Mudstone Group (MMG), which lies below the Lias Group, is within the depth range of interest under much of the onshore area and has a thickness of approximately 300 metres.

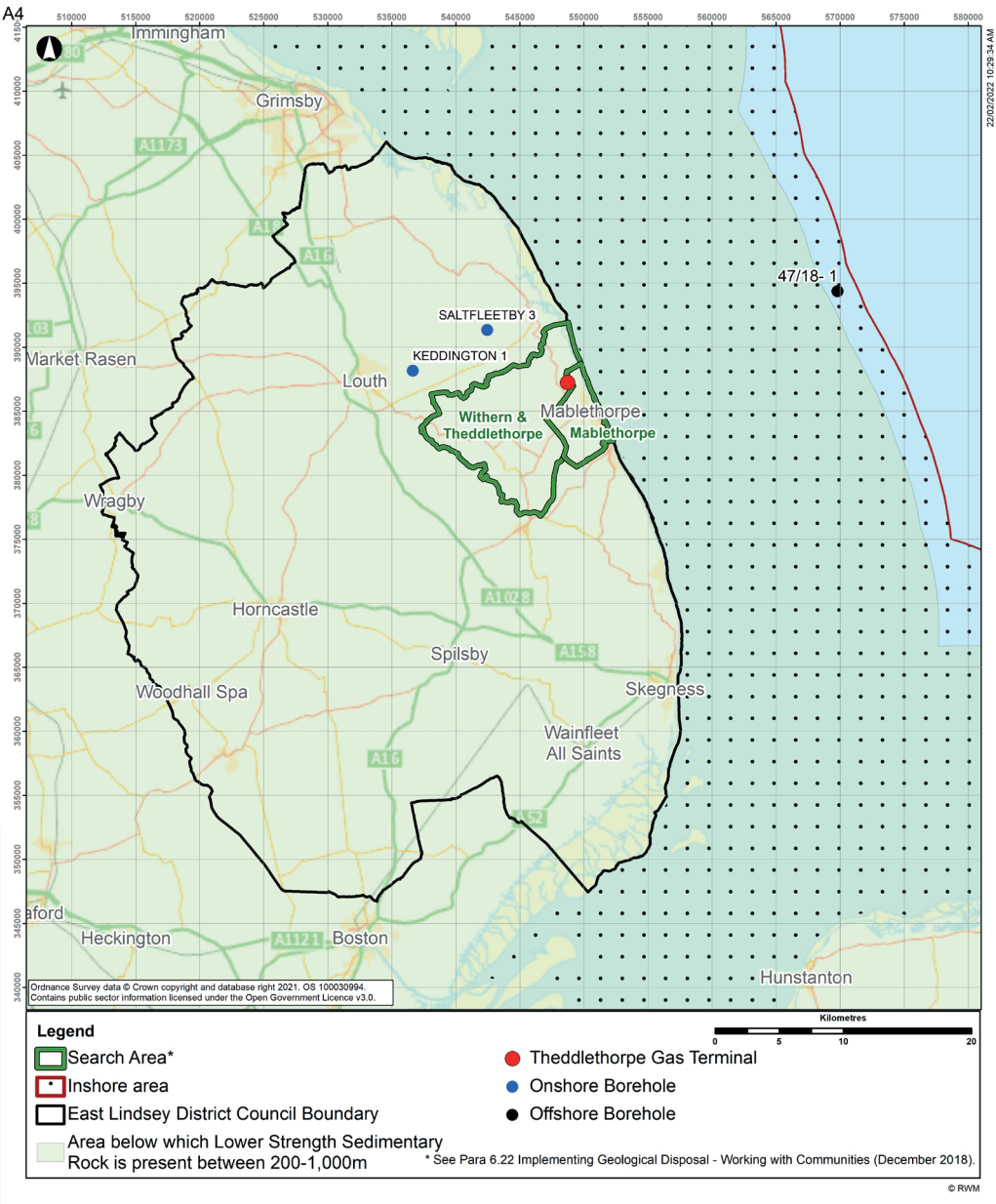
In the MMG there are some mudstone dominated formations of which the Penarth Group are potential rock types of interest, including the Branscombe Mudstone Formation, and the Sidmouth Mudstone Formation. These consist mainly of mudstones with occasional beds of siltstone, sandstone and anhydrite. The depth to the top of the MMG from borehole information is shown below:

Table 3: Showing borehole data for the top of the Mercia Mudstone Group Formation (metres below ground level).

Formation	Keddington 1 Borehole	Saltfleetby 3 Borehole	47/18-1 Borehole
Mercia Mudstone Group	750mbgl	870mbgl	>1000mbgl

At the limit of UK Territorial Waters, the MMG is entirely out of the depth range of interest. Based on information from existing boreholes, and the regional structure of the area, it is likely that the MMG is too deep to be in the depth range of interest in the inshore area.

Figure 3: Areas where LSSR are present.



A simplified column of rock types present in the East Lindsey District is presented in Table 4. The oldest and deepest rocks at the bottom, with progressively younger rock units towards the top.

Table 4: Sequence of major rock types present based upon the BGS Regional geological visualisation models (only rock units occurring in the depth range 200-1,000 metres below NGS datum are included).⁷

Geological Period (age in millions of years)	Geological Unit	Dominant Lithology	Rock Types of Interest		
			LSSR	HSR	Evaporite
Cretaceous (66.0 – 145.0)	Chalk Group	Chalk			
	Tealby Formation	Mudstone and sandstone	✓		
Jurassic (145.0 – 201.3)	Ancholme Group including Kimmeridge Clay, Ampthill Clay, West Walton and Oxford Clay Formations	Mudstone, siltstone, limestone and sandstone	✓		
	Corallian Group	Limestone, sandstone and mudstone			
	Ravenscar Group	Sandstone, siltstone and mudstone	✓		
	Great Oolite Group	Sandstone and limestone with mudstone			
	Inferior Oolite Group	Limestone, sandstone, mudstone			
	Lias Group	Mudstone with limestone and sandstone	✓		
Triassic (201.3 – 251.9)	Penarth Group	Mudstone, siltstone and sandstone	✓		
	Mercia Mudstone Group	Mudstone with siltstone	✓		
	Sherwood Sandstone Group	Sandstone with conglomerate and mudstone			

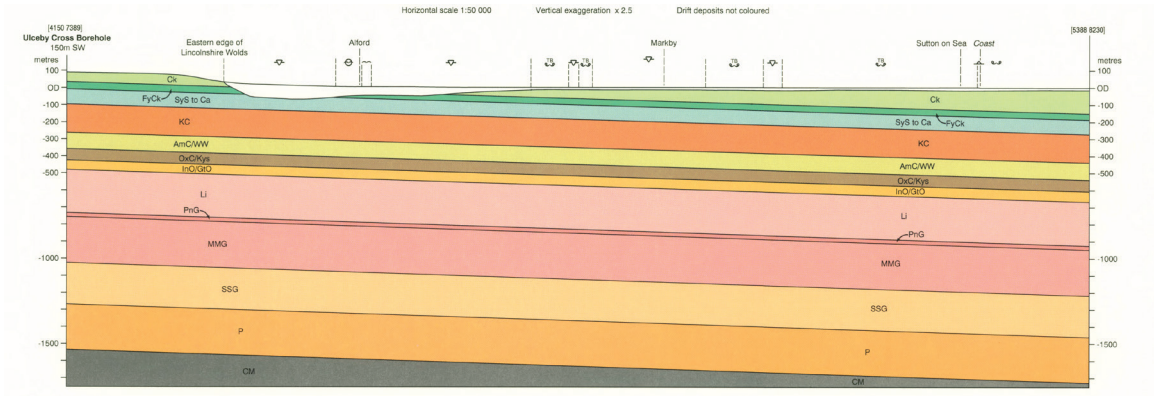
Rock Structure

The term “rock structure” describes natural geological features, that could affect the safety of a GDF or the ease with which a GDF could be constructed in a given geological environment.

Faults may act as barriers to or pathways for groundwater movement, depending upon their characteristics. Understanding the rock structure and its complexity within an area is a highly important aspect that is required to characterise any potential site. The present understanding of the East Lindsey District indicates that the geological environment in the Theddlethorpe GDF Search Area and its surrounds, is structurally simple, comprising a sequence of sedimentary rocks which gently slope (or “dip”) towards the east. This gentle slope means that the rock formations described above are shallowest in the west of the area, and deepest off the coast. The angle of this slope is approximately 1 to 2 degrees (see Figure 4 below).

⁷ In some areas the Mercia Mudstone Group also contains evaporite rocks, however, in this area, it is not thought there are evaporite rocks within the Mercia Mudstone Group in the depth range of interest.

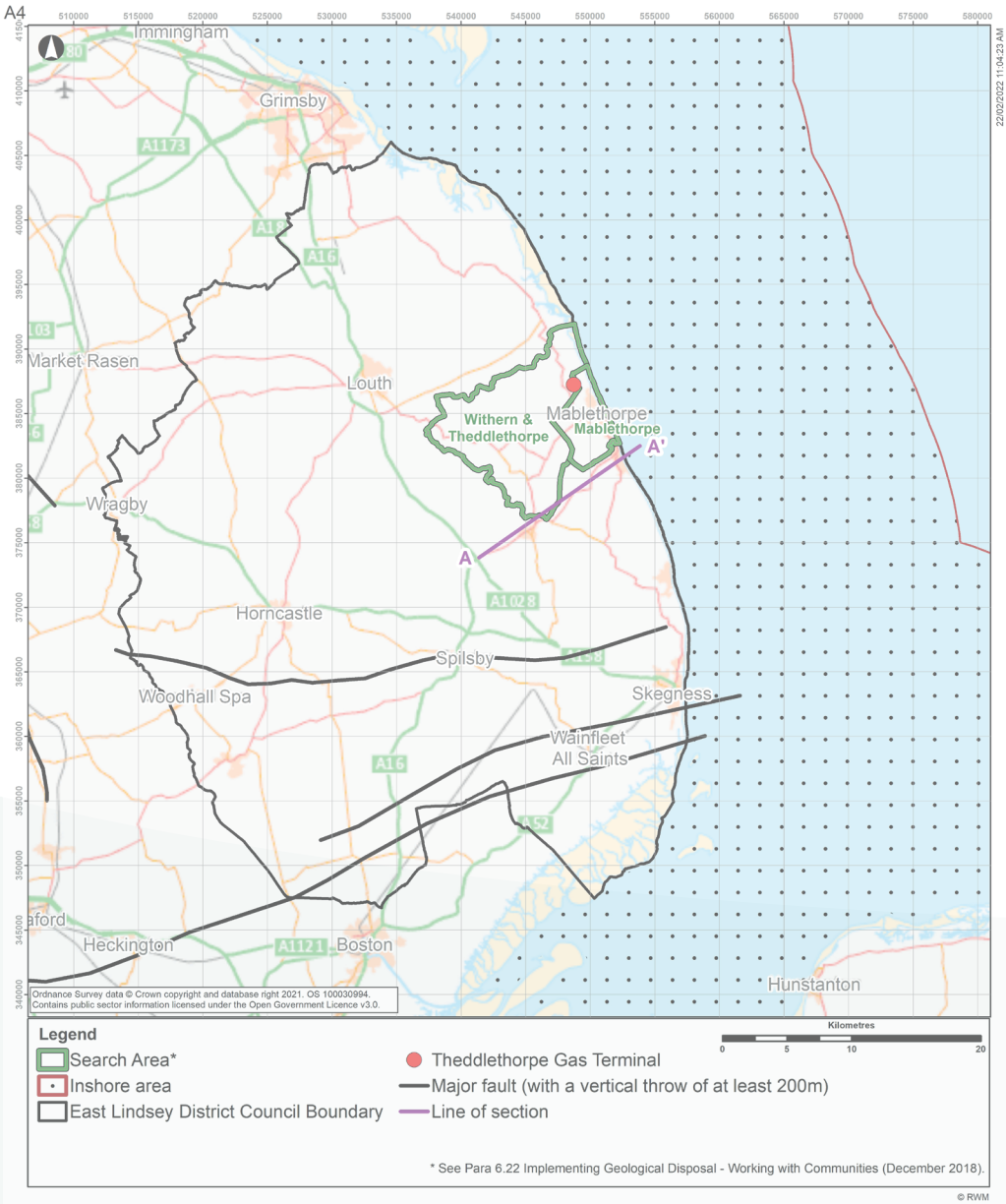
Figure 4: Cross Section (A – A') of the Structural Geology of the LSSR in the depth range of interest in the East Lindsey District showing the younger LSSR gently dipping at 1 to 2 degrees eastwards in both the onshore and inshore area.



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The location of the Geological Cross Section is shown on figure 5 below.

Figure 5: Major faulting and folding occurring within the depth range of interest and detailed structure in the inshore.



There are no major faults (defined as faults that offset adjacent rock layers by 200 metres or more) that affect the rocks in the depth range of interest either onshore or off the coast in the inshore area adjacent to the Theddlethorpe GDF Search Area. The nearest major fault is located approximately 11 kilometres to the south of the Search Area (Figure 5), running east to west through Spillsby.

As a result, the geological sequence is predictable across the area. There are some larger structures including faults and folding in older rocks, however, these occur much deeper than the depth range of interest. If any faults are identified as part of future investigations in this area, they will be examined, as they have the potential to act as barriers to or pathways for groundwater movement, depending upon their characteristics, and these would need to be considered during the siting of a GDF.

Groundwater

The term “groundwater” describes all types of subterranean water. Groundwater attributes relate to the movement and chemical composition of groundwater present in pores and fractures in rocks from surface to a depth of around 1,000 metres. Groundwater saturates the pores and fractures in the majority of UK rocks below a few tens of metres depth and, where these pores and fractures are interconnected, water can move through the rock formations. Groundwater moves differently depending on the type of host and surrounding rocks, and consequently radionuclides contained within the groundwater will behave differently.

There is very little information on groundwater in the depth range of interest for a GDF, 200 to 1,000 metres below NGS datum, although there is information on groundwater in aquifers above 200 metres in adjacent areas. The Chalk Group occurs at the surface in this area and extends to several hundred metres below the surface in some areas. It is designated as a Principal Aquifer in the onshore area, and fresh water is routinely abstracted in water wells from these rocks. A groundwater Source Protection Zone (SPZ) I to III extends across the Theddlethorpe GDF Search Area. There are eighteen surface water and ten groundwater abstraction points within the Search Area for a range of end uses including industrial and agricultural. Those used for water supply are located inland, which may be due to high salinity of coastal groundwaters. In general water wells reach depths of only tens of metres. Groundwater from depths greater than 400 metres is unlikely to be suitable as drinking water anywhere in the UK⁸. In the inshore area, groundwater in the Chalk Group will be saline, and not suitable for drinking.

The mudstone formations described above are likely to act as barriers (providing hydraulic separation) to groundwater movement between the permeable units in the shallow Chalk Group and the groundwater within deeper rocks.

8 Water Framework Directive UK TAG. Defining and reporting on groundwater bodies, 2012.

There are a few small areas around Keddington and Saltfleetby where concentrations of deep exploration boreholes and production wells for oil and gas may influence the connectivity between shallow and deep groundwater. These effects are likely to be localised around areas with several existing boreholes. Furthermore, it is noted that there are a number of shallow boreholes 30-40 metres depth around the Theddlethorpe Gas Terminal site.

If this area progresses through the siting process, more information will need to be sought about the groundwater chemistry and groundwater movement; however, it is unlikely that such information would be available until later on in the siting process, through direct samples taken from boreholes. Similarly, further information will be required to explore the location and nature of groundwater and aquifers in the Theddlethorpe GDF Search Area and adjacent inshore area.

Natural processes

The term “natural processes” include earthquakes, glaciations and sea level change (sea level change is discussed further in the environmental section). One of the benefits of geological disposal of radioactive waste is that the waste is isolated and therefore protected from future natural processes which occur at the surface. Therefore, whilst a GDF would need to be sited and designed to take account of natural processes which may occur during its operational lifetime, there is no reason to suggest that the Theddlethorpe GDF Search Area and adjacent inshore area should be excluded from the siting process on the basis of the areas susceptibility to natural processes alone.

Resources

Resource attributes relate to geological resources present or suspected to be present at depth. It covers both deep-mined or intensely drilled areas and the presence of potentially exploitable resources (coal, hydrocarbons, metal ores and industrial minerals). Many resources that have been exploited in the past are considered relevant because exploration for new resources often takes place around sites of past exploitation. Therefore, there is a risk of inadvertent human intrusion in the future or potential sterilisation of the resources which may permanently prevent the extraction of mineral resources for future generations. The presence of natural resources, whilst important to siting, may not automatically exclude an entire area from further consideration and would be evaluated in detail as part of a full site characterisation process. The GDF Team would need to assess the extent of existing and future exploration and operational activities to ensure the integrity of the GDF would not be compromised.

There are no existing mines in the Theddlethorpe GDF Search Area for either metalliferous metals or coal.

There are two areas near Saltfleetby and Keddington that have been developed for oil and gas in the past. The Saltfleetby Gas Field is located on the northern boundary of the Search Area with the Keddington Oilfield located about 1 kilometre further north from the Search Area. Both fields were targeting Carboniferous Sandstones (around 2250 metres deep).

There are also Petroleum Exploration and Development Licences (PEDLs) in place around Saltfleetby and Keddington, as well as in the area between Louth and Cleethorpes. If this area progresses the GDF Team will continue to monitor how this exploration programme evolves in order to understand potential implications.

There are no operating hydrocarbon fields or PEDLs in the inshore area, however, there are past offshore hydrocarbon fields located further out to sea, the Amethyst West, Amethyst East and Juliet fields in the Southern North Sea, located some 30-40 kilometres from Theddlethorpe GDF Search Area. Existing production fields are located yet further offshore, being some 30-50 kilometres to the east of the Search Area.

The Carboniferous Coal Measures Formations are encountered in the Keddington 3 borehole and Saltfleetby 3 borehole at depths between approximately 2000 and 2500 metres in the onshore area.

The coastal area between Grimsby and Mablethorpe from the coast to approximately 4 kilometres off the shore has previously been covered by a Coal Authority License Area relating to potential coal gasification. This license was acquired by Europa and Oxford Energy Consulting Limited (Europa) in 2010 however, following a technical evaluation, Europa concluded “there is at present no commercial means of exploiting the coal using Underground Coal Gasification (UCG) at the depth at which the coal occurs and taking into account thickness of the individual coal seams”⁹. These licences were allowed to lapse in 2013. The GDF Team will continue to monitor any further underground coal gasification exploration programmes.

Historical information

It is also recognised that there is geological information relating to parts of the wider East Lindsey District (both onshore and offshore) that were generated through historical surveys and studies to investigate and exploit the underlying natural resources. If the Theddlethorpe GDF Search Area progresses to a point where a Community Partnership is formed the GDF Team will, where possible, look to obtain relevant information. It is noted that some could be commercially sensitive. The GDF Team would need to be mindful of the purposes of the historic surveys and studies, and legislative and regulatory changes that may have occurred in the intervening years, but this information could enhance it's understanding of the geological environment of the area.

⁹ <https://www.europaoil.com/wp-content/uploads/2021/05/13Groupstatsfinal.pdf>

Construction and Operational Safety

Construction and Operational safety is about ensuring the safety of workers and the public during the construction and operation of a GDF up until the point of closure of the facility. A GDF will be designed to be safe and in order to do so, the location and nature of the site and its surrounding environment will be taken into account to inform development of the design and safety case.

At this stage, a preliminary assessment of anthropogenic and natural hazards has been undertaken in line with relevant good practice for the siting of nuclear facilities from the International Atomic Energy Authority and the Office for Nuclear Regulation. Considerations such as potential off-site operational safety impacts are also discussed.

The findings of the GDF Team as part of this evaluation work indicate that there are no fundamental constraints relating to construction and operational safety matters which would prevent the Theddlethorpe GDF Search Area and adjacent inshore area from being considered further in the siting process. There are, however, a number of characteristics that have been identified that would need to be investigated further should the Theddlethorpe GDF Search Area and adjacent inshore area progress through the siting process.

The underlying geology in both the onshore and inshore areas has been identified as having potentially suitable host rocks (LSSR). This means that siting the GDF in this area could utilise either shaft or drift access to the underground galleries. The safety implications of each option will need to be considered in due course, alongside other relevant factors, to produce the outcome where risks can be demonstrated as being As Low As Reasonably Practicable.

Parts of the Search Area are prone to flooding with the source of flooding primarily being the sea (tidal flooding). Other sources of flooding in the region are rivers and flash flooding due to extreme rainfall.

Almost all of the coastal area of East Lindsey is designated as Flood Zone 3¹⁰. Without mitigation, in some locations, this could present challenges to the construction and consequent operation of the surface based elements of a GDF and the drilling of deep boreholes to characterise the geological environment. Further work would need to be undertaken to understand the potential impact of flood risk when considering locations for the surface facilities and accessways, including potential effects of climate change and coastal erosion.

¹⁰ Zone 3 can be sub-divided into 3a and 3b. 3a is defined as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year. 3b is defined as the functional floodplain that would be susceptible to flooding from rivers or the sea during any event up to and including the 1 in 20 (5%) year event (or more frequently), taking full account of any defences which may offer protection to the area.

The GDF Team would look to work collaboratively with relevant stakeholders to consider the potential for, and the implications of, locating the surface facilities of a GDF in areas more resilient to flood risk, taking account of the effects that climate change may have. The GDF Team would also seek to investigate the possibility of introducing design features to mitigate the impact of flooding on the surface site, as well as opportunities to implement wider flood protection schemes that could benefit the area. This is an important matter that would need collaborative working with relevant stakeholders, including the community, the Environment Agency and Lead Local Flood Authorities.

The nearest known Upper Tier COMAH sites (Control of Major Accident Hazards) industrial site in the region is the Tetney Oil terminal (oil storage) approximately 22 kilometres north west of the Search Area. Additionally, there are further (and larger) industrial facilities on the Humber estuary, particularly around Grimsby (approximately 32 kilometres) and Immingham (approximately 40 kilometres) north west of the Search Area as well as Wickenby Airfield (chemical storage) approximately 39 kilometres west of the Search Area. At this stage, it is expected that these facilities are sufficiently distant that an incident at these facilities is unlikely to affect a GDF if it was to be sited in the Search Area. However, further work would need to be undertaken to understand the potential impact that the presence of these facilities would have on the siting of the surface facilities of a GDF in the area. Whilst an incident at any of these facilities may be sufficiently distant not to significantly affect any surface facilities within the Search Area, there could be disruption to transport routes and in the vicinity of workers' homes. There are ongoing discussions between Neptune Energy and National Grid regarding the potential use of the Theddlethorpe Gas Terminal site for a blue hydrogen production plant. The GDF Team will continue to monitor this potential development with respect to the implications under COMAH regulations.

The former gas terminal at Theddlethorpe (closed 2018) distributed gas from the North Sea to the National Grid. The gas pipeline infrastructure still exists in the region (believed to have been capped), however further work would be needed to establish details of the 'live' gas pipework in the vicinity and to understand the impact of this on the siting of a GDF in the area.

Onshore natural gas extraction occurred at the Saltfleetby Gas Field, approximately 7 kilometres northwest of the former Theddlethorpe Gas Terminal until it closed¹¹. There were plans to bring the field onstream in early 2021 via an alternative route to the National Grid pipeline. Further work is required to establish the current status of any plans and to understand the impact that these activities may have on the siting of a GDF in the area.

¹¹ <https://www.angusenergy.co.uk/what-we-do/saltfleetby-gas-field/> (accessed 30/11/2021)

It is noted that Humberside Airport is located north west of the Search Area between Scunthorpe and Grimsby. The GDF Team would need to do more work to understand the impact that flight paths and any future development plans for the airport would have on the siting of a GDF. The GDF Team would also need to consider the impact of military aircraft low flying areas, particularly the military training operations around the RAF Donna Nook air weapons range. Additionally, military and industrial areas were targeted by the Luftwaffe during World War II in the region and hence there may be a risk from unexploded ordinance that would need further consideration.

The impact of a GDF on the safety of the public during construction and operation is of paramount importance. Depending on the location of the surface site, there could be implications for holiday parks on the north west edge of Mablethorpe, and other settlements, such as the town of Mablethorpe itself. The GDF Team will consider the impact of the location of a GDF on the safety of the public in the district, noting considerations such as the proximity to adjacent sites and the impact that a GDF may have on these as well as the impact that a GDF site may have on flood risk in the area.

The GDF Team would engage with all the relevant stakeholders and the wider community to understand the implications of such matters should the Theddlethorpe GDF Search Area and adjacent inshore area progress through the siting process.

Security

Many of the considerations highlighted above in the context of Safety apply equally in the context of Security, and The GDF Team would need to consider these issues further should the Theddlethorpe GDF Search Area and adjacent inshore area progress through the siting process.

The GDF Team will need to meet expectations set from the Office of Nuclear Regulation in respect of safeguards, an important part of the nuclear non-proliferation treaty compliance set by the International Atomic Energy Agency upon signatory member states. The purpose of such agreements is to ensure that nuclear materials acquired for peaceful purposes are not diverted for military purposes.

The initial work undertaken indicates that there are no fundamental constraints relating to security, or nuclear safeguards, which would prevent the Theddlethorpe GDF Search Area and adjacent inshore area being considered further in the siting process for a GDF.

4.2 Community

Based on the review of readily available information relating to the Community Siting Factor, RWM has concluded that the Theddlethorpe GDF Search Area and the adjacent inshore area have potential to host a GDF.

The community information that has informed this early evaluation work was obtained from public domain sources and local authority publications. Some of the gathered information is summarised here to explain the current view of the GDF Team. Further work that looks at a progressively more detailed and wider suite of information would be undertaken in due course if the Theddlethorpe GDF Search Area progresses through the siting process.

Local Government and Demographics

In Lincolnshire, there are currently two tiers of local government consisting of Lincolnshire County Council and seven District Councils. The Theddlethorpe GDF Search Area lies within the administrative area of East Lindsey District Council, which has 37 electoral wards. Currently, the Search Area (Figure 6) covers two electoral wards (Withern & Theddlethorpe and Mablethorpe).

The population of the Search Area is 10,309; 76% of whom live in Mablethorpe which is the main settlement within the Search Area¹². Between 2011 and 2018 Mablethorpe saw just a 1.0% growth in population which was below the regional growth of 5.9% and national average of 5.4%¹³.

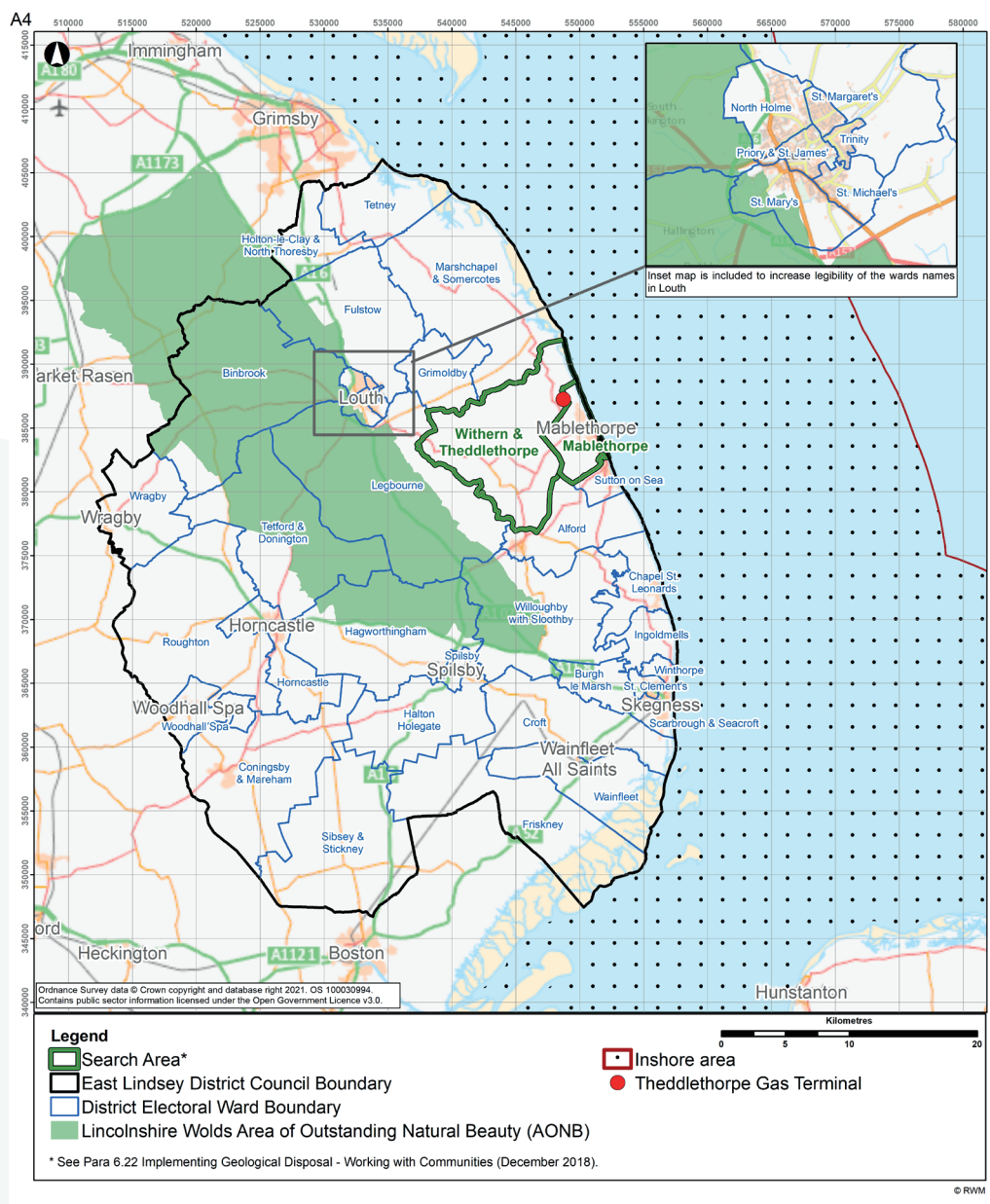
The East Lindsey district borders North East Lincolnshire and the Humber River to the north, the North Sea to the east, Boston (borough) to the south, and North Kesteven and West Lindsey districts to the west. East Lindsey District Council is based in Manby. Major settlements include Skegness, Louth, Mablethorpe, Alford, Spilsby, Horncastle & Chapel St Leonards. Reflecting the predominantly rural context of the district, only 5% of the area is classed as 'urban'. East Lindsey benefits from statutorily protected natural assets including those along the coast as well as the Lincolnshire Wolds Area of Outstanding Natural Beauty covering approximately a third of the district area. Transport connectivity is relatively poor with no trunk roads, the nearest being the A46 which connects Lincoln to the A1. Principal road links are the A1031, A1104, A52, A157 and B1373 and are subject to periodic congestion.

¹² ONS Population Estimates 2020

¹³ Towns Fund Dashboard

East Lindsey district comprises c.142,000 people (72,700 female and 69,300 male)^{iv}. The district is characterised by an ageing population (almost a third of population is 65+) and tendency for outmigration of the young^v, and this trend is forecast to continue in the period through to 2040. It is expected that this demographic context will result in a lack of people to fill available jobs in the future. The district is subject to areas of deprivation and is considered to be the 30th most deprived district in England (1 most deprived to 317 least deprived)¹⁴. Crime rates are comparatively low with an IMD rank of 254th of England districts^{vi}.

Figure 6: Theddlethorpe GDF Search Area and Surrounding Wards within East Lindsey District.



14 Average ranking when considering all indices within the Indices of Multiple Deprivation (IMD)

Structure of the Economy

The economy of East Lindsey District is particularly influenced by agriculture and this is borne out by a total of 1065 local 'units'¹⁵ within the agriculture, forestry and fishing category of business^{vii}.

In addition, the coastal belt provides important tourism activity between Saltfleet, Mablethorpe and Skegness supported by extensive caravan parks. The visitor economy of the East Lindsey District as a whole generated over £733 million expenditure in 2019^{viii}. Within the East Lindsey District tourism is by far the largest category of local units by industry type, although retail (755) and accommodation and food services (715) are also important.

The existing tourism economy of East Lindsey District is of significant local importance and the GDF Team recognises the need to treat the features and assets that support it sensitively. There may be an opportunity to create a GDF/scientific centre of excellence, which itself could generate significant visitor traffic and even become a tourism point of interest alongside the existing assets. For example, the French counterpart to the GDF Team has developed an Environmental Observatory, an Environmental Specimen Bank and a Technological Exhibition Facility within the area in which it is intending to construct its GDF. The facilities in France attract over 10,000 visitors per year. Similarly, facilities constructed at Äspö in support of the Swedish spent fuel repository programme host 20,000 visitors per year.

Lincolnshire has a history of onshore oil and gas production and there are a number of live projects within the East Lindsey Area with ongoing leases and planning permission for well drilling^{ix}. However, none of these are within the Theddlethorpe GDF Search Area.

Unemployment in East Lindsey District is typically higher than the Great Britain average and the levels of those who are economically active across the district for the age band 16 – 64 equates to 73.8% as against 78.4% in the East Midlands and 78.4% across Great Britain as a whole^x. In addition, the percentage of the population within the 16-64 age profile in the district is relatively low. Full time weekly average wages are at £491 compared with £560 in the East Midlands and £613 across Great Britain^{xi}. The nature of the economy, which is highly influenced by features of seasonality in the agricultural and tourism sectors, typically presents relatively low income and poor long term job prospects in the context of highly paid, highly skilled employment.

¹⁵ A local unit is an individual site e.g. a factory or shop associated with an enterprise often referred to as a workplace

Policy and Economic Strategy

The East Lindsey Local Plan^{xii} was adopted in 2018 and sets out East Lindsey District Council's vision for sustainable development by 2031 and the East Lindsey Economic Baseline 2021^{xiii} provides evidence for Local Plan review. The Council has secured UK Government Towns Fund support of £23.9 million for Mablethorpe and £24.5 million for Skegness.

The adopted East Lindsey District Council Local Plan Core Strategy aims to match its vision with the Council's Corporate Strategy, so that, through shared action, the common priorities of the two strategies can be tackled effectively, in order to achieve the delivery of sustainable development in the district.

The visions and objectives¹⁶ for East Lindsey are that by 2031 East Lindsey will be a district with:

- A network of thriving, safer and healthy sustainable communities, where people can enjoy a high quality of life and an increased sense of wellbeing and where new development simultaneously addresses the needs of the economy, communities, and the environment.
- Quality affordable and open market housing to try and meet the differing needs of the District's residents.
- A growing and diversified economy that not only builds on and extends the important agriculture and tourism base but supports the creation of all types of employment.
- A commitment to address the issues of deprivation and rural isolation to make an inclusive, equal and diverse district.
- A high-quality environment that makes the most of its special qualities, particularly the coast, the Lincolnshire Wolds, and the historic market towns; and
- A commitment to tackling the causes and effects of global climate change through local action.

16 East Lindsey Local Plan, Core Strategy (Adopted July 2018), paragraph 1.5

The East Lindsey Core Strategy has a specific Coastal Policy (SP17)^{xiv}, which states:

- The Council will give a high priority to development that extends and diversifies all-year round employment opportunities, contributes directly to the local economy, infrastructure or extends and diversifies the tourism market.
- The Council will support improvements to the existing flood defences, the creation of new flood defences and infrastructure associated with emergency planning.
- New and replacement community buildings will be supported, providing they are located within or adjoining an existing settlement.
- Development will need to demonstrate that it satisfies a Sequential and Exception Test¹⁷.
- All relevant development will need to provide adequate flood mitigation.

On a wider regional basis, the Greater Lincolnshire Local Enterprise Partnership Strategic Economic Plan 2014-2030^{xv} sets out the following priorities for growth:

1. To drive the growth of the area's defining and strongest sectors which offer the most competitive advantage: agri-food; advanced manufacturing and engineering; the low carbon economy, with a particular focus on renewable energy; visitor economy.
2. To grow specific opportunities identified as future defining features of the area: health and care sector; ports and logistics.
3. To drive this growth by putting expansion into new markets, modern telecommunications infrastructure improvements and the skills of individuals and business owners, at the forefront.
4. To promote Greater Lincolnshire as a place for sustainable growth through improved transport infrastructure to connect us with national and international markets enabling wider enjoyment of our world-class heritage sites, culture, and strong communities.
5. To recognise the need for new housing for the existing local population and potential movers to the area and support balanced housing and economic development through promoting the area's capacity to deliver high-quality growth.

¹⁷ All relevant development in areas of flood risk has to show how it has passed the Sequential and Exception tests. With regard to the Sequential Test this steers development to areas of lowest risk. For the Exception test, the very term exception means that it is development beyond that which would normally be allowed. It is important that all relevant development still does demonstrate that it provides wider sustainability benefits.

East Lindsey Local Plan, Core Strategy (Adopted July 2018) – Annex 2, p.134 – Sequential and Exception Test for development in the Coastal Zone of East Lindsey

The GDF Team's review of the above local and regional policy documents concluded that the development of a GDF has the potential to deliver a transformational effect to both the local and regional economies that would align with the local policy objectives set out above and could, in addition, enhance the existing dominant sectors of the local and regional economy, namely agri-food, manufacturing and engineering, the low carbon sector and tourism/visitor economy. Part of this transformation would be driven by hundreds of new highly paid jobs generated by the GDF as well as indirect employment and supply chain activity needed to support the development and operation of the GDF. This would provide a boost to the local economy throughout the whole year compared to the current situation which is dominated by a seasonal economy.

In addition, Community Investment Funding that is made available to those communities within the Search Area during the early site evaluation Community Partnership stage and throughout the siting process could be directed towards initiatives in support of the above local and regional objectives.

Deciding on a suitable site for a GDF will take several years. This means that there is a real opportunity for a community to consider how a GDF could benefit that community over the long-term. There will be a wide range of support available to communities that wish to explore more fully what a GDF might mean for them. The process of building a Community Vision by the Community Partnership will help the community to identify and articulate what is important and how it will align with local and regional economic and social priorities.

The East Lindsey Council's Economic Baseline 2021 predicts an expected faster growth rate in population in the district than the East Midlands and this is expected to be largely in the 65+ age range. The report also predicts a decline in the 0-15 age group (2020 – 2040 projections) and suggests a longer-term structural shift in the area in respect of the age profile. The report also states employment forecasts are expected to markedly increase in the period to 2040 being particularly focused in the accommodation / food and construction sectors. Given this context of an ageing population profile alongside growth in employment it is possible that, if current trends in younger people leaving the area continue, there will be insufficient numbers of people to fill future jobs within the district unless this trend can be reversed. The development of a GDF could allow for significant opportunities to be created in the future to enhance the skills base within the district, helping a more diverse economy, a greater level of educational attainment and an increasing emphasis on higher skilled jobs and a more sustainable economy. These opportunities could provide a significant boost to help reverse the trend of outward migration of younger people.

Skills and Employment

Both the Search Area and the East Lindsey District as a whole, have an ageing and relatively low-skilled population, which means there could be an opportunity to support more people of working age in gaining high skilled better paid jobs. This includes offering the workforce the opportunity for a good quality of life, as well as the promise of high-value job opportunities.

The Search Area has several qualities which would make it an attractive place to live and work. There are number of natural assets in the area, including an Area of Outstanding Natural Beauty, extensive attractive coastline and areas of nature conservation. In addition, the area benefits from low crime rates and lower than national average house prices. Median house prices in the major settlement of Mablethorpe were 37.5% lower than the regional average and 50% lower than the national average in 2019^{xvi}. Almost 50% of houses were detached in Mablethorpe in 2011, compared to a national average of 22%^{xvii}.

In terms of employment, the area currently has a strong reliance on the accommodation and food services industry which is typically a low-productivity seasonal industry. The industry has also been heavily impacted by Covid-19. The Mablethorpe Town Investment Plan reported that 60% of employment was identified as being in 'at risk'¹⁸ categories; that is the proportion of employment in Covid-19 'at-risk' sectors. Growth in the area could be achieved through creating jobs in sectors with higher levels of productivity. Given the impacts of Covid-19 on the area, the pandemic has reinforced the need for diversification into other sectors and greater provision of high-skilled jobs.

A GDF in the region could support the provision of high-skilled jobs. There could also be an opportunity to link to existing initiatives in the Humber, and this could be strengthened further through improved transportation links; the district is isolated from major roads and the nearest active train stations to the Search Area are located 17 and 24 kilometres away in Skegness and Cleethorpes respectively.

Benefits associated with the delivery of a GDF would include job creation, the development of new supporting industries and the potential for investment in regional infrastructure. These outcomes could help address the aforementioned challenges faced by the communities within East Lindsey and the Search Area.

The construction and operation of a GDF has the potential to provide direct and indirect employment opportunities over a very long period of time and to support a diverse economy in the East Lindsey Area.

18 'Any sector that has over 50% reduction in GDP was classified as 'at risk'. The sectors 'at risk' are: Accommodation and food services; Arts, entertainment, recreation and other services; Retail; Manufacturing; Construction; Motor trades; Wholesale and Education'. Source: Business Register and Employment Survey (2018); Grant Thornton (2020) via Towns Fund dashboard Dashboard — townsfund.org.uk

Skill Development and Training

A GDF could assist the Search Area, the district of East Lindsey and the wider Lincolnshire area to be a centre of skilled engineering and low carbon technologies for the longer term as well as helping to diversify local employment. The development of a GDF could support the recognised importance of young people to the area's future by providing them with the opportunity to stay and succeed through potential education and skills partnerships. For example by delivering Science, Technology, Engineering & Maths (STEM) activities within schools, projects to increase aspiration, career mentoring and skills and training courses for local residents. This would be aligned to local objectives to promote economic diversification and growth in engineering and manufacturing sectors.

In addition to the construction, engineering and other technical skills that would be required to build and operate a GDF a number of other associated services would be needed from the supply chain in areas such as facilities management, hotels and catering. The potential opportunities to enhance growth in the food/agriculture, tourism and transport sectors could be significant and potentiality go some way to addressing the seasonal nature of these sectors as currently experienced.

Housing

The delivery of a GDF could require additional housing for workers involved in the construction and operational phases over a long period of time. The GDF Team would work closely with East Lindsey District Council, Lincolnshire County Council and other relevant stakeholders to agree a local worker accommodation and housing strategy that complements the overarching housing strategy for the area and that could potentially create legacy benefits.

The siting, investigation, construction and management of a GDF would be developed and delivered in partnership with communities, to ensure that it is sensitive to the local environment and the priorities of the local community. The GDF Team would seek to work collaboratively through a Community Partnership, to ensure that local priorities and concerns are understood, considered and addressed.

4.3 Environment

Based on the review of readily available information relating to the Environment Siting Factor, RWM has concluded that, with appropriate mitigation, the Theddlethorpe GDF Search Area and adjacent inshore area have potential to host a GDF.

The environmental information that has informed the evaluation work was obtained from key documentation and national data sets which are publicly available. Some of the gathered information is summarised here to explain the GDF Team's current view. More detailed work that looks at a wider suite of information would be undertaken in due course, if the Theddlethorpe GDF Search Area and adjacent inshore area progresses in the siting process.

The delivery of a GDF to safely and securely dispose of higher activity radioactive waste would be one of the largest environmental infrastructure projects in the UK, however, all developments have the potential to generate both positive and negative impacts on the environment. At this early stage in the siting process, a detailed assessment of potential sites for the surface facilities of a GDF has not been undertaken. As such, it is not possible to assess the specific potential impacts of delivering a GDF on the environment at a particular location. That will come at a later stage in the process.

A number of key environmental constraints have nonetheless been identified in the Theddlethorpe GDF Search Area and adjacent inshore area. Three of these are considered to be particularly noteworthy at this stage in the siting process, namely: the ecological designated sites, the landscape designations and flood risk. These identified constraints would influence the deliverability and consenting of a GDF in the Theddlethorpe GDF Search Area and adjacent inshore area and would have particular implications for the location of surface infrastructure. If the Theddlethorpe GDF Search Area and adjacent inshore area progresses through the siting process, the GDF Team would work collaboratively with all relevant stakeholders to consider and investigate these environmental constraints and the implications of delivering a GDF at a specific site or sites in the area.

The landscape and recreation opportunities and the broader wildlife interest as well as cultural heritage assets within the wider area are also important for the local tourism economy. The GDF Team would seek to work collaboratively to ensure that local priorities and concerns are understood and taken into account.

Landscape Designations

The Lincolnshire Wolds Area of Outstanding Natural Beauty (AONB) is located approximately 1.3 kilometres west of the Theddlethorpe GDF Search Area. Unlike some AONBs with large tracts of wild land, much of the area has been in intensive agricultural use for centuries with the shift from sheep farming to cultivation through agricultural improvements from as early as the 1800's. Topographically, the Wolds are a dissected chalk plateau in the north, falling gently eastward from a western scarp face which crests in subtle contrast to the surrounding plain. To the south and east, the chalk ridge gives way to river valleys of mixed geology, sheltered settlements and pastureland. The grasslands and abandoned chalk pits are an important habitat for rare flowers and insects and some areas of fine mixed woodland are managed to conserve their traditional oak, ash and hazel coppice.

North Lincolnshire Council are proposing to make a submission to Natural England to extend the AONB boundary in North Lincolnshire, primarily to include the northern Wolds area up to the River Humber and Ancholme valley. This proposed extension is outside of the Search Area.

The Lincolnshire Wolds AONB is a valuable asset for tourists and the local community and particular emphasis needs to be given to its special character to maintain and protect those qualities. The AONB is considered to present a potential constraint to be taken into account in the siting of a GDF, even though the Search Area is not within the AONB's boundaries. This is due to potential indirect effects from both the GDF (e.g. visual impact) and associated activities (e.g. traffic movement through the AONB or in close proximity to the AONB) which will be matters that will need to be considered in more detail if the Theddlethorpe GDF Search Area progresses through the siting process.

The Lincolnshire Wolds AONB Management Plan identifies opportunities for the AONB including infrastructure improvements (Broadband & other IT improvements, public transport), community support, tourism, agriculture and forestry. Such measures could be investigated with the AONB Management Team in the context of GDF development.

Ecologically Designated Sites

The Theddlethorpe GDF Search Area is largely comprised of agricultural land, with the seaside town of Mablethorpe occupying the south eastern end of the coastal section. There are important coastal habitats located along the eastern boundary of the Search Area. The coastal environment supports a diverse range of habitats, many of which are of significant value for biodiversity.

Throughout the Theddlethorpe GDF Search Area there are a range of priority habitats as designated by Natural England¹⁹. These include coastal and floodplain grazing marsh, coastal saltmarsh, coastal sand dunes, deciduous woodland and good quality semi-improved grassland.

The Humber Estuary Ramsar Site occupies part of the inshore area adjacent to the Theddlethorpe GDF Search Area and extends to the north. The Humber Estuary is the largest macro-tidal estuary on the British North Sea coast with high suspended sediment loads, which feed a dynamic and rapidly changing system of accreting and eroding intertidal and subtidal mudflats, sandflats, saltmarsh and reedbeds. It supports a breeding colony of grey seals *Halichoerus grypus* and the dune slacks at Saltfleetby-Theddlethorpe on the southern extremity of the Ramsar site are the most north-easterly breeding site in Great Britain of the natterjack toad *Bufo calamita*. It also supports an assemblage of waterfowl and species/populations occurring at levels of international importance.

The Humber Estuary Special Protection Area (SPA) is located within the north eastern corner of the Theddlethorpe GDF Search Area and extends north towards the Humber. The SPA comprises extensive wetland and coastal habitats. The inner estuary supports extensive areas of reedbed, with areas of mature and developing saltmarsh backed by grazing marsh in the middle and outer estuary. The estuary supports important numbers of waterbirds (especially geese, ducks and waders) during the migration periods and in winter. In summer, it supports important breeding populations of protected species²⁰, including bittern *Botaurus stellaris*, marsh harrier *Circus aeruginosus*, avocet *Recurvirostra avosetta* and little tern *Sterna albifrons*.

The Greater Wash SPA is located in the mid-southern North Sea between Bridlington Bay in the north and the Outer Thames Estuary SPA in the south. This SPA is located immediately east of the Theddlethorpe GDF Search Area. The SPA regularly supports populations of nationally important species, including red-throated diver *Gavia stellata* and sandwich tern *Sterna sandvicensis*.

The Saltfleetby-Theddlethorpe Dunes SAC is located partially within the north eastern corner of the Theddlethorpe GDF Search Area and extends north towards Saltfleet. The dune system contains good examples of shifting dunes within a complex site that exhibits a range of dune types. The SAC hosts five protected habitats, including fixed dunes with herbaceous vegetation (grey dunes) which are Annex I priority habitats.

¹⁹ Priority habitats describes a range of semi-natural habitat types, identified to be the most threatened in the UK and therefore requiring conservation action.

²⁰ Annex I of the Birds Directive lists 193 species and sub-species which are: in danger of extinction; vulnerable to specific changes in their habitat; considered rare because of small populations or restricted local distribution; requiring particular attention for reasons of the specific nature of habitat

The Humber Estuary SAC is located immediately north of the Saltfleetby-Theddlethorpe Dunes SAC and the Theddlethorpe GDF Search Area. It is primarily notified for Annex I habitats including estuaries and mudflats and sandflats not covered by seawater at low tide.

There are no Marine Conservation Zones (MCZ) located in the nearby inshore area. The nearest MCZ is the Holderness Inshore area which is located approximately 20 kilometres north of the Search Area.

There are no designated shellfish waters or classified Bivalve Mollusc Harvesting Areas located within the inshore area adjacent to the Theddlethorpe GDF Search Area. The nearest such areas are located in The Wash over 25 kilometres south of the Search Area.

The marine area to the south of the Theddlethorpe GDF Search Area towards Skegness is heavily designated around The Wash (Ramsar, SPA and SAC).

There is one Site of Special Scientific Interest (SSSI) located partially within and adjacent to the Theddlethorpe GDF Search Area. Saltfleetby-Theddlethorpe Dunes SSSI is designated due to biological interests and includes flats, dunes, salt and freshwater marsh which together support an exceptionally rich flora and fauna. There are outstanding assemblages of vascular plants, invertebrates and breeding birds and it is the most north-easterly breeding site in Britain for the Natterjack Toad *Epidalea Calamita*. The Humber Estuary SSSI lies just beyond the Saltfleetby SSSI and the Theddlethorpe GDF Search Area. There are also several SSSI's located in proximity to the Search Area to the south and west.

There is one National Nature Reserve (NNR), Saltfleetby-Theddlethorpe Dunes NNR located within the Search Area. There are no Local Nature Reserves (LNR) located within the Search Area, the nearest being over 4 kilometres away (Willoughby Branch Line and Southern Thoresby Warren). In addition, the Rimac Nature Reserve is located within the Saltfleetby -Theddlethorpe Dunes NNR.

There are also areas of ancient woodland located within or on the boundary of the Search Area and there are a number of Tree Preservation Orders.

Local Nature Recovery Strategies (LNRs) are a new system of spatial strategies for nature, established through the Environment Act 2021. They are designed as tools to drive more coordinated, practical and focussed action to help nature. The Greater Lincolnshire Nature Partnership (GLNP) is in the process of developing an LNRs, including engaging with land managers and stakeholders.

East Lindsey District has local designated biodiversity sites, these are Sites of Nature Conservation Importance (SNCI) and Local Wildlife Sites (LWS). These sites have been identified for features including their rarity, diversity, fragility or because they are typical of the local biodiversity. From a review of the Adopted Local Plan proposals map^{xviii}, there are SNCI and LWS located within the Theddlethorpe GDF Search Area. This includes SNCIs located along watercourses (the Long Eau and Great Eau) and a LWS located along the coast near Saltfleet.

If the Theddlethorpe GDF Search Area and adjacent inshore area progresses through the siting process, the GDF Team would work with the local authorities, the community and relevant stakeholders to understand and investigate the sensitivities of the area's natural environment.

The GDF Team would seek to establish whether the delivery of a GDF could be aligned to relevant environmental objectives and consider the implications of delivering a GDF in the Search Area and adjacent inshore area for the assets that should be conserved and enhanced, in compliance with relevant legislation and policy. There may be opportunities to provide environmental enhancements in the Search Area and adjacent inshore area as part of the delivery of a GDF through the provision of biodiversity enhancements, improving ecological networks or improving public access, if this was deemed appropriate.

The GDF programme could support environmental objectives within the Theddlethorpe GDF Search Area by forming partnerships with groups such as the GLNP. There are 49 partners involved including statutory agencies, local authorities, wildlife groups and water companies. The GLNP are involved in a range of initiatives which could be supported by the GDF project including:

- Fens for the Future
- Humber Management Scheme
- Lincolnshire Chalk Streams
- Lincolnshire Limewoods
- Lincolnshire Wolds AONB
- South Lincolnshire Fens Partnership
- The Wash and North Norfolk Coast European Marine Sites.

As noted above, the GLNP are also in the process of developing a LNRS, there may be opportunities for the GDF project to support the strategy, such as through creation of new habitat. The Lincolnshire Wildlife Trust and a range of local wildlife groups undertake a variety of wildlife conservation projects which could also be supported by the GDF programme.

Flood risk and Coastal Change

Large areas of the Theddlethorpe GDF Search Area are at risk from coastal flooding, with additional risk coming from surface water flooding (i.e., from rivers, drains and localised flooding), particularly within the eastern area along the coast where the majority of land is located within Flood Zone 3 (high risk), including the Theddlethorpe Gas Terminal site. There are also localised areas of high (Flood Zone 3) and medium risk (Flood Zone 2) which follow rivers that run through the Search Area and cover parts of the smaller villages and towns including Alford.

There are flood defences located along the length of the coast. Defences are located within and adjacent to the Search Area and extend beyond the Search Area to the north and south. The comprehensive system of coastal flood defences was built following a major tidal surge in 1953 and extends from Mablethorpe to Skegness.

The Strategic Flood Risk Assessment for the East Lindsey District presents hazard maps for both current flood risk and flood risk through to 2115, taking into account climate change and rising sea levels. The coastal zone within the Search Area is at present day risk from breaching and the majority of the Search Area is at future risk associated with climate change.

The National Policy Statement for Geological Disposal Infrastructure (NPS)^{xix} notes that 'Development consent should not be granted for development where any part of the surface infrastructure of a geological disposal facility is located in Flood Zone 3b'. The NPS further notes that 'Development consent should only be granted for development in respect of deep boreholes where those boreholes are located in whole or in part in Flood Zone 3b where there are no other reasonable alternative locations', and that 'Whilst the surface facilities of a geological disposal facility should take account of Flood Zones, an applicant is not precluded from developing the underground parts of a geological disposal facility beneath Flood Zones'. At this stage there is no specific information which determines whether any parts of the Search Area would be classified as either flood zone 3a or 3b. Further investigation of this would be undertaken if the Search Area progresses through the siting process.

Given its coastal location, the Theddlethorpe GDF Search Area is considered to be particularly vulnerable to environmental changes brought about by climate change.

The Flamborough Head to Gibraltar Point Shoreline Management Plan (SMP)^{xx} was approved in 2011. The Theddlethorpe GDF Search Area is located within the SMP Policy Unit N (south Humberston Fitties to Theddlethorpe St Helens) and Policy Unit O (Viking Gas Terminal (Mablethorpe) to southern end of Skegness). The defence system along this coast frequently comprises dune systems sometimes with statutory environmental protection and hard defences supported by beach nourishment. The current long term (2055 – 2105) policy for the immediately adjacent 'unit' of the Shoreline Management Plan is to "hold the line" of the coastal defences in their current position and maintain their flood defence function. Defences will be raised and improved to counter sea level rise as required. Localised managed realignment could be considered to increase defence sustainability, in some areas where this is considered appropriate.

To counter erosion, since 1994, the Environment Agency has undertaken a major beach renourishment scheme (known as 'Lincshore') along the entire coast between Saltfleet and Gibraltar Point. This scheme periodically puts a significant

amount of sand back onto the beaches to replace the sediment removed through erosion which helps in maintaining the beaches and defences which protect the area against flooding. This strategy is currently under review. It is understood that Lincolnshire County Council is planning to undertake work to consider coastal adaptation. This is something that the GDF Team will wish to more fully understand and feed into as this work is progressed.

If the Search Area progresses, the GDF Team would look to work collaboratively with stakeholders (including environmental regulators) to investigate and understand the local challenges related to flooding, and the implications of future climate change for both the local community and the delivery of a GDF.

There could be opportunities to deliver flood and / or coastal protection measure as part of the delivery of a GDF that could benefit the wider area, protecting not only homes and businesses, but also protecting, and enhancing existing ecological habitats. There could be potential for the spoil that would be generated as part of the construction of a GDF to be used to support such benefits. This would be an area for further work and discussion later in the siting process, if the Theddlethorpe GDF Search Area progresses, as the GDF Team would need to consider the volume and characteristics of spoil that may be generated and work collaboratively with stakeholders to understand the implications of reusing the material generated.

Other matters

There are six Scheduled Monuments in the Theddlethorpe GDF Search Area, mainly to the south and west. There are 58 Listed Buildings in the Theddlethorpe GDF Search Area, including one Grade I Listed Building: All Saints Church in Theddlethorpe All Saints.

There are no Conservation Areas located in the Search Area. The nearest are located in Alford to the south and Louth to the north west of the Search Area. There are also no Registered Parks and Gardens located within the Theddlethorpe GDF Search Area. The nearest is South Ormsby Park which located to the west of the Search Area. Whilst these nearby Conservation Areas and Registered Parks and Gardens are not within the Search Area their setting could be indirectly affected.

It is noted that there is an action/ activity in the Coastal Community Teams Economic Plan: East Lindsey Heritage Coast report^{xxi} that Lincolnshire County Council is looking to designate parts of the coast as Heritage Coast. However, there is limited publicly available information on these proposals. Further information on the designation proposals should be sought and monitored if the Theddlethorpe GDF Search Area progresses in the siting process.

If the Theddlethorpe GDF Search Area progresses through the siting process, the GDF Team would seek to establish whether the delivery of a GDF could be

aligned to relevant objectives relating to the historic environment and consider the implications of delivering a GDF in the area for the cultural and heritage assets that should be conserved and enhanced, in compliance with relevant legislation and policy.

There are various waterbodies within the Search Area including lakes, main rivers and groundwater bodies (including principal and secondary aquifers) which provide important water resources for communities, industry and wildlife. The overall Water Framework Directive (WFD) status of the majority of the waterbodies within the Search Area is 'moderate' with most failing on chemical status because of pollution from rural and from wastewater discharges. Siting of the GDF would need to consider potential impacts on these resources, including on quantitative, ecological and chemical status.

Much of the land along the coast within the Search Area is former fen and marshland that has been reclaimed over several centuries. There is now a complex system for managing water levels in the marshland and fens, including the use of embankments, sea walls, dykes and pumps controlled by the Environment Agency and local Internal Drainage Boards.

There is a cluster of abstraction points located on the north eastern boundary of the Search Area, north of Theddlethorpe St Helens associated with Industrial, Commercial and Public Services, Water Supply and Agriculture primary uses. There are other abstraction licences located across the Search Area that have similar primary uses as well as amenity uses. Of the abstraction points, 18 are surface water and 10 are groundwater.

There is one WFD Protected Bathing Water site within the Theddlethorpe GDF Search Area at Mablethorpe Town. The most recent classification is "excellent". There is also another designated bathing water site immediately south of the Search Area at Sutton-on-Sea.

The Lincolnshire Transitional Water lies within the inshore area east of the Search Area. In 2019, it was identified as having a 'moderate' ecological status and 'fail' chemical status. The Reasons for Not Achieving Good Status were identified as diffuse source pollution associated with poor agricultural and rural land management and also natural reasons.

Based on currently available data, there are no significant air quality or noise issues in the Search Area.

Individual matters that would require further consideration in due course, for example the noise implications associated with the programme of site characterisation and construction of a GDF, would need to be considered, both in terms of the impacts on noise sensitive premises, and on designated sites and wildlife.

4.4 Engineering Feasibility

Based on the review of readily available information relating to the Engineering Feasibility Siting Factor, RWM has concluded that, with appropriate design measures, the Theddlethorpe GDF Search Area and the adjacent inshore area have potential to host a GDF.

Design and Construction

The GDF surface facilities could require in the region of one square kilometre of land, however the precise layout cannot be determined at this stage and more specific land requirements will need to be assessed in due course. These surface facilities would be linked to the sub-surface facilities by sloping tunnels and/or vertical shafts. The layout of GDF surface facilities would depend on the geography of a particular site, how much space is available, and the arrangement of existing infrastructure. There could also be the potential, on carrying out further investigation, to consider whether some of the ancillary facilities, such as offices and stores could be located off-site in nearby locations.

A desktop review of key documentation has been completed. This evaluation has also been informed by national data sets which are publicly available. More detailed work that looks at a wider suite of information would be undertaken later if the Search Area and adjacent inshore area progresses through the siting process.

Based on the current geological understanding of the Search Area, there are several layers of potentially suitable host LSSR under the entirety of the Search Area, including deep beneath the inshore area which could be accessed from an onshore surface facility. The current understanding of the geology of the area suggests that accessway(s) to an underground facility may require construction through chalk, which may present construction challenges. The superficial geology is highly variable and depending on the surface facility location some ground improvement and/or deep foundations may be required. Surface excavations are likely to require groundwater control and or dewatering as the risk of flooding over the area presents a significant engineering challenge and further work will be needed to understand the implications of climate change on this risk.

Based on current estimates of the UK Radioactive Waste Inventory, it is anticipated that there could be a sufficient volume of host rock to dispose of the potential inventory for disposal.

However, further work will be required to understand the depth, thickness and suitability of the potential host rocks in due course. There are no major faults (defined as faults that offset adjacent rock layers by 200 metres or more) that affect the rocks in the depth range of interest either onshore or off the coast in

the immediate area around the Theddlethorpe GDF Search Area. The nearest major fault is located approximately 11 kilometres to the south of the Search Area, running east to west through Spillsby. Understanding the rock structure in detail, including the presence of faults within an area is an aspect that will also require further investigation.

Surface facilities

As outlined above the GDF surface facilities would require in the region of one square kilometre of land, however the precise layout and land requirements will need to be determined in due course. The layout of GDF surface facilities would depend on the geography of the site, how much space is available, and the arrangement of existing infrastructure.

As discussed above, the surface facilities may be split across more than one site if required in response to relevant surface constraints or local priorities. However, splitting the site also has the potential to increase the adverse impacts of a GDF, for example it may increase vehicle movements or increase the visual impact of development. The full implications of splitting the surface facilities would be considered if this approach were to be pursued.

One of the potential challenges identified at this early stage relates to coastal flooding, with additional risk coming from surface water flooding (i.e., from rivers, drains and localised flooding). The GDF Team would need to work with the community, the district council and the county council (with respect to its role as the Lead Local Flood Authority) as well as the Environment Agency and other stakeholders to ensure that the development of a GDF and any associated infrastructure takes into account the issues relating to all sources of flooding.

Further work in respect of matters such as ground stability and associated engineering aspects would need to be considered in greater detail should the area progress to identifying specific sites and the GDF Team need to ensure sustainability and good design practices.

The construction and continued operations of a GDF would result in the generation of excavated spoil and there could be opportunities to reuse the spoil locally, for instance in support of flood mitigation or habitat creation or enhancement and other potential infrastructure schemes. The potential opportunities would need to be considered further if the Theddlethorpe GDF Search Area progresses through the siting process as the scope for reuse would be dependent on the volume and characteristics of spoil generated as well as the construction schedule.

Sustainable Design

The GDF Team will apply 'good design' to a GDF in order to meet the sustainable infrastructure objectives as described in Section 4.5 of the NPS, which confirms that applying 'good design' to geological disposal infrastructure projects should produce sustainable infrastructure that is sensitive to place, efficient in the use of natural resources and energy used in their construction and matched by an appearance that demonstrates good aesthetics as far as possible. It should also mitigate any existing adverse impacts wherever possible, for example, in relation to the environment.

A good design would also be one that sustains the improvements to operational efficiency for as many years as practicable, taking into account capital cost, economics and environmental impacts.

4.5 Transport

Based on the review of readily available information relating to the Transport Siting Factor, RWM has concluded that the Theddlethorpe GDF Search Area and the adjacent inshore area have potential to host a GDF.

Publicly available information regarding the transport infrastructure has been reviewed to understand the current transport links and any issues likely to affect the ability to carry out all potential transport operations safely and securely to inform this early evaluation work. More detailed work that looks at a wider suite of information would be undertaken later if the Theddlethorpe GDF Search Area progresses through the siting process.

Transport links to and from a GDF will be vital throughout the lifetime of the facility. Transport will be required for the following:

- transportation of excavated material;
- construction materials for underground and surface facilities and associated infrastructure;
- delivery of plant and equipment;
- transport of radioactive waste for disposal in the GDF; and
- personnel movements during site studies and characterisation, construction, operation, decommissioning and closure.

During operations, the GDF would receive different types of radioactive waste packages from across Great Britain for emplacement at the facility. The GDF Team has developed a range of transport containers that will be used to safely transport radioactive waste packages to a GDF.

Rail

The railway provisions to the wider Lincolnshire area are good with the East Coast Main Line (ECML) running through the south-west corner of the county through Grantham. A number of other primary, secondary and rural routes cross the county, stretching into East Lindsey to the south. The ECML is the only electrified line in the county.

There are no railway provisions serving the Theddlethorpe GDF Search Area, however it is observed that a number of historic railway lines have previously operated in the vicinity. As the use of rail in preference to road is a key part of the GDF Team's Transport Safety Strategy^{xxii}, it would be desirable to connect a GDF to the existing rail network.

The South Humberside Main Line (and relevant branch lines), Newark to Barnetby Line and Grantham to Skegness Line are at the heart of the communities which they serve, often being the only form of public transport within rural areas. They play a critical role in providing connectivity both within and outside Lincolnshire through connecting people to education, key services, leisure and tourism opportunities. They also link people with key employment sites along the line, such as oil refineries, steel works and ports.

The South Humberside Main Line runs from Doncaster at the west to Cleethorpes at the east. The majority of the route is located beyond the northern border of Lincolnshire with incursions into the county at Barnetby and Brocklesby. At its closest point, it is approximately 32 kilometres north of the Theddlethorpe GDF Search Area. Whilst this route carries an hourly interurban passenger service between Cleethorpes and South Yorkshire, the route is primarily used by freight with some of the highest tonnage movements in the United Kingdom operating on the south bank of the Humber between the port of Immingham, Scunthorpe and Doncaster, approximately 60 freight trains per day operate each way on the core section between Brocklesby and Wrawby Junction carrying:

- Coal and biomass traffic for power stations
- Imported fuel and iron ore for the steel works at Scunthorpe
- Steel production from Scunthorpe
- Oil products from the Humber ports to various destinations.
- Imported timber

There is an extensive freight yard at Scunthorpe serving the British Steel Works plant. There are also up and down goods loops at Scunthorpe.

A number of important branch lines connect on to the South Humberside Main Line. The notable lines include the Immingham and Killingholme Docks branch line, the Newark to Barnetby Line and the Grantham to Skegness Line.

The Immingham and Killingholme Docks branch line serves the Humber Ports complex situated on the south bank of the Humber. The route links the docks complex and freight terminals at Killingholme, Immingham West and Immingham East with South Humberside Main Line at Ulceby North Junction. Much of the port side rail infrastructure is owned by Associated British Ports.

The Newark to Barnetby Line (via Lincoln) is a 74 kilometres secondary route consisting of two tracks throughout almost its entire length. There is a short four-track section between West Holmes and East Holmes Junctions and another through Lincoln station. It passes to the west of East Lindsey, 5 kilometres away at its closest point, and 27 kilometres away from the Search Area. At Lincoln, there are interfaces with the line both towards Peterborough and Doncaster and at Wrawby Junction this line joins with those from Doncaster via Scunthorpe and from Gainsborough via Brigg on route to Immingham and Cleethorpes.

A broadly two-hourly Newark North Gate to Grimsby via Market Rasen service runs on this line. The main use is for freight operations reflecting that this route is a link from the intensively used port complex at Immingham to terminals in the Midlands. There are currently plans to improve the gauge clearance of the line as part of the Intercity Express Programme rolling stock enabling and ECML Gauging programmes.

The Grantham to Skegness Line runs east-west across Lincolnshire and into the south of East Lindsey and is classified as a rural route. It is a mainly two track railway with some single track sections along its 90 kilometres length. It runs into East Lindsey at Eastville and is approximately 11 kilometres away from the Search Area at its closest point. The main market for this route is the hourly passenger service between Nottingham and Skegness whilst there is some freight activity to and from Boston Docks. Passenger traffic is characterised by heavy demand during the summer months.

There are a number of historic railways in the county which previously served the area of East Lindsey, as well as the wider area.

The East Lincolnshire Railway (ELR) linked Grimsby in the north to Boston in the south via Louth in the past. The section from Grimsby to Louth remained in use for goods trains to Associated British Maltsters at Louth, until it ceased in December 1980. Part of the line is still operated as a heritage railway. At its closest point, the line ran approximately 1.5 kilometres to the west of the Theddlethorpe GDF Search Area.

The Mablethorpe Loop Railway connected the seaside resorts of Mablethorpe and Sutton-on-Sea to the ELR at Louth to the North and Willoughby to the South. The line between Mablethorpe and Louth (passing through Theddlethorpe Station) was closed in 1960. The Mablethorpe Loop Railway used to run through the east of the Theddlethorpe GDF Search Area, directly adjacent to the redundant gas terminal site.

The Louth to Bardney Line, between Louth in the East to Bardney closed in 1960. At its closest point it would have been approximately 6 kilometres from the Search Area.

The Lincolnshire Wolds Railway (LWR) is a heritage railway running since 2009 on part of the decommissioned ELR line which closed in 1980. The railway currently operates over 3 kilometres between Ludborough and North Thoresby, with a short extension towards Utterby Halt currently under construction.

The Theddlethorpe GDF Search Area is approximately 13 kilometres from Ludborough Station, and approximately 6.5 kilometres from the southern extent of the LWR owned track bed. Much of the track bed through Louth and out of Grimsby has been redeveloped. If use of the LWR corridor is to be considered, options for connecting back to the existing main line infrastructure away from the old connection points would need to be sought.

Lincolnshire contains some very capable railways which are well connected to both the strategic railway network and established regional ports. The available capacity on these lines would need to be studied further should the Search Area progress through the siting process. However, railway access to East Lindsey is more limited, particularly north of Skegness. Furthermore, the Theddlethorpe GDF Search Area is some distance from the nearest rail infrastructure, so the distance from a potential GDF to the railway network would need to be considered further. There may be opportunities to look at whether historic railway lines could be reinstated to facilitate a GDF, and whether new rail infrastructure may benefit local communities.

Road

The M180 is the nearest motorway located approximately 40 kilometres north-west of the Theddlethorpe GDF Search Area. The M180 transitions to the A180 strategic route which runs as a dual carriageway for almost its entirety before terminating at Grimsby, approximately 30 kilometres to the north of the Theddlethorpe GDF Search Area. This is the nearest connection of the strategic road network to the Theddlethorpe GDF Search Area.

Access from the strategic road network into East Lindsey is provided by the A16 which runs from Grimsby in the north to Boston in the South. Access to the Theddlethorpe Search Area is provided by the A16 to Louth, and then the A157 and A1013. The A16 is the main north-south route through East Lindsey and is not classified as a strategic route. It is a single carriageway road with the occasional section of dual carriageway. At its closest point, the A16 is approximately 4 kilometres to the west of the Search Area.

It should be noted that the Lincolnshire Wolds AONB attracts almost 4 million visitors per year who also require access via the A16, which is the main road servicing the area. It is also the main road accessing coastal destinations such as Mablethorpe and Skegness.

The only other strategic route in Lincolnshire is the A46 which runs from Leicester to the north of Lincoln, connecting to the A1 Newark-on-Trent and the M1 to the east of Leicester. The A46 strategic route is a combination of dual and single carriageway. It terminates approximately 40 kilometres to the west of the Theddlethorpe GDF Search.

The existing strategic roads are located some distance from the Search Area, with the wider area serviced by a number of non-strategic A and B roads. This area would be sensitive to increased road traffic and therefore use of the road network would need to be investigated further with the appropriate stakeholders if the Search Area progresses through the siting process.

Sea

The Search Area offers no existing marine infrastructure, however there are a number of established regional ports which offer opportunities for sea transport for movements of excavated materials, construction materials and radioactive waste packages. The three nearest regional ports to the Theddlethorpe GDF Search Area are at Grimsby, Immingham and Boston. These ports are well connected to the road and rail networks with potential to be utilised as part of a multi-modal transport strategy.

The Port of Grimsby is owned and operated by Associated British Ports. It is situated approximately 27 kilometres north of the Theddlethorpe GDF Search Area. Located at the mouth of the Humber Estuary it can operate 24 hours a day and consists of a river terminal and gated docks. The port has a frontage of over 1,500 metres and consists of 20 berths, two of which are Roll-On Roll-Off (RO-RO). The port has direct quayside rail connections which are linked to the South Humberside Main Line. The Port of Grimsby is extremely well connected to the strategic road network, situated at the end of the A180 strategic route.

The Port of Immingham, owned and operated by Associated British Ports, is approximately 36 kilometres north of the Theddlethorpe GDF Search Area. It is also situated on the Humber Estuary and consists of a river terminal and gated docks. The river terminal has a frontage of over 600 metres and consists of six berths (excluding oil & gas berths) with RO-RO capability. The dock has a frontage of over 2,000 metres and offers 15 berths. The port has direct quayside rail connections which are linked to the South Humberside Main Line operated by Network Rail at Ulceby junction. The Port of Immingham is well connected to the strategic road network, situated 4 kilometres from the A180 strategic route, connected by the A160 dual carriageway which has recently been upgraded.

The Port of Boston is owned and operated by the Victoria Group Ltd and is approximately 37 kilometres south of the Theddlethorpe GDF Search Area. It is situated at the confluence of Maud Foster Drain, South Forty Foot Drain and the River Witham which together form The Haven. The Haven is accessed from

The Wash to the east. The Port of Boston consists of a river terminal and gated docks. The river terminal has four NAABSA²¹ berths with a total frontage of 375 metres. The dock has seven berths, with a total frontage of 645 metres. The port has a private rail connection which is linked to the Skegness to Grantham rural line operated by Network Rail just south of Boston Station. Although the Port of Boston is not connected to the strategic road network, it has excellent access to the A16 which runs north through the centre of East Lindsey.

The regional ports are capable of all relevant sea movements required to construct and operate a GDF, with varying degrees of connectivity for onward logistics. It is not known whether any of the ports identified above have experience in the shipment of radioactive materials and the security measures required. The intermodal transport connection of these ports (either by road, rail or as a marine staging point) needs to be examined further if the Theddlethorpe GDF Search Area progresses through the siting process.

The potential need for new marine infrastructure within the Search Area would depend on the provision of other transport modes (road and rail). It should also be noted that the functional requirements for marine infrastructure can vary significantly and depend on whether it would be intended to support construction, import of radioactive waste packages or both. Options for the development of new marine infrastructure within the Theddlethorpe GDF Search Area will also need to be considered if the area progresses through the siting process.

Transport Safety and Security

The existing transport network in the Theddlethorpe GDF Search Area is not currently used for radioactive waste transports. As significant transport developments would need to be undertaken to enable the construction of a GDF within the Search Area, these developments would need to be designed with transport safety and security in mind. There are no transport safety or security issues envisaged which would preclude the Theddlethorpe GDF Search Area.

²¹ NAABSA is an abbreviation for the term "Not always afloat but safely aground", it is used to describe ports where the seabed is suitable for the vessel to rest at low tide without damage to its hull.

4.6 Value for Money

Based on the review of readily available information relating to the Value for Money Siting Factor RWM has concluded that the Theddlethorpe GDF Search Area and the adjacent inshore area have potential to host a GDF.

Given the early stage in the siting process, there are many uncertainties that would influence the overall programme cost and delivery schedule. The GDF Team will keep these under close review should the Theddlethorpe GDF Search Area and adjacent inshore area progress through the siting process.

The Theddlethorpe GDF Search Area has limited existing transport network provisions suitable for hosting a GDF. Strategic network roads and railway are approximately 30 kilometres away, although there are three ports that could be suitable, albeit at a distance so goods would need road or rail transport to a GDF. It is expected that substantial road and / or rail infrastructure enhancements would be required to facilitate transport of waste packages and materials. Assessment of potential costs and timescales for this work, including for public consultation, obtaining planning consents and construction would need to be undertaken if the Search Area progresses further in the siting process.

A GDF could bring significant economic benefits to the Search Area and the wider region. Further work will be required in order to understand what steps will need to be taken to optimise this opportunity including taking account of the Community Vision as it develops and the potential areas for significant additional investment (SAI).

At this early stage in the siting process there are many uncertainties that would influence the overall programme cost and delivery schedule. There is nothing to suggest a GDF located in the Search Area would have particularly high costs relative to other locations. Should the Search Area progress in the siting process, further value for money studies will be undertaken when additional information has informed the engineering design of the GDF and uncertainty in the safety cases, and potential socio-economic benefits and SAI requirements have been understood.

Notwithstanding the uncertainties highlighted above, nothing has been identified at this early stage in the siting process which suggests or indicates that a GDF could not be delivered in the Theddlethorpe GDF Search Area and adjacent inshore area in a way which secures value for money, or that the cost of doing so would be particularly high relative to other locations.

5. Conclusion

Conclusion

Having considered the readily available information, and particularly the National Geological Screening outputs, RWM has concluded that the Theddlethorpe GDF Search Area and adjacent inshore area have potential to host a GDF.

This Search Area Evaluation Report expands on RWM's Initial Evaluation work that has already been completed in respect of parts of the East Lindsey District, and uses readily available information relevant to the identified Theddlethorpe GDF Search Area and adjacent inshore area to confirm the GDF Team's understanding of the potential to host a GDF.

This report presents the findings of work to evaluate the potential of the Theddlethorpe GDF Search Area and adjacent inshore area to host the GDF considering the six identified Siting Factors set out in the GDF Team's Site Evaluation document.

At this stage, nothing has been identified which would prevent the development of a GDF in the Theddlethorpe GDF Search Area and adjacent inshore area and therefore the GDF Team **has concluded that the Theddlethorpe GDF Search Area and adjacent inshore area have the potential to host a GDF.**

It is important to note that these evaluations have not confirmed that the Theddlethorpe GDF Search Area and adjacent inshore area are suitable to host a GDF. Further work would be required to establish this as highlighted in the next section 'Potential Future Work'.

6. Potential Future Work

Potential Future Work

If the Theddlethorpe GDF Search Area were to move forward in the siting process, the GDF Team would work collaboratively with the local community, the Community Partnership (if formed) and relevant stakeholders on the areas set out below. This is a list of potential future work; it is not exhaustive and could change during Community Partnership.

- The GDF Team as a priority would work with the Community Partnership to identify initial desk-based data gathering activities, field surveys and initial assessment work that could be undertaken within the Theddlethorpe GDF Search Area and wider region if appropriate.
- At this early stage of Site Evaluation, the brownfield site at the former Theddlethorpe Gas Terminal site (TGT) has been identified as a potential location for the surface component of a GDF. The GDF Team will continue to explore this option, in addition to any possible alternatives within the Search Area and alongside the potential for locating the subsurface component deep beneath the sea bed of the adjacent inshore area. There may also be an opportunity to consider split surface site options, which could, for example, include locating administration buildings or training facilities in or close to Mablethorpe. Consideration of dual use of the TGT site could also form part of the work during Community Partnership. The GDF Team is aware of other, early stage, proposals to use the site for carbon capture and storage and/or possibly hydrogen production. Although it is unlikely that a GDF could be co-located with a hydrogen facility, there may be potential to collocate with carbon capture and storage. As further investigation and more detailed site evaluation is undertaken, there could be a need to further amend the Search Area. For example, when there is a greater understanding of transport improvements or other associated developments that may be required and where they may be located. If formed, the Community Partnership could amend the Search Area and ultimately identify the Potential Host Community.

- The sensitivities of the local natural environment and the potential implications of delivering a GDF in the Theddlethorpe GDF Search Area and adjacent inshore area need to be considered. In addition, there is a need to investigate whether there could be alignment with local environmental objectives, and the potential to deliver environmental enhancements to designated areas and sites. The implications of national and international regulations and designations would also be taken into account. There would also be a need to understand whether there are any new/emerging designations which would need to be taken into consideration.
- In order to gain an understanding of any likely significant effects of the GDF on protected habitats and species sites, the GDF Team will work with key stakeholders such as Natural England, East Lindsey District Council and local wildlife groups to prepare an initial assessment to evaluate the current environmental baseline. This work would help to identify and understand any Habitat Regulations Assessment (HRA) issues and consenting risks, and will identify further detailed surveys and assessments that may be required. Data gathered during this early phase of evaluation could contribute towards an evidence base for HRA reporting required to support any future planning applications should the Theddlethorpe GDF Search Area progress through the siting process. The GDF Team recognises that building the evidence base for the HRA with good quality research and insight can help to reduce uncertainties and ensure a more informed assessment. In addition, in order to understand the functional connectivity between the designated sites and surrounding habitats further investigation will be undertaken in consultation with Natural England and local wildlife groups.
- In relation to transport (road rail and sea), further studies and option appraisals will be undertaken, based on the construction and operational requirements for a GDF within the Search Area. These studies could also help to identify potential benefits for local communities currently underserved by connections to the existing strategic road and rail networks, and which could make the area more attractive for development and inward investment. This would also help to inform the work of the Community Partnership in the development of a Community Vision, which could include elements related to enhancement of local connectivity that could benefit local businesses and the tourism sector. Once this aspect has been investigated and understood during the potential Community Partnership phase, this will help to determine whether there may need to be any amendment of the Search Area to reflect potential locations of transport infrastructure improvements.

- In order to gain a greater understanding of the flood risks within the Search Area, consultation will be undertaken with key stakeholders such as the Environment Agency, the Internal Drainage Boards, Lincolnshire County Council and East Lindsey District Council. In addition, further work could include modelling of the key flood mechanisms to provide a clearer picture of flood risk and the implications of future climate change scenarios and coastal erosion. Detailed flood modelling and analysis at a local level would also be required to delineate flood Zone 3b (functional floodplain) from Zone 3a (high probability).
- The GDF Team would look to obtain more information on the location and nature of groundwater and aquifers in the Theddlethorpe GDF Search Area to enhance the understanding of local hydrology and hydrogeology.
- The GDF Team would look to obtain any details on historical geological surveys and studies that could enhance the GDF Team's understanding of the geological environment of the area. This would include purchasing additional existing borehole and seismic data from the Search Area and wider area including the inshore area. The GDF Team would also look to undertake its own seismic surveys within the Search Area and adjacent inshore area. Environmental surveys may also be required to support the licence and permit applications required to undertake these surveys. These environmental surveys could be undertaken during the summer of 2022 with a view to undertaking the seismic surveys in 2023.
- There are also Petroleum Exploration and Development Licences (PEDLs) in place around Saltfleetby and Keddington, as well as in the area between Louth and Cleethorpes. The GDF Team will continue to monitor how this exploration programme progresses.
- The GDF Team would look at the potential impacts associated with RAF Donna Nook and the active air weapons range located on the coastline that may have an effect on the siting of a GDF locally. In addition, work related to nearby airfields, airports, flight corridors and military air traffic may be required to determine the level and location of air traffic.
- Further work would need to be undertaken to understand the potential impact that the presence of industrial facilities and related infrastructure such as pipelines in the area, would have on the siting of the surface facilities of a GDF in the area. This work would also include consideration of future plans of any utility operators in the area, such as National Grid. Consideration of factors related to Control of Major Accidents and Hazards (COMAH) would also be taken into account.

- The development of a GDF has the potential to create transformational socio-economic benefits for local communities and businesses as a result not only of the jobs created in both construction and operation, but also in supporting sectors such as office and facilities management, catering and hospitality. In order to optimise the conditions to realise these potential benefits, further study and investigation will be required on topics such as population demographics, education and skills gaps, health and wellbeing, local services provision and housing strategy. In addition, assessment of the potential impacts and benefits relating to tourism and the agri-food sectors which are key mainstays of the local economy will be a priority for further work. The outputs of this work can then feed into the work of the Community Partnership and the ongoing development of a Community Vision. This work would also link to consideration of areas that may benefit from Community Investment Funds and in the future significant additional investment. Any further study in this area would also need to take account of relevant local strategies and initiatives such as on coastal adaptation and towns funds.
- The Government recognises that communities may be concerned about effects a GDF may have on property values in the local area. Most major infrastructure projects involve making provision for compensation for local residents and property owners who experience an impact on the value of their property as a result of construction of the new infrastructure. The GDF Team is already undertaking work to assess whether there is likely to be any impact on local property prices and consider whether a property support scheme would be appropriate. Once this assessment work is complete, a decision will be taken and an appropriate approach will be adopted for each community.
- The GDF Team will explore in further detail how it can work collaboratively with all relevant stakeholders to develop safe and secure potential design solutions and identify potential locations for a GDF that are sensitive to local priorities and the legislative, policy and regulatory frameworks within which the GDF Team must operate.

Glossary

Community Guidance

Guidance that the GDF Team has developed to provide information, help and advice in support of the policy frameworks that exist in England and Wales. It is for anyone who is interested in learning more about geological disposal and the process for identifying a site for a GDF.

Community Partnership

The partnership between the members of the community, at least one Relevant Principal Local Authority and the GDF Team.

Disposal Concept

A high-level description of the engineered and natural barriers required to ensure that the radioactivity in the wastes is sufficiently contained so that it will not be released back to the surface in unacceptable amounts that may cause harm to people and the environment.

East Lindsey Area

The 'East Lindsey Area' comprises the administrative area of East Lindsey district and the adjacent inshore area off the coast.

Engineered Barrier System

The combination of the man-made engineered components of a disposal facility, including the waste packages / disposal containers, buffer, backfills and seals.

Geological Disposal Facility (GDF)

A geological disposal facility is a highly-engineered facility capable of isolating radioactive waste within multiple protective barriers, deep underground, to ensure that no harmful quantities of radioactivity ever reach the surface environment.

Host Rock

The rock in which a disposal facility is located.

Initial Discussions

Early contact with an Interested Party to help them to find out more about the Siting Process; to understand whether a site/area put forward has any potential to host a GDF; and to help them to decide whether they want to seek to form a Working Group and open up a wider discussion.

Interested Party

The group, organisation, or individual(s) who first started discussions with the GDF Team.

Inshore Area

The inshore is defined as the UK Territorial Waters which extend up to 12 nautical miles (22.2 km) from the Mean Low Water Mark.

Inventory for Disposal

The specific types of higher activity radioactive waste (and nuclear materials that could be declared as waste) which may need to be disposed of in a GDF.

National Geological Screening (NGS)

The National Geological Screening provides a high-level summary of the existing geological information of relevance to the safety of a GDF to inform initial discussions with communities.

Nuclear Decommissioning Authority (NDA)

A non-departmental public body established by the Energy Act 2004 to ensure the safe and efficient clean-up of the UK's public sector, civil nuclear legacy. The NDA has statutory responsibility for decommissioning and cleaning-up 17 UK sites and the associated liabilities and assets. It reports to the Department for Business Energy and Industrial Strategy (BEIS); for some aspects of its functions in Scotland, it is responsible to Scottish Ministers.

Policy – The Working with Communities Policy

'Implementing Geological Disposal – Working with Communities', An updated framework for the long- term management of higher activity radioactive waste, HM Department for Business, Energy and Industrial Strategy, (December 2018).

Potential Host Community

The Potential Host Community is the community within a geographical area that could potentially host a GDF.

Radioactive Waste Management Ltd (RWM)

A wholly owned subsidiary of the Nuclear Decommissioning Authority, established in 2014 for the purpose of delivering geological disposal and providing solutions for the management of higher activity waste. Since 31st January 2022 it operates as Nuclear Waste Services

Relevant Principal Local Authorities

A principal local authority is a district, county or unitary authority. Relevant principal local authorities will be the principal local authorities that represent people in all or part of the area under consideration, whether the Search Area or the Potential Host Community.

Search Area

The Search Area is the geographical area encompassing all the electoral wards within which the GDF Team will be able to search for potential sites. For areas which include potential for development under the seabed, the Search Area will comprise only that area on land.

Working Group

The Working Group is formed in the early part of the GDF siting process in order to gather information about the community and provide information to the community about geological disposal before a Community Partnership is formed. It comprises the Interested Party, The GDF Team, an independent facilitator, an independent chair and any relevant principal local authorities that wish to join.

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Mapping Data

Dataset	Source
Geology	<p>National Geological Screening Guidance – RWM 2016</p> <p>National Geological Screening – Eastern England – Regional Geology – RWM 2018</p> <p>National Geological Screening – Eastern England Sub-region 2 - RWM 2018</p> <p>National Geological Screening: Eastern England - Minerals and Waste Programme Commissioned Report CR/17/092 – BGS 2018</p> <p>Contains British Geological Survey materials © UKRI [2021]</p>
Inshore Area	Marine Management Organisation, December 2020
Environmental Designations	<p>Natural England Open Data, August 2021, © Natural England copyright</p> <p>Open Government Licence</p>
Historic Landscape Characterisation	Lincolnshire Country Council (accessed 2021)
Contour	<p>OS Terrain® 50 Open Data (accessed 2021)</p> <p>Ordnance Survey data</p> <p>Open Government Licence</p>
Flood Zones and Flood Defences Main River WFD Protected Areas: Bathing Waters 2016 WFD Shellfish Water Protected Areas Source Protection Zones EA Sensitive Areas	<p>Environment Agency Open Data (accessed 2021)</p> <p>Contains Environment Agency information.</p> <p>Open Government Licence</p>
Other water courses	<p>OS Rivers Open Data (accessed 2021)</p> <p>Ordnance Survey data</p> <p>Open Government Licence</p>
Water Abstraction Licences (England)	The Rivers Trust and Environment Agency (accessed 2021)
Boreholes	British Geological Survey GeoIndex Onshore - GeoIndex - British Geological Survey (bgs.ac.uk) (accessed 2021)
Hydrocarbon wells	Oil and Gas Authority, UK National Data Repository - https://ndr.ogauthority.co.uk/ (accessed 2021)
Unitary Authority Boundaries Ward Boundaries	<p>OS Boundary Line Open Data (accessed 2021)</p> <p>Ordnance Survey data © Crown copyright and database right</p> <p>Open Government Licence</p>

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Nuclear Waste Services is a joint trading name of LLW Repository Limited (Company Registration No. 05608448) and Radioactive Waste Management Limited (Company Registration No. 08920190). Both of these companies are registered in England and Wales with their registered office located at Pelham House, Pelham Drive, Calderbridge, Cumbria CA20 1DB.